FAIRFAX COUNTY HEALTH DEPARTMENT

YOU have the power:
Battery management for adult mosquito surveillance

Andy Lima
Environmental Health Specialist III
Division of Environmental Health
Fairfax, Virginia

What is battery *management*?

Tracking battery maintenance, function and performance.

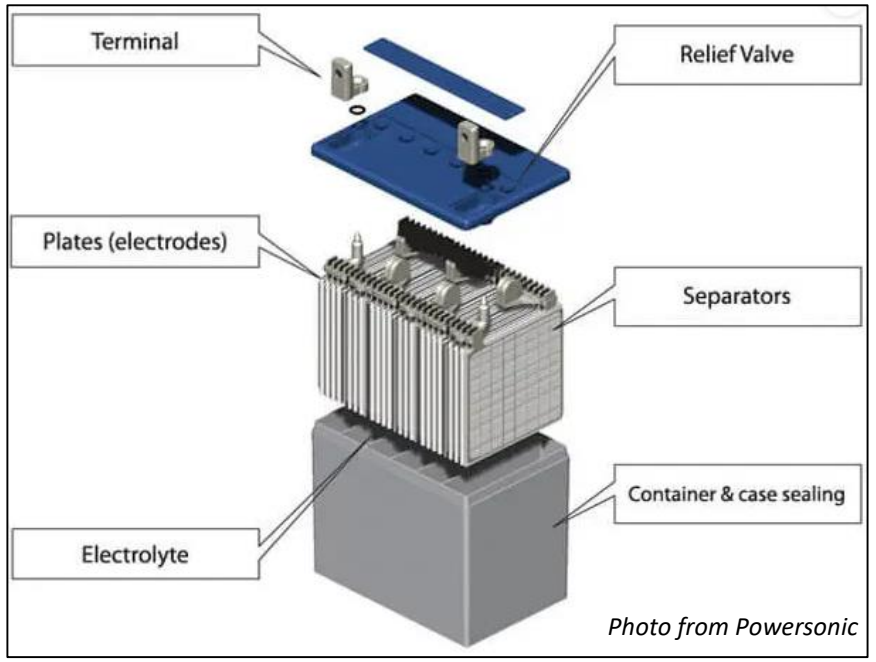
- Data consistency
- Operational efficiency
- Safety

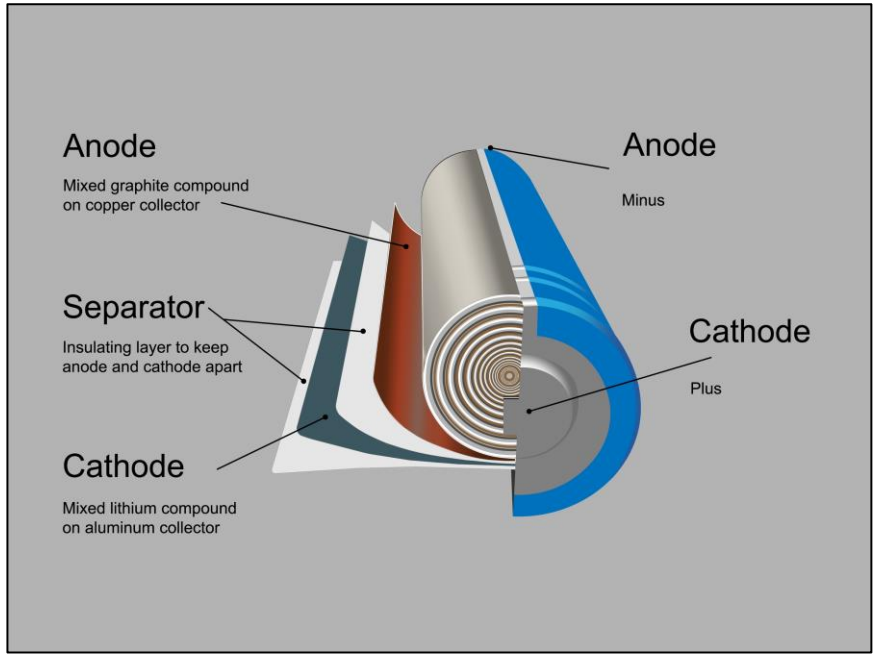
	SLA	Lithium-ion
Charging intelligence	lower	higher
Cost per charger	lower	higher
Cost per battery	lower	higher
Charge decline	gradual	sudden
Risk of deep discharge	higher	lower
Fire/explosion risk	lower	higher
Life expectancy	lower	higher
Weight	higher	lower

Sealed Lead Acid (SLA)

vs.

