

1. Introductions

- A. Presenters
- B. Attendees
- C. Poll Everywhere questions related to current battery recycling situations

2. Backhauling Batteries in Alaska

- A. **AK DEC** – Trisha Bower: *Current Collection Practices in Rural AK*
- B. **EPA** – Chris Newman: *Battery Disposal and Recycling Regulations*
- C. **USDOT PHMSA** – Daniel Richards: *Battery Shipping Regulations*
- D. **FAA** – Jay Sorah: *Shipping Battery by Air Regulations*
- E. **Zender Environmental** – Reilly: *Backhauling Batteries in Alaska – Overview of Battery Chemistries & Important Backhaul Considerations*

BREAK (10 min)

3. Hands-On Identification and Packaging Practice

A. Lead Acid Batteries

- i. ID & why is it hazardous
- ii. PPE
- iii. Spill Response & Cleanup
- iv. Supplies & Packaging Materials
- v. Packaging
- vi. Marking, Labeling, Shipping Paperwork
- vii. Shipping by Air Cargo – Special Permits

B. Household Batteries

- i. Battery ID (Alkaline, Ni-Cad, NiMH, Li, Li-Ion)
- ii. PPE
- iii. Spill Response & Cleanup
- iv. Supplies & Packaging Materials
- v. Sorting Exercise
- vi. Packaging
- vii. Marking, Labeling, Shipping Paperwork

4. Questions, Comments, Concerns

HazMat Table (49 CFR §172.101) – Batteries

Symbols	Hazardous materials descriptions and proper shipping names	Hazard class or Division	ID Numbers	PG	Label Codes	Special Provisions (§ 172.102)	(8) Packaging (§ 173.***)			(9) Quantity Limitations (see §§ 173.27 and 175.75)		(10) Vessel Stowage	
							Exceptions	Non-bulk	Bulk	Passenger aircraft/rail	Cargo aircraft only	Location	Other
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	Batteries, wet, filled with acid, <i>electric storage</i>	8	UN2794		8	A51	159	159	159	30 kg	No limit	A	53, 58, 146
	Batteries, wet, filled with alkali, <i>electric storage</i>	8	UN2795		8	A51	159	159	159	30 kg	No limit	A	52, 146
	Batteries, wet, non-spillable, <i>electric storage</i>	8	UN2800		8		159a	159	159	No limit	No limit	A	
W	Batteries, nickel-metal hydride see Batteries, dry, sealed, n.o.s. for <i>nickel-metal hydride batteries transported by modes other than vessel</i>	9	UN3496		9	340						A	25
	Batteries, dry, containing potassium hydroxide solid, <i>electric storage</i>	8	UN3028		8	237	154	213	None	25 kg	230 kg	A	52
	Batteries, dry, sealed, n.o.s.					130							
	Lithium ion batteries <i>including lithium ion polymer batteries</i>	9	UN3480		9	388, 422, A54, A100	185	185	185	Forbidden	35 kg	A	156
	Lithium ion batteries contained in equipment <i>including lithium ion polymer batteries</i>	9	UN3481		9	181, 360, 388, 422, A54	185	185	185	5 kg	35 kg	A	156
	Lithium ion batteries packed with equipment <i>including lithium ion polymer batteries</i>	9	UN3481		9	181, 360, 388, 422, A54	185	185	185	5 kg	35 kg	A	156
	Lithium metal batteries <i>including lithium alloy batteries</i>	9	UN3090		9	388, 422, A54	185	185	185	Forbidden	35 kg	A	156
	Lithium metal batteries contained in equipment <i>including lithium alloy batteries</i>	9	UN3091		9	181, 360, 388, 422, A54, A101	185	185	185	5 kg	35 kg	A	156
	Lithium metal batteries packed with equipment <i>including lithium alloy batteries</i>	9	UN3091		9	181, 360, 388, 422, A54	185	185	185	5 kg	35 kg	A	156

Suggested Battery Recycling Supplies

Items	Lead Acid	Wet Ni-Cad	SP12283	Alkaline	Ni-Cad	NiMH	Lithium	Li-Ion
General Packaging Supplies								
Pallets (Strung Sturdy)	X	X	X					
Fish Tote w/lid	o	o	X					
Banding Kit (Straps, Buckles, Tensioner)	X	X	X					
Stretch Wrap (80 gauge or better)	X	X	X					
Heavy Plastic Bags ("Battery Bags" or similar)	X	X	X					
UN Rated Bucket w/screw top lid				o	o	o	X	X
Containers (Strong, sturdy, capable of containing any leaks)				X	X	X		
Tape (ex: electrical, packaging tape) for insulating terminals				X	X	X	X	X
Plywood, Foam Board, Cardboard, Waffleboard, etc. (for stacking wet batteries)	X	X	X					
Labels & Markings								
Universal Waste	X	X	X		X		X	X
"Used Batteries" (or similar)				o		o		
#8 Corrosive	X	X	X					
#9 Misc (for NiMH vessel/barge shipments only)						X		
#9 Lithium							X	X
Cargo Aircraft Only			X				X	X
"Up" Arrows			X					
UN3090 Markings							X	
UN3480 Markings								X
Spill Cleanup								
Absorbent (Vermiculite, Kitty Litter, etc.)	X	X	X					
Baking Soda	X		X					
Vinegar		X	X					
Broom & Dust Pan	X	X	X					
Heavy Mil. Plastic Bags	X	X	X					
PPE								
Chemical Resistant Apron	X	X	X					
Chemical Resistant Gloves	X	X	X					
Eyewash	X	X	X	X	X	X	X	X
First Aid Kit	X	X	X	X	X	X	X	X
Fire Extinguisher	X	X	X	X	X	X	X	X
Steel Drum & Fine Sand (or similar)							X	X
Fine Sand							X	X
Safety Glasses	X	X	X	X	X	X	X	X
Safety Goggles	X	X	X					
Work Gloves	X	X	X	X	X	X	X	X
Nitrile Gloves	X	X	X	X	X	X	X	X

