Regulations Governing Shipment of Electric Vehicle Batteries in the U.S.

To provide guidance that identifies EV battery transportation regulations by chemistry, by state of health (end-of-life vs. damaged-defective-recalled), by mode of transportation, and then links those regulations to types of shipping containers permitted for use.

Some links lead to regulations behind paywalls.

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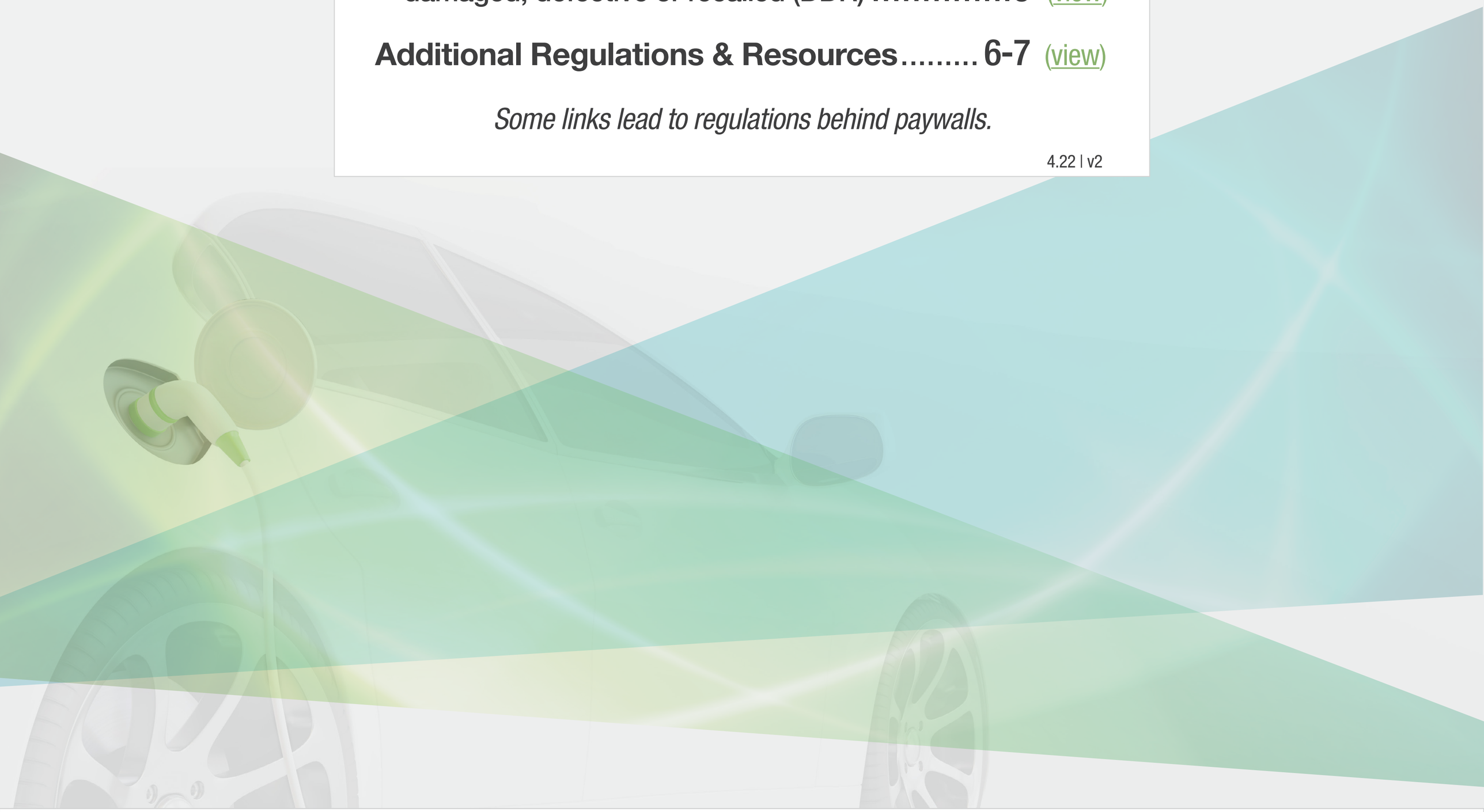