Lithium-ion



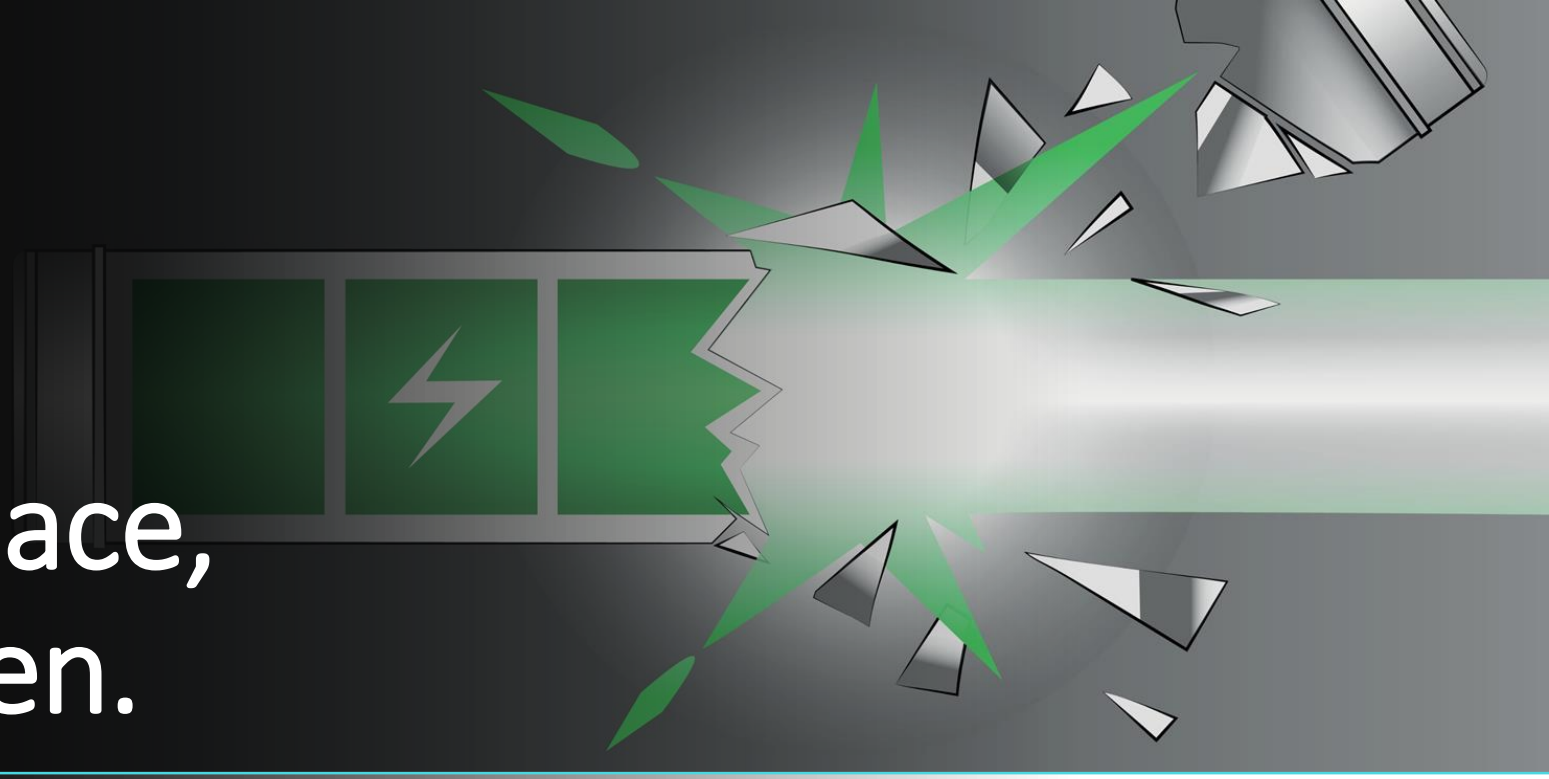


SLA batteries remain the safest and most cost-effective battery for adult mosquito trapping.