"X" – Required or Strongly Recommended

"o" – Optional, but Recommended

Online Resources

USDOT – PHMSA: www.phmsa.dot.gov

- Electronic Code of Federal Regulations (eCFR): www.ecfr.gov
49 CFR App for Android: <https://play.google.com/store/apps/details?id=gov.dot.phmsa.ocfr&hl=en>
49 CFR App for iOS: <https://itunes.apple.com/us/app/ocfr/id1228220888?mt=8>
- Hazardous Materials Information Center
www.phmsa.dot.gov/standards-rulemaking/hazmat/hazardous-materials-information-center
- Chart 17 (Marking, Labeling, Placarding):
www.phmsa.dot.gov/training/hazmat/dot-chart-17-markings-labeling-and-placarding-guide
App for Android: <https://play.google.com/store/apps/details?id=gov.dot.phmsa.ocfr&hl=en>
App for iOS: <https://itunes.apple.com/us/app/dot-chart-16/id1245251292?mt=8>
- Lithium Battery Guide for Shippers
www.phmsa.dot.gov/training/hazmat/lithium-battery-guide-shippers
- Safety Tips for Lithium-Ion Battery-Powered Micromobility Devices
<https://www.phmsa.dot.gov/training/hazmat/safety-tips-lithium-ion-battery-powered-micromobility-devices>
- Understanding the Risks of Damaged, Defective, or Recalled (DDR) Lithium Batteries
www.phmsa.dot.gov/training/hazmat/understanding-risks-damaged-defective-or-recalled-ddr-lithium-batteries
- Online HazMat Regulations Training: <https://dothazmat.vividlms.com>

FAA – HazMat: www.faa.gov/hazmat

- Alaska Dangerous Goods Resources: www.faa.gov/hazmat/resources/alaska
- FAA Lithium Battery Resources: www.faa.gov/hazmat/resources/lithium_batteries
- FAA Interactive Guide to Shipping Lithium Batteries:
www.faa.gov/hazmat/safecargo/resources/lithium-battery-guide

EPA – www.epa.gov

- Universal Waste: www.epa.gov/hw/universal-waste
- Used Household Batteries: www.epa.gov/recycle/used-household-batteries
- Used Lithium-Ion Batteries: www.epa.gov/recycle/used-lithium-ion-batteries

Other Resources

- Rechargeable Battery Association (PRBA): www.prba.org
- Call2recycle.org Safety Portal: www.call2recycle.org/safety
- Call2recycle.org Avoid the Spark Campaign: www.call2recycle.org/avoid-the-spark
- Lithium Battery Guide: www.hazmateam.com/content/Lithium-Battery-Transportation.aspx
- Lithium Battery Fire Code: www.prba.org/areas-of-focus/fire-codes

For an electronic version of this document with “clickable” links, email Reilly Kosinski at rkosinski@zendergroup.org

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Battery Labeling Matrix










TYPE	PROPER SHIPPING NAME	UNIVERSAL WASTE?	HAZARDOUS MATERIAL?
ALKALINE	BATTERIES, DRY, SEALED, N.O.S (ALKALINE)	NO	NO*
NICKEL METAL HYDRIDE	<i>Vessel/Barge Shipment:</i> UN3496, BATTERIES, DRY, NICKEL METAL HYDRIDE, 9	NO	YES
NICKEL METAL HYDRIDE	<i>Truck/Air/Rail Shipment:</i> BATTERIES, DRY, SEALED, N.O.S (NICKEL METAL HYDRIDE)	NO	NO*
NI-CAD (Dry)	BATTERIES, DRY, SEALED, N.O.S (NICKEL CADMIUM)	YES	NO*
NI-CAD (Wet)	UN2795, BATTERIES, WET, FILLED WITH ALKALI, 8 (NICKEL CADMIUM)	YES	YES
LEAD ACID (Wet)	UN2794, BATTERIES, WET, FILLED WITH ACID, 8 (LEAD ACID)	YES	YES
LITHIUM	<i>Small Battery Exemption (Truck or Vessel – Limited to 30 kg or 66 lbs):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	NO**
LITHIUM	<i>Small Battery Exemption (Air – Limited to 2.5 kg or 5.5 lbs):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	YES
LITHIUM	<i>Fully Regulated (Limited to 35 kg or 77 lbs on Cargo Aircraft):</i> UN3090, LITHIUM METAL BATTERIES, 9	YES	YES
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Truck or Vessel – Limited to 30 kg or 66 lbs):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	NO**
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Air – Limited to 10 kg or 22 lbs):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	YES
LITHIUM ION (including Li-Poly)	<i>Fully Regulated (Limited to 35 kg or 77 lbs on Cargo Aircraft):</i> UN3480, LITHIUM ION BATTERIES, 9	YES	YES

* These batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** Marking, labelling, and packaging requirements for Lithium batteries vary depending on size and mode of transportation. Please refer to 49 CFR 173.185 for specific instructions for your shipping situation.





















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Battery Labeling Matrix

TYPE	PROPER SHIPPING NAME	LABELS	ADDITIONAL LABELS	ADDITIONAL LABELS
ALKALINE	BATTERIES, DRY, SEALED, N.O.S (ALKALINE)		---	---
NICKEL METAL HYDRIDE	<i>Vessel/Barge Shipment:</i> UN3496, BATTERIES, DRY, NICKEL METAL HYDRIDE, 9			---
NICKEL METAL HYDRIDE	<i>Truck/Air/Rail Shipment:</i> BATTERIES, DRY, SEALED, N.O.S (NICKEL METAL HYDRIDE)		---	---
NI-CAD (Dry)	BATTERIES, DRY, SEALED, N.O.S (NICKEL CADMIUM)		---	---
NI-CAD (Wet)	UN2795, BATTERIES, WET, FILLED WITH ALKALI, 8 (NICKEL CADMIUM)			---
LEAD ACID (Wet)	UN2794, BATTERIES, WET, FILLED WITH ACID, 8 (LEAD ACID)			---

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Battery Labeling Matrix

TYPE	PROPER SHIPPING NAME	LABELS	ADDITIONAL LABELS	ADDITIONAL LABELS
LITHIUM	<i>Small Battery Exemption (Truck or Vessel):</i> UN3090, LITHIUM METAL BATTERIES, 9			
LITHIUM	<i>Small Battery Exemption (Air):</i> UN3090, LITHIUM METAL BATTERIES, 9			 
LITHIUM	<i>Fully Regulated:</i> UN3090, LITHIUM METAL BATTERIES, 9			<i>If shipping by air</i> 
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Truck or Vessel):</i> UN3480, LITHIUM ION BATTERIES, 9			
LITHIUM ION (including Li-Poly)	<i>Small Battery Exemption (Air):</i> UN3480, LITHIUM ION BATTERIES, 9			 
LITHIUM ION (including Li-Poly)	<i>Fully Regulated:</i> UN3480, LITHIUM METAL BATTERIES, 9			<i>If shipping by air</i> 

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Household Batteries

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

- 1-Gallon Container – 15 lbs
- 5-Gallon Bucket – 80 lbs

Note: Lithium/Lithium Ion/Lithium Polymer containers are limited to a gross weight not exceeding than 66 lbs (Combination of batteries and packaging materials)

Personal Protective Equipment (PPE)

Suggested PPE for the sorting, consolidation, and packaging of household batteries includes the following items:

- Gloves
- Eye protection

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing household batteries for backhaul includes the following items:

- Containers that are closeable, structurally sound, compatible with the contents of the battery, and lacks evidence of leakage, spillage, or damage.
- UN rated (packing group II or higher) buckets with lids, when required.
- Insulating material (ex: packaging tape, electrical tape)
- Appropriate Markings & Labels

Spill Cleanup/Emergency Response

The potential for fire and explosion is the main risk when managing batteries; Lithium, Lithium-Ion, and Lithium Polymer batteries pose the greatest threat of fire/explosion. When handling batteries the following materials will assist with cleanup and emergency response.

- Nitrile gloves
- Chemical resistant gloves
- Absorbent (ex: vermiculite, kitty litter, absorbent powder)
- Broom/Brush & Heavy plastic bag (for containing spill cleanup matter)
- Bucket or other container with a sealable lid;
- Fire Extinguisher

General Packaging Guidelines

The following general packaging guidelines and notes apply to packaging and shipping electronic waste for recycling:

- The following batteries must be insulated to prevent short circuits (leading to fires/explosions)
 - All batteries greater than 9-volts
 - All Ni-MH batteries, if shipped by barge/vessel
 - All “Lantern” style batteries
 - All batteries containing lithium (Lithium, Lithium-Ion, Lithium Polymer, etc.)
 - Any battery with an “unknown” chemistry
- Batteries should be fully contained in a DOT approved shipping container with a sealing lid.
- Avoid storing batteries in a manner that could allow water to mix with the batteries

Household Batteries

Labeling

The following labels should be used for staging and shipping batteries to be recycled.

- Universal Waste (Lead Acid, Ni-Cad, Lithium, Lithium-Ion, Lithium Polymer)
- Corrosive #8 (Lead Acid, Ni-Cad)
- Miscellaneous #9 (NiMH)
- Miscellaneous #9 Lithium Batteries (Lithium, Lithium-Ion, Lithium Polymer)
- UN 3090 (Lithium Primary)
- UN 3480 (Lithium-Ion, Lithium Polymer)
- “Danger – do not ship on passenger aircraft/Cargo Air Craft only” (Lithium-Ion, Lithium Polymer)

Shipping

Further, ensure the following prior to shipping:

- All battery terminals are insulated to prevent fires or short circuits.
- Follow all applicable Hazardous Materials Regulations
- Ship materials in appropriate containers that are marked, labeled, closed, secure, & upright.
- When needed, block/brace into place to ensure containers don't shift during transport.
- Placards shipping connexes, when applicable
- Ensure all Lithium, Lithium-Ion, and Lithium Polymer battery containers' gross weight do not exceed 66 pounds
- Remember all Lithium, Lithium-Ion, and Lithium Polymer batteries cannot be shipped on passenger aircraft.

Battery containers can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Alkaline Batteries

Packaging Guidance

Chemistry: Alkaline

Identification Information:

- Alkaline Batteries look like “typical” household batteries that are commonly used in everyday devices.
- In general, Alkaline Batteries are not rechargeable (but rechargeable Alkaline do exist).
- Carbon-Zinc batteries can be easily confused with Alkaline Batteries.
- Alkaline Batteries also exist in button cell form.