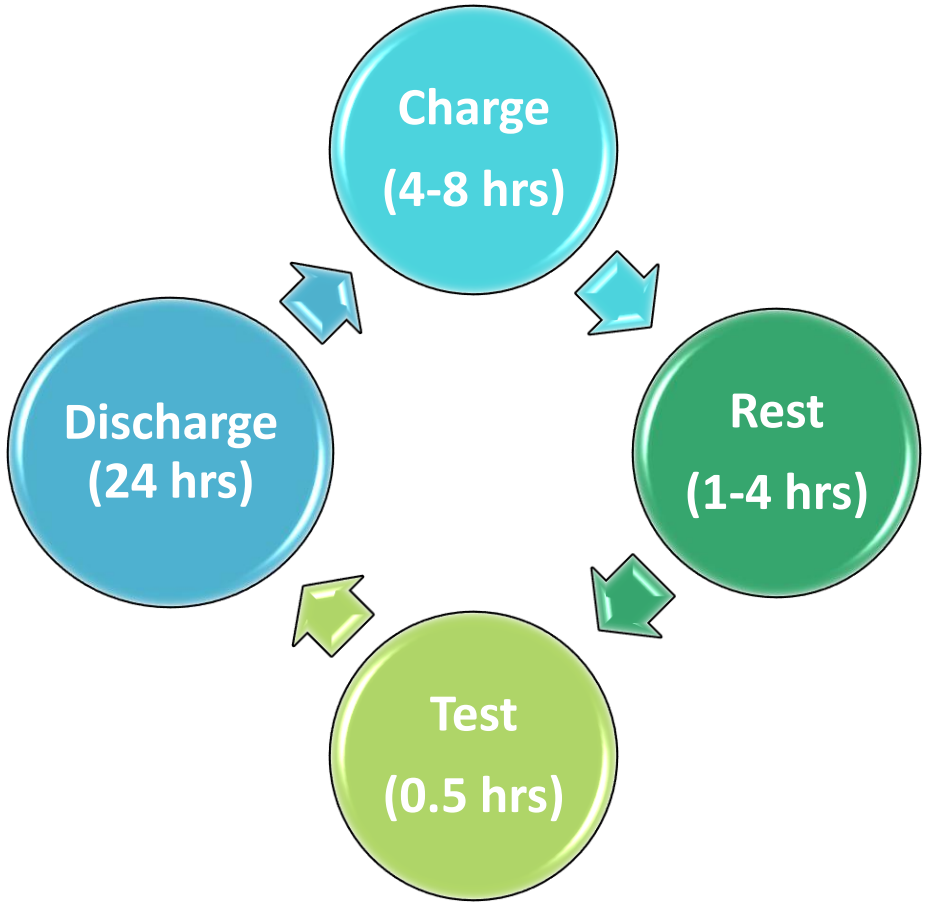
Most rechargeables have an internal battery management ***system.***

- Monitors
- Reports status
- Optimizes performance
- Protects

Even with safeguards in place, accidents happen.

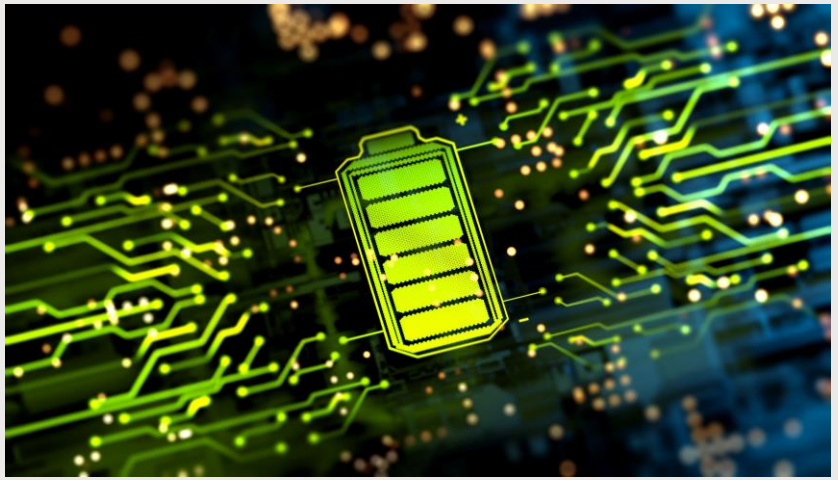


Batteries influence surveillance operations.