Labels:



Note: This is not a DOT label.

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	NO*	NO

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Alkaline Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, Nickel Metal Hydride, and Nickel Cadmium batteries.

* Alkaline Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

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Carbon-Zinc Batteries

Packaging Guidance

Chemistry: Carbon-Zinc (also Zinc-Chloride)

Identification Information:

- Carbon-Zinc look like “typical” household batteries that are commonly used in everyday devices (similar applications as Alkaline Batteries).
- Alkaline Batteries can be easily confused with Carbon-Zinc Batteries.
- Carbon-Zinc Batteries are often labelled “Heavy Duty”, “Extra Heavy Duty”, and “Super Heavy Duty.”
- Carbon-Zinc Batteries are not rechargeable.

Labels:



Note: This is not a DOT label.

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	NO*	NO

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Carbon-Zinc Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, Nickel Metal Hydride, and Nickel Cadmium batteries.

* Carbon-Zinc Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

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Nickel Cadmium (Ni-Cad) Batteries

Packaging Guidance

Chemistry: Nickel Cadmium (Ni-Cad) dry cells

Identification Information:

- Nickel Cadmium Batteries occur in multiple forms:
 - Some look like “Typical” household batteries;
 - They are found in Power Packs (ex: power tools, cordless phones).
- Nickel Cadmium Batteries can be easily confused with Nickel Metal Hydride (NiMH) Batteries.
- Nickel Cadmium Batteries are rechargeable.
- The base voltage (of a single cell) for a Ni-Cad Battery is 1.2 Volts.
- Nickel Cadmium Batteries also exist in button cell form (rarely).
- Wet Nickel Cadmium Batteries (similar to Lead Acid Batteries) also exist – See *Wet Battery Packaging Guidance* section

Labels:



Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
YES	NO*	NO**

Detailed Shipping Description:

Batteries, dry, sealed n.o.s. (Nickel Cadmium Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- If shipping by air or barge, insulate terminals all battery terminals.
- In general, do not mix with Lithium, Lithium Ion, or Nickel Metal Hydride, and Alkaline batteries.

* Dry cell Ni-Cad Batteries are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** Universal Waste Regulations require containers are closeable, structurally sound, compatible with the contents of the battery, and must lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions.

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Nickel Metal Hydride (NiMH) Batteries

Packaging Guidance

Chemistry: Nickel Metal Hydride (NiMH)

Identification Information:

- Nickel Metal Hydride Batteries occur in multiple forms:
 - Some look like “Typical” household batteries;
 - They are found in Power Packs (ex: power tools, cordless phones).
- Nickel Metal Hydride Batteries can be easily confused with Nickel Cadmium (Ni-Cad) Batteries.
- Nickel Metal Hydride Batteries are rechargeable.
- The base voltage (of a single cell) for a NiMH Battery is 1.2 Volts.
- Nickel Metal Hydride Batteries also exist in button cell form (rarely).

Labels:



Note: This is not a DOT label.



When shipped by Barge/Vessel

Suggested Packaging:



Screw-top plastic bucket

Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
NO	Vessel – YES Other Modes of Transport – NO*	NO**

Detailed Shipping Description:

Barge/Vessel Shipments – UN3496, Batteries, Dry, Nickel-Metal Hydride, 9

All Other Modes of Shipment – Batteries, dry, sealed, n.o.s. (Nickel Metal Hydride Batteries)

Special Handling Instruction:

- Preferably, contain in a sturdy undamaged screw top plastic bucket;
- Insulate **ALL** terminals (regardless of size and shape); and
- Do not mix with Lithium, Lithium Ion, Nickel Cadmium, and Alkaline batteries.

* NiMH Batteries, when shipped in any mode other than vessel/barge, are not subject to requirements of 49 CFR Subchapter C (i.e. Hazardous Materials Regulations) if the conditions in 49 CFR 172.102 Special Provision 130 are met.

** When shipped by vessel/barge, 49 CFR 172.102 Special Provision 130, states NiMH batteries must be prepared and packaged for transport in a manner to prevent a dangerous evolution of heat, short circuits, and damage to terminals

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Lithium Ion & Lithium Polymer Batteries

Packaging Guidance

Chemistry: Lithium Ion (Li-Ion) & Lithium Polymer (Li-Poly) Batteries

Identification Information:

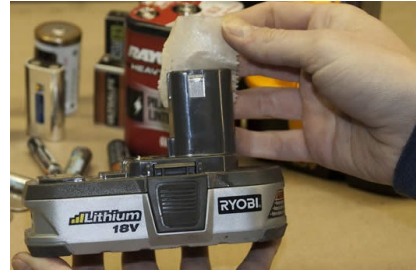
- Li-Ion and Li-Poly batteries are all rechargeable batteries.
- Li-Ion and Li-Poly batteries will generally have a label indicating it is a rechargeable lithium battery.

Suggested Packaging:



Screw-top plastic bucket – Not to exceed 66 lbs

Insulate All Terminals:

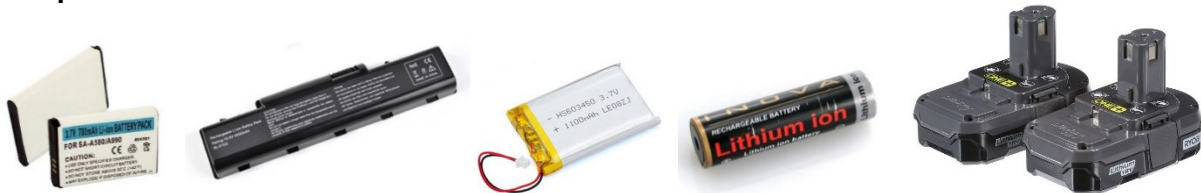


- Terminals can be insulated using tape.
- Avoid excessive taping and ensure labels can be read.

Required Marks & Labels (requirements vary depending on battery size and shipping mode*):



Examples:



Universal Waste?	USDOT HazMat?	Need UN Certified Specific Packaging for Shipment?
YES	YES*	YES*

Detailed Shipping Description:

UN3480, Lithium Ion Batteries, 9

Special Handling Instruction:

- *Handle carefully* – Damaged and short-circuited Li-Ion batteries can cause intense fires/explosions.
- Insulate terminals on all Li-Ion and Li-Poly batteries without recessed terminals.
- Contain in a UN Rated (level II packaging or greater) screw-top plastic bucket – Not to exceed 66 lbs.
- Do not mix with other battery chemistries.

* Marking, labelling, and packaging requirements for Li-Ion batteries vary depending on size and mode of transportation. Please refer to 49 CFR 173.185 for specific instructions for your shipping situation.

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Wet Batteries (Lead Acid & Ni-Cad)

Inventory Estimates

The following are rough average weights and estimates that can be used for planning purposes:

Battery Type	Weight
ATV & UPS Batteries	5 – 20 lbs
Car and Truck batteries	40 lbs
Deep Cycle Marine and Solar Batteries	80 – 120 lbs
Pallet of Wet Batteries	2,500 – 3,200 lbs (800 – 1,200 lbs per layer)
Tote of Wet Batteries	1,600 – 2,000 lbs (800 – 1,000 lbs per layer)

Note: Wet batteries shipped in totes by air under special permit number SP 12283 are limited to a gross weight of 1,800 lbs (combination of batteries and packaging materials).

Personal Protective Equipment (PPE)

Suggested PPE for the sorting, consolidation, and packaging of wet batteries includes the following items:

- Gloves (ex: chemical resistant gloves)
- Eye protection (ex: protective goggles).
- Long sleeves
- Heavy pants
- Steel/composite toed boots

Supplies/Packaging Materials

Suggested supplies and packaging materials for preparing wet batteries for backhaul includes the following items:

- Sturdy pallet
- Material to separate & insulate battery layers (Cardboard, Waffle board, etc.)
- Stretch wrap (80 gauge or similar)
- Banding
- Non-leaking fish tote with a lid, if needed
- Labels

Spill Cleanup/Emergency Response

The potential for fire/explosion and the risk of leaking electrolyte are the main risk when managing wet batteries; Battery terminals should be insulated and to reduce the threat of fire/explosion. Batteries should be handled, stacked, and staged in a responsible manner to limit the risk of spilling electrolyte.

When handling batteries the following materials will assist with emergency response and spill cleanup:

- Nitrile Gloves
- Heavy/Thick Plastic Bags
- Chemical Resistant gloves
- Absorbent (ex: vermiculite, kitty litter, absorbent powder)
- Electrolyte neutralizer (ex: Baking powder for Acid, Vinegar for Alkali)
- Broom/Brush & Heavy plastic bag (for containing spill cleanup matter)
- Fire Extinguisher

General Packaging Guidance

The following general packaging guidelines and notes apply to packaging and shipping wet batteries for recycling:

- Packaging Wet Batteries on Pallets
 - Choose pallets that are not split, broken, or otherwise significantly damaged. Pallets should be able to support the full load of the packaged batteries.

Wet Batteries (Lead Acid & Ni-Cad)

- Materials on pallets should be wrapped tightly with stretch wrap and secured with banding. Material should not shift, spill, or collapse while being transported.
- Do not stack more than 3 layers of batteries.
- Ensure each layer (including the top layer) has a significant amount of insulating material separating the layers of batteries.
 - Insulating layers should prevent accidental short circuit (leading to fires/explosions)
 - Insulating layers should protect against battery terminals on lower layers from puncturing the bottom of batteries stacked on top of them.
 - Insulation on the top layer should be thick enough to ensure banding material does not come in contact with any battery terminals.
- Packaging Wet Batteries in Totes
 - Typically, totes can hold 2 layers of batteries.
 - Ensure each layer (including the top layer) has a significant amount of insulating material separating the layers of batteries.
 - Insulating layers should prevent accidental short circuit (leading to fires/explosions)
 - Insulating layers should protect against battery terminals on lower layers from puncturing the bottom of batteries stacked on top of them.
 - Ensure the lid can fully cover the tote and securely band the lid shut when finished packaging

More detailed packaging guidelines are provided in the *Wet Battery – Packaging Guidance* sections (for packaging on pallets and totes, respectively)

Labeling

The following labels should be used for staging and shipping wet batteries to be recycled.

- Labeling for transport by barge or road
 - Universal Waste Label
 - Corrosive #8
- Labeling for transport by air (Batteries packed in a tote utilizing SP 12283)
 - Universal Waste Label
 - Corrosive #8
 - Up arrows
 - “Danger – Do not ship on passenger aircraft” or similar
 - Special Permit – Full document attached to the container

Shipping

If possible, keep pallets and totes dry prior to shipment. Further, ensure the following prior to shipping:

- All battery containers are appropriately labeled
- Declare batteries as Hazmat
- Ship materials upright
- Do not stack battery pallets/totes on top of any other pallets of material.
- Block/brace battery pallets/totes into place to ensure materials don't shift during transport
- #8 Corrosive placards will be needed for the shipping container
- Remember, wet batteries shipped in totes by air under special permit number SP 12283 are limited to a gross weight of 1,800 lbs.