Charging

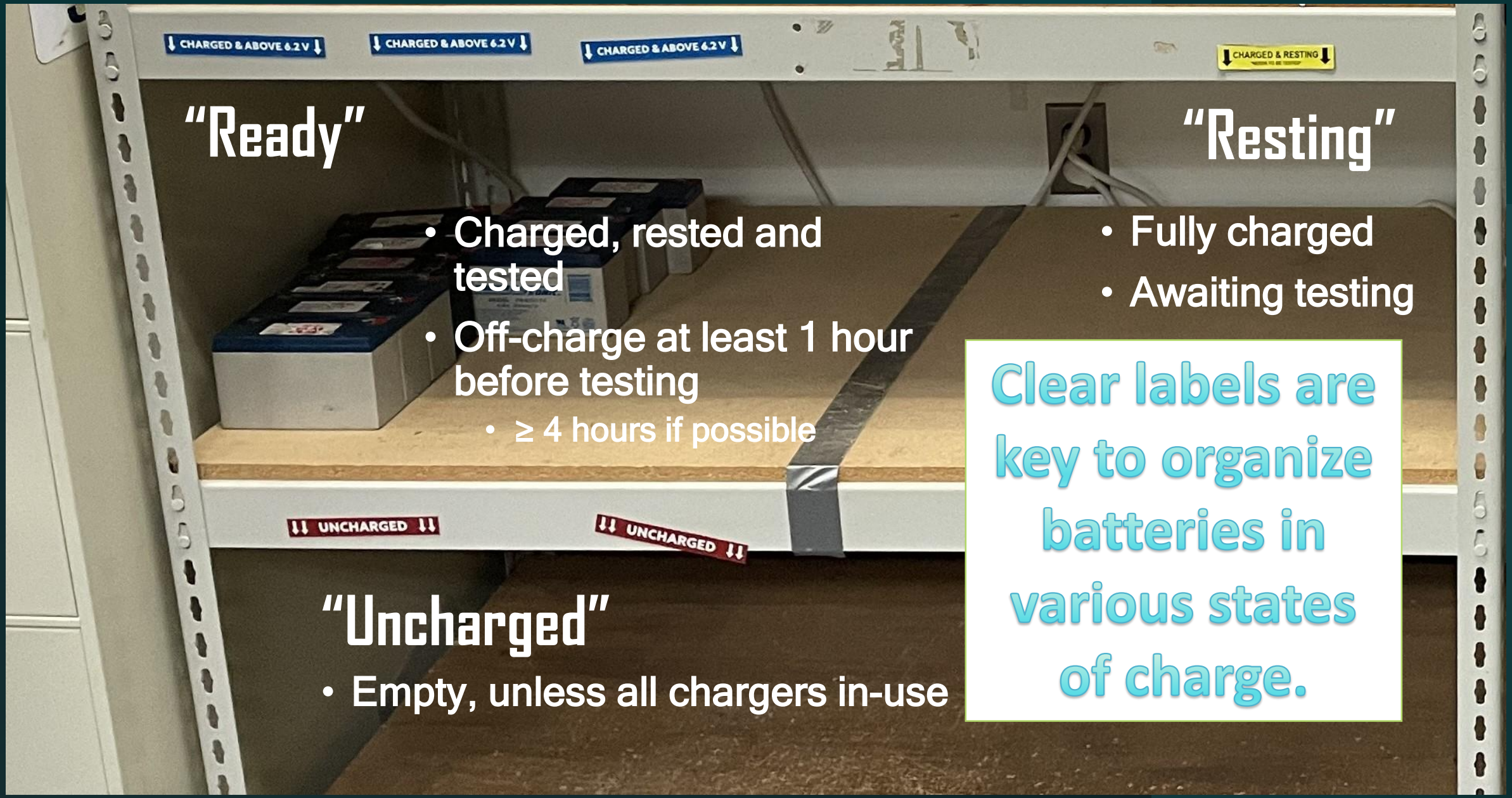
- Use surge protectors
- Rest charged batteries
- Manage cords
- Spacing to distribute heat



Every charge is a party!