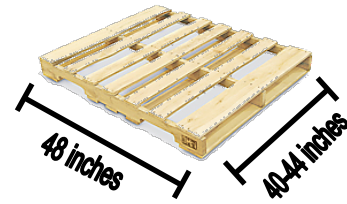
Battery containers can be shipped via plane, truck or barge. Be sure to check with transporters and vendors to see if there are any additional requirements prior to shipping.

Wet Batteries (Lead Acid & Ni-Cad)

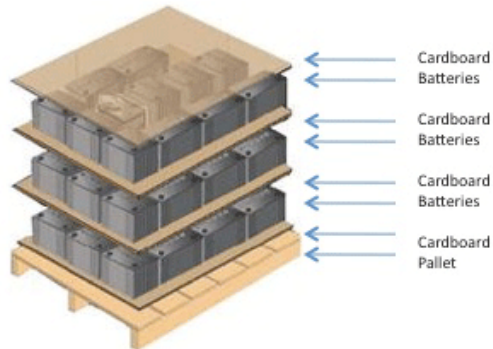
Packaging Guidance – Pallets

Important Pallet and Packaging Specifications:

1. Maximum pallet sizes: 40" x 48" or 44" x 48"



2. Maximum layers per pallet: 3 – roughly 24 batteries/layer = 72 batteries for 3 layers.



Wet batteries must have a layer cardboard separating each level. This includes a layer of cardboard on the bottom and the top of the load.

3. Typical Pallet Weight (for 3 layers): *Between 2800 and 3300 lbs – Pallets are not to exceed 3300 lbs.*
4. Only lead-acid batteries may be packaged: *No mixing in other batteries or recyclables.*
5. Pallet must be built with a minimum of **3** bottom boards and durable enough to handle the weight of the batteries.

This pallet has 3 bottom boards



Instructions for Stacking Wet Batteries on a Pallet

1. Select a sturdy pallet with no broken or missing boards. Be sure there are no nails sticking out, which could puncture the batteries or pose a safety hazard.



An example of a typical wood pallet

2. Place a layer of cardboard on the pallet to create a flat work surface and help prevent batteries from sliding off of the pallet.

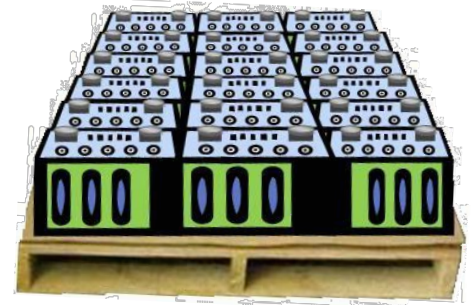


A pallet with a layer of cardboard

Wet Batteries (Lead Acid & Ni-Cad)

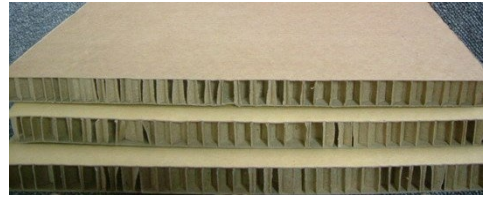
Packaging Guidance – Pallets

3. Make the first layer of batteries as level and as close together as possible.
 - If some of the batteries are shorter, they should be placed in the center of the layer.
 - Batteries that are relatively taller should be saved and placed on the top layer (if stacking more than 1 layer).
 - Ensure no batteries are hanging over the edge of the cardboard/pallet.



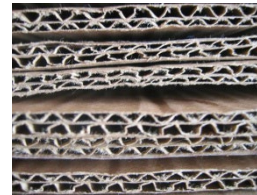
Single layer of batteries

4. Place cardboard (multiple sheets if necessary) between each layer of batteries.
 - It is best to use the thick honeycomb cardboard (if available).



Examples of honeycomb cardboard

- Alternatively, multiple layers of cardboard can also be used.



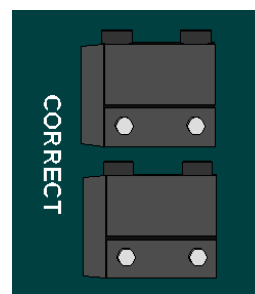
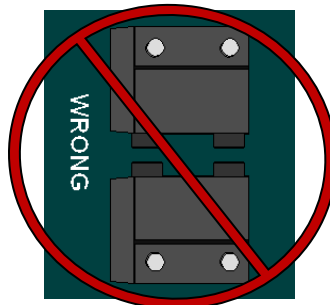
Examples of layers of typical cardboard

- Enough layers of cardboard must be applied to achieve the following:
 - Prevent the possibility of short circuits; and
 - Prevent the terminals from puncturing the underside of the batteries in the layer above.



2 layers of batteries with honeycomb cardboard separating the two layers

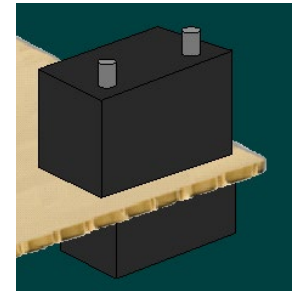
Note #1: Side terminal batteries must be stacked so the posts are facing away from each other and not facing towards the outside of the pallet. Side terminals must never touch (below displays overhead views of “Side Terminal Batteries”).