"On-Air" lights

- Makes charging more visible
- Reminder for staff
- No chargers left on overnight



"Ready"

- Charged, rested and tested
- Off-charge at least 1 hour before testing
  - ≥ 4 hours if possible

"Resting"

- Fully charged
- Awaiting testing

"Uncharged"

- Empty, unless all chargers in-use

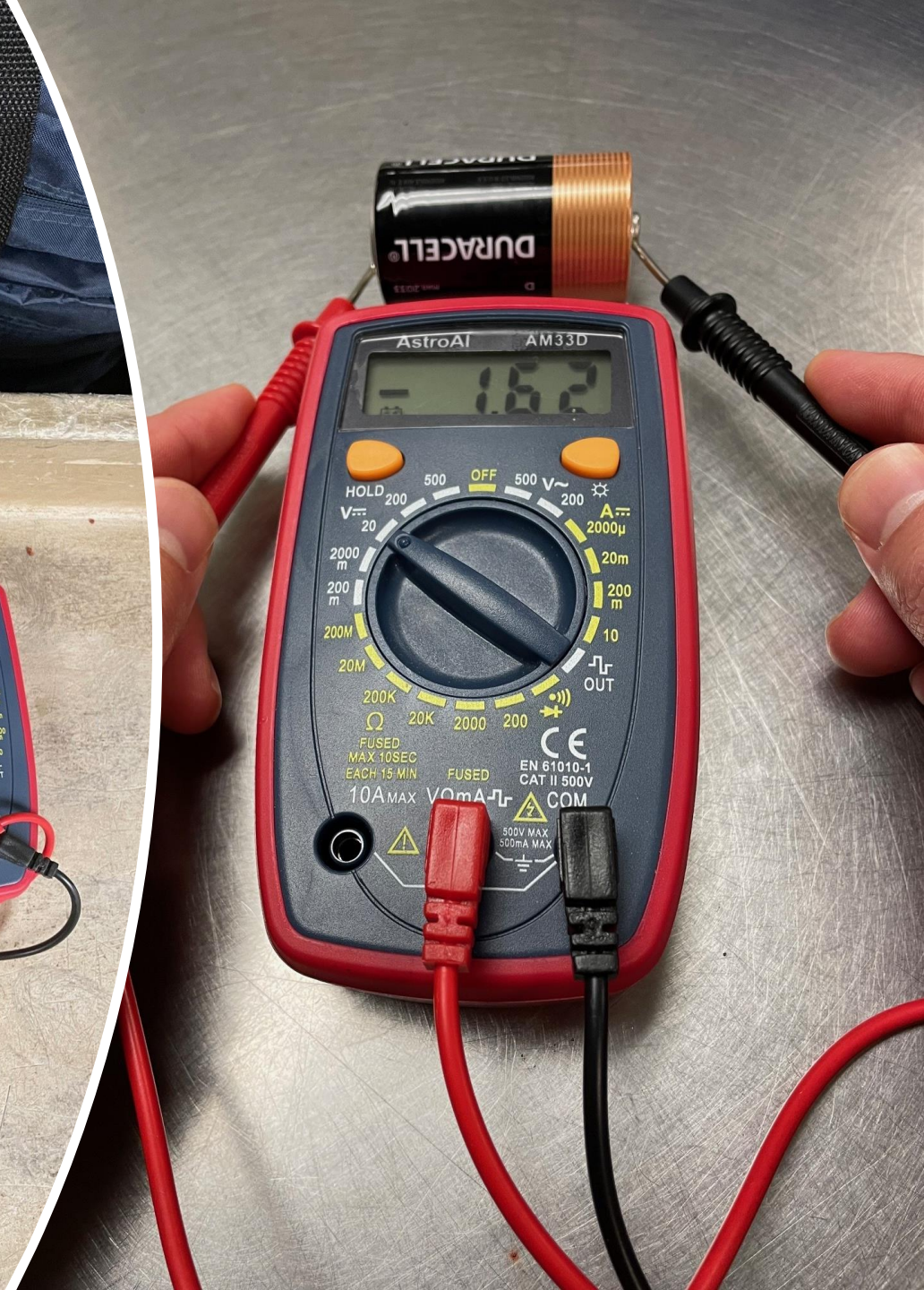
Clear labels are key to organize batteries in various states of charge.