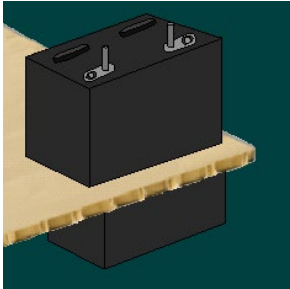
Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Pallets

Note #2: Top posts must be positioned toward the outside of the pallet so the layer above it leans toward the center. Make sure that no batteries are overhanging the cardboard.



Example: The top battery has the terminals positioned toward the outside of the pallet.



Note #3: Stud post batteries (such as Marine Batteries) should be on the top layer. If this is not possible, you will need extra layers of cardboard between the layers of batteries to prevent punctures. This is also important when stacking three layers high.

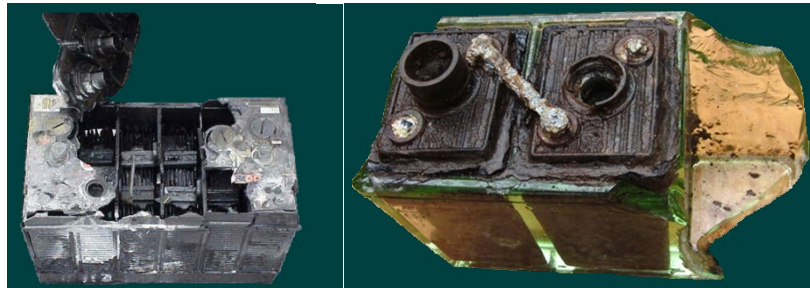
Example: The top “stud post” battery has its terminals positioned toward the outside of the pallet, and would need extra layers of cardboard to prevent puncturing the next layer of batteries.

5. A maximum of 3 layers of batteries may be placed on a pallet. When stacking is complete, place cardboard on top of the final layer of batteries.



3 layers of batteries with a layer of cardboard on top.

6. Any battery that has been damaged and has the potential to leak must first be placed in a container capable of holding its contents.



Examples of damaged lead acid batteries

- Damaged batteries that are not visibly leaking electrolyte should be put in heavyweight polyethylene plastic bags (minimum: 6 mil), properly sealed with plastic tie, and placed in the middle of the top layer.
- Damaged batteries that have the potential to leak must be placed in a container that is capable of holding its contents (i.e. will not leak fluid) such as a DOT approved 5- gallon bucket.



An example of a DOT approved 5-gallon container

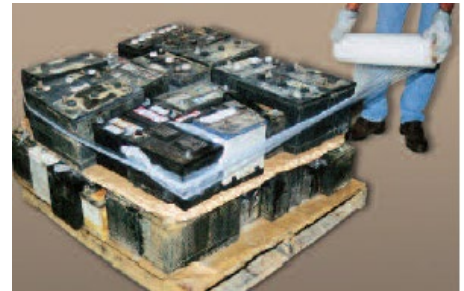
Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Pallets

Instructions for Wrapping Pallet

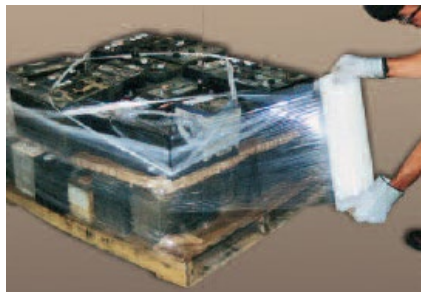
All batteries should be secured to the pallet with stretch wrap. An 80 gauge (or stronger) stretch wrap is recommended. Stretch wrap works best if it is pulled tight before stretching it around the corners.

1. Start with the stretch wrap turned sideways to create a “rope-effect”. Wrap around the top layer twice.*
2. Using the rope-effect, wrap the top layer twice* more, each time crossing over the top to form an “X-pattern.” This should pull the batteries towards the center, preventing batteries from falling off of the pallet.



Creating a “rope-effect” with stretch wrap

3. Holding the stretch wrap open, wrap around the bottom layer twice*, being sure to catch the edges of the pallet.



Holding the stretch wrap open



3 layers of batteries wrapped up

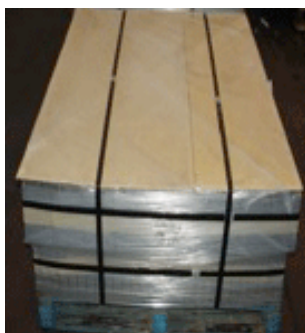
4. After placing a layer of cardboard on top of the batteries, wrap around the top layer at least twice* and tear-off the stretch wrap at the last corner.



Fully wrapped pallet of batteries

****Note:*** After wrapping twice (during each step) judge the load; wrap as many times as necessary to stabilize the load.

5. To further secure the load, band the material to the pallet.



A wrapped and banded pallet of lead acid batteries (3 levels)

6. Finally, ensure the pallet is properly labeled. At minimum, the pallet should include a #8 Corrosive and a Universal Waste Label. Check with your transporter to see if any additional labeling is required.



Ex: #8 Corrosive Label



Ex: Universal Waste Label

NOTE: The information, guidance, and instructions herein are made in good faith and are believed to be accurate at the date of preparation. The authors of this document make no guarantee of the information's current and future accuracy, either expressed or implied. It is incumbent of individuals collecting, packaging, and shipping materials to be aware of and comply with all current applicable regulations and other relevant requirements.

Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Totes

Suggested Material List

- Safety Glasses and Gloves
- Fish Tote (No cracks or holes)
- Absorbent (Vermiculite or other absorbent)
- Plywood
- Blue board, heavily corrugated cardboard, or regular cardboard (to separate layers of batteries and protect their terminals)
- Shipping Labels
- Special Permit (for shipping by air)
- Straps (for securing the tote lid)



1) It is important to use a nonreactive container to backhaul wet batteries if they are being shipped by air. Plastic fish totes are perfect containers for backhauling lead acid batteries.

2) To prepare a fish tote for backhauling wet batteries, first apply some sort of absorbent to the bottom of the fish tote. This absorbent can be vermiculite, kitty litter, or some other absorbent material capable soaking up any leaking battery acid.



Adding absorbent to a fish tote

3) Next, cut a piece of plywood to fit snugly in the bottom of the fish tote (if needed, you can cut multiple pieces and jigsaw them to fit on the bottom). The plywood will give you a level surface on which to stack batteries. After the plywood is in place, apply some more absorbent.



Plywood, cut to fit the bottom of the tote



Plywood with absorbent (vermiculite) sprinkled on top

Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Totes

- 4) You are now ready to stack a first layer of batteries. Carefully, place batteries in the tote so they are sitting upright. Batteries that are not stacked upright are more likely to spill their electrolyte (i.e. battery acid).



First layer of batteries being stack upright



- 5) The first layer is complete when you can easily fit another battery onto the bottom. If needed, you can place excess cardboard into fill in gaps to keep the batteries from jostling during transport.



A completed first layer of lead acid batteries



Batteries with cardboard inserted between them for better stability

- 6) Once the first layer is complete, a protective layer is needed before beginning the second layer of batteries. Heavily corrugated cardboard is ideal for protecting the terminals of the first layer. Also acceptable is blue board (blue Styrofoam) and multiple layers of regular cardboard.



A side view of heavily corrugated cardboard, perfect for separating layers of wet batteries



Applying multiple layers of thinner regular cardboard.

Heavily corrugated cardboard, notice the holes created by the battery terminals. The cardboard protects against the terminals on the lower layer from punching through the bottom of the batteries on the upper layer

Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Totes

- 7) Before beginning a second layer, it is a good idea to apply some additional absorbent. Stack a second layer of batteries just like the first.



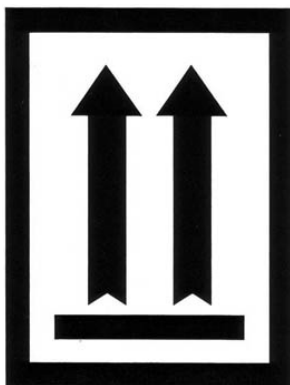
Separating layer of cardboard with more absorbent sprinkled on top



Beginning a second layer of batteries

- 8) Once full, the lid can be placed onto the tote. The lid will have to be secured with straps. The entire tote needs to be properly labeled before it can be shipped by air. Check with your shipper to determine proper labeling. Typically, a fish tote of lead acid batteries will need the following labels:

- 4 – Up arrow stickers (1 placed on each side of the tote);
- 5 – “Danger” stickers (1 placed on each side and 1 on the lid);
- 5 – #8 Corrosive stickers (1 placed on each side and 1 on the lid).



Examples of a typical "up arrow" sticker, "#8 corrosive sticker, and a "Danger" sticker.

A fish tote completely packed with lead acid batteries for recycle. The tote has been properly labeled and the lid has been securely strapped down for air transport.



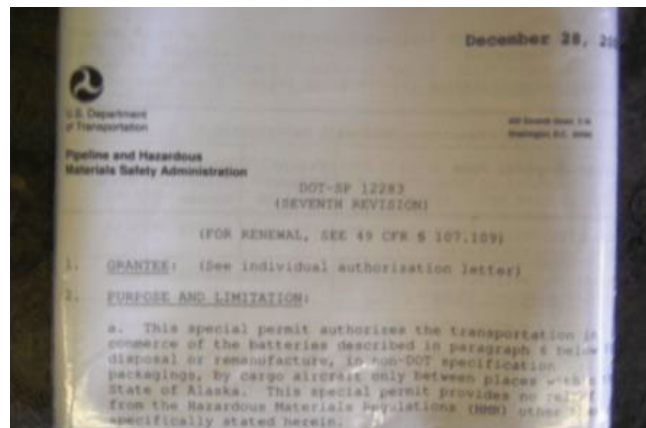
Wet Batteries (Lead Acid & Ni-Cad)

Packaging Guidance – Totes

- 9) Shipping wet batteries by air requires a special permit if you are using non-DOT containers such as fish totes. You can request a party status to a special permit by 1) writing a *hardship letter* to USDOT PHMSA or 2) applying online through the US DOT PHMSA Portal (for the internet link, Google the phrase “*PHMSA Portal Access Page*”).

If you obtain a special permit, *be sure to comply with all the conditions within the special permit. Failure to follow all the requirements within the special permit can result in major fines.*

In addition to providing your air carrier with a copy of the Special Permit, an additional copy needs put in a clear plastic bag (to be protected and visible) and attached to the tote lid. The Special Permit Number (ex: SP12283) will must be visible on the tote. Always check with your carrier to ensure that packaging is done properly.



Example - Special Permit used to ship lead acid batteries by air

Be sure to work with your recycler and transporter to ensure the return of your fish tote.