Raise your hand if…

- You perform **voltage tests**
- You perform **load tests**
- You **rest** your batteries before testing

Testing battery voltage

- *After* resting 1-4 hrs
- *Before* every deployment
- Multimeter @ 20V setting
- “good” threshold
  - ≥ 6.2 volts
  - ≥ 12.3 volts
  - ≥ 1.2 volts



Testing battery load (capacity)

- Simulated current drain for ~15 secs
- Change mode for voltage/AmpHr
- Perform weekly
- “good” threshold
  ≥ 60%

Photo by Reddit user @original_account_nam

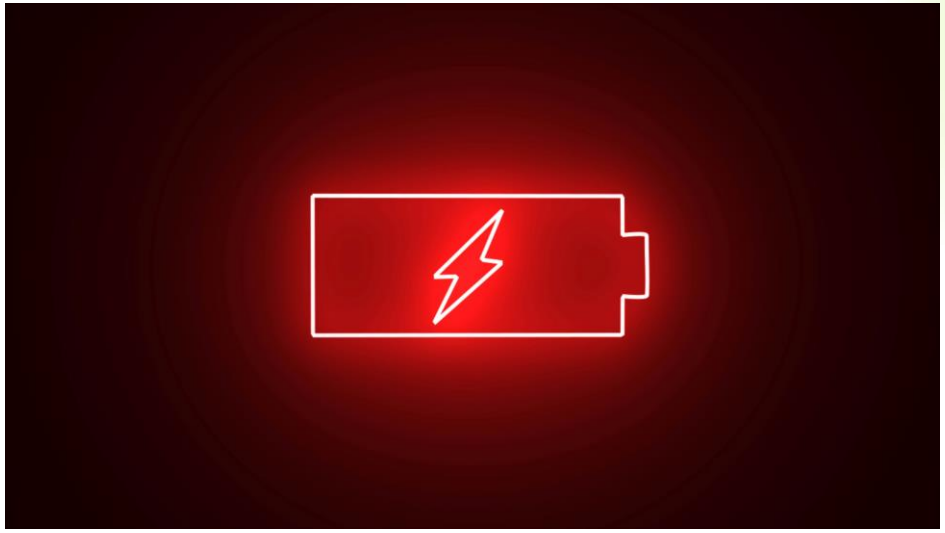
Battery damage

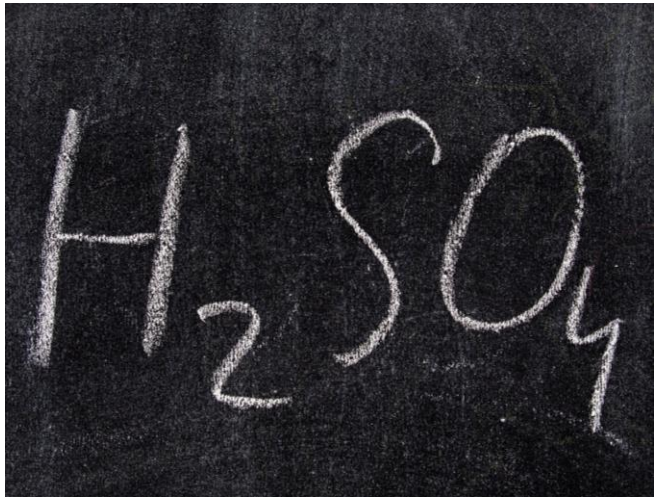
- Thermal runaway
  - Positive heat feedback loop
    - SLA – swelling, sulfuric acid
    - Lithium-ion–swelling, fire
  - Self-discharge entire capacity in minutes
  - Usually caused by internal short
    - Drops can exacerbate
  - Charging error

Battery damage (cont'd)

Deep discharge

- Longer recharge period
- Red death light
- Reduced lifespan





- **Sulfation**
  - Natural process
  - Reduces lifespan
  - Sped up when…
    - Unused
    - Under-charged
    - Stored at high temps
    - Stored with insufficient charge

Calculating Maximum Run Time

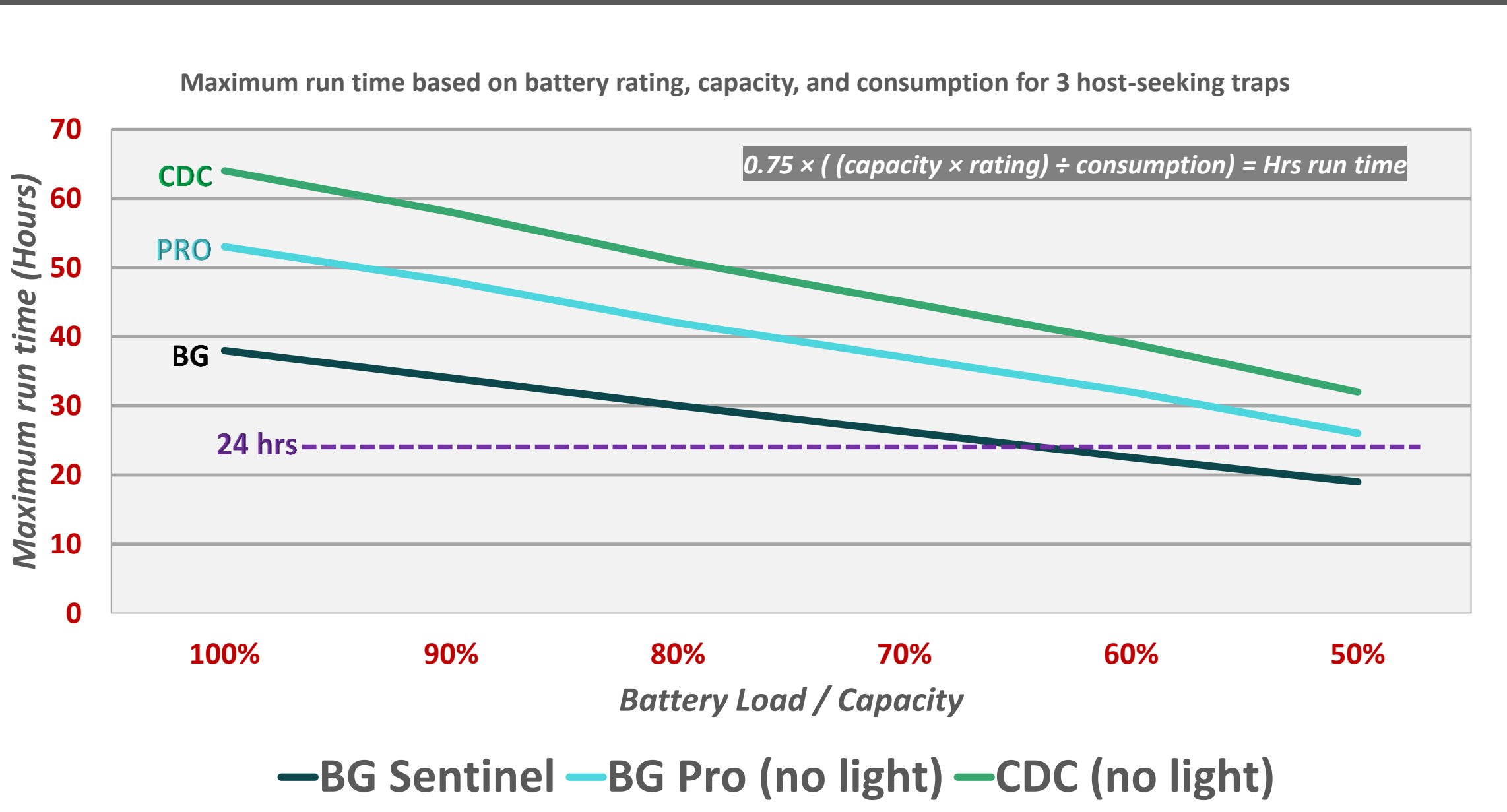
0.75 × ((load test × AmpHr rating) ÷ consumption) = Hrs run time

Trap type	Battery type	AmpHr rating	Consumption (Amps/hr)	Hrs of run time (100% capacity)
CDC*	6V SLA	12	0.14	64
BG Pro*	6V SLA	12	0.17	53
BG	12V SLA	14	0.28	38
Gravid	(4) 1.5V Alkaline D-Cell	-	0.14	-

**Run without lights. CDC incandescent bulb increases consumption by 0.11 Amps/hr. BG Pro UV light increases consumption by 0.25 Amps/hr.*

Example: BG Sentinel trap with a 12V / 14Ah @ 60% capacity

0.75 × ((0.6 × 14) / 0.28) = 22.5 hours run time


Maximum run time based on battery rating, capacity, and consumption for 3 host-seeking traps
0.75 × ((capacity × rating) ÷ consumption) = Hrs run time
CDC
PRO
BG
24 hrs
Maximum run time (Hours)
70
60
50
40
30
20
10
0
100%
90%
80%
70%
60%
50%
Battery Load / Capacity
BG Sentinel
BG Pro (no light)
CDC (no light)

Trap fails (overall)

2023

- BG Pro – 13.6%
- BG - 3.2%
- CDC - 2.2%
- Gravid - 1.5%

Trap fails (battery)

2023

- BG Pro – 0%
- **BG - 56%**
- CDC - 10%
- Gravid - 37%

34% of trap fails were caused by weak batteries.

Troubleshooting following a battery-related fail

1. Communicate battery-related trap fail
2. Small, orange sticker applied (field)
3. Place on trap repair shelf
4. Large, pink sticker applied
5. Record fail date, voltage and load on large sticker
6. Record in electronic log
7. Place battery on charge
8. Remove from charge and rest 4-24 hours
9. Re-test voltage/load and update log
10. Return to service or recycle
11. Update electronic records

Field

Office

Recordkeeping for batteries

- Voltage and load testing:
  - Weekly (May – Oct)
  - Monthly (Nov – Apr)
- Recorded in battery binder
- Transferred to electronic

10/6/23 and 10/9/23 (good data)		10/13/23, 10/16/23		10/20/23 and 10/23/23		10/27/23 and 10/30/23		11/3/23 and 11/6/23	
Load %	Voltage	Load %	Voltage	Load %	Voltage	Load %	Voltage	Load %	Voltage
70%	12.75	60%	12.54	70%	12.65	70%	12.81	60%	12.68
60%	12.34	60%	12.68	60%	12.51			60%	12.54
60%	12.64	60%	12.69	60%	12.59			60%	12.73
70%	12.93	60%	12.79	70%	12.78	70%	12.88	70%	12.76
		60%	12.61		???	70%	12.88	70%	12.88
80%	12.86	70%	12.84	70%	12.72	60%	12.75	70%	12.92
70%	12.79	70%	12.82	40%	12.56	40%	12.52	40%	12.43
70%	12.77	70%	12.81	70%	12.84	70%	12.68	80%	12.97
70%	12.72	80%	12.96	80%	12.85	70%	12.80	70%	12.94
60%	12.70	70%	12.71	60%	12.50	70%	12.84	70%	12.79
70%	12.82	40%	12.60	60%	12.61	60%	12.58	40%	12.22
			12.72	70%	12.78	60%	12.76	60%	12.50
60%	12.76	60%	12.77	60%	12.61	60%	12.64	60%	12.56
70%	12.78	60%	12.62	70%	12.76			60%	12.67
70%	12.79	70%	12.81	70%	12.86	70%	12.88		12.25
70%	12.72	40%	12.52	60%	12.58	60%	12.43	70%	12.89
70%	12.72	60%	12.60	60%	12.50	70%	12.70	60%	12.54
60%	12.67	60%	12.64	60%	12.66	70%	12.73	60%	12.78
70%	12.73	70%	12.74	60%	12.55	60%	12.56	60%	12.62
70%	12.80	70%	12.74	70%	12.73	60%	12.55	70%	12.83
60%	12.63	40%	12.48	60%	12.59	70%	12.86	60%	12.74

Battery recycling

SLAs

- commercial hazardous waste drop-off events

Alkaline D-cells

- shipped for recycling

Review of Best Practices in Fairfax Co.

- Develop and follow a protocol
  - Train staff
  - Troubleshoot
- Talk to experts
  - Battery distributors
  - Fire safety
- Label clearly
- Handle batteries with care
- Keep records

- Avoid deep discharge and drops
  - Damages batteries and shortens their life
- Charge consistently
  - Including every month during the off-season
- Test your batteries often
  - Voltage before each deployment
  - Voltage and Load weekly
  - Ideal rest time before testing = at least 4 hours
- Recycle

Thank you to all the staff that contributed to this presentation!