SUPPLIERS PARTNERSHIP FOR THE ENVIRONMENT

call2recycle®
Leading the charge for recycling.™

Battery Solutions

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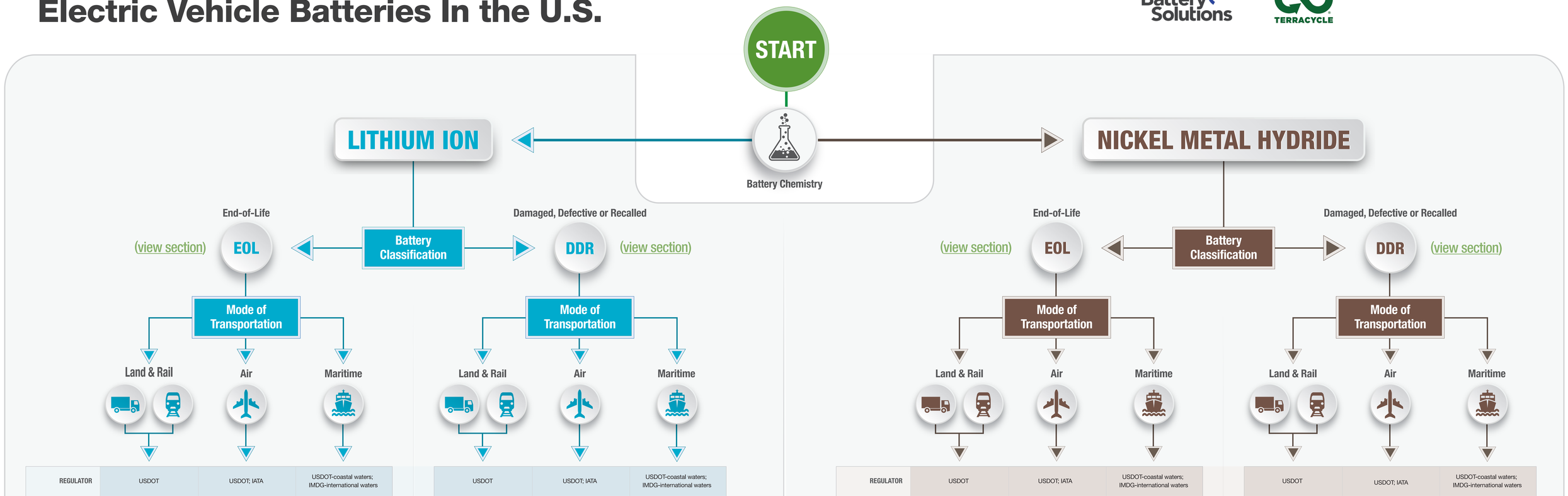
Developed by Suppliers Partnership and Call2Recycle, with input from Battery Solutions and TerraCycle.

Battery Solutions

TERRACYCLE

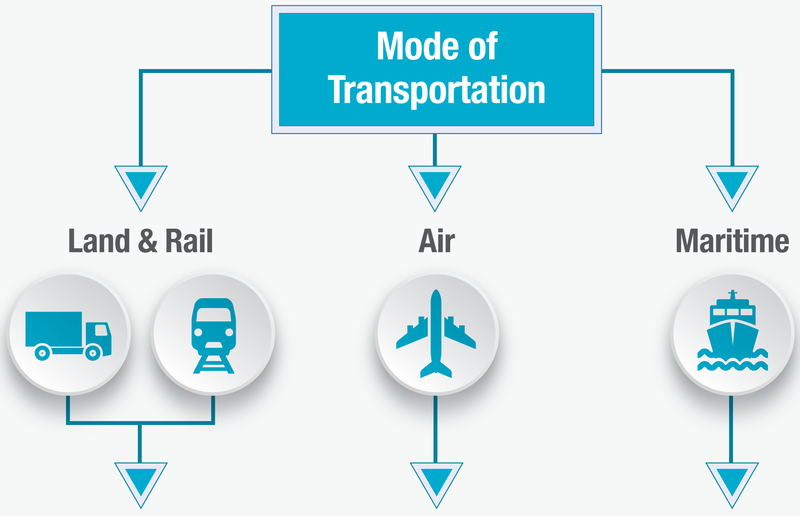


	LITHIUM ION					
	End-of-Life			Damaged, Defective or Recalled		
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49CFR 173.185 (a)(b)(d)	49CFR 173.185 (a)(b)(d); IATA 965	SP 188, 230-IMDG 39-18; P 903, 909	49CFR 173.185 (f)	49CFR 173.185 (f)	SP 188, 230-IMDG 39-18; P 904, 908, 911
SECTIONS	(a)(b)(d)	IATA 965	IMDG P 903, 909	(f)	(f)	IMDG P 908, 911
SIMPLE INTERPRETATION	Lithium batteries that weigh 12 kg (26.5 lbs) or more and have a strong, impact-resistant outer casing and assemblies of such batteries, may be packed in strong outer packagings; in protective enclosures (for example, in fully enclosed or wooden slatted crates); or on pallets or other handling devices. FULL REGULATION, USDOT	Do not pack lithium cells and batteries with explosives and flammable liquids and/or solids. Batteries or battery assemblies packaged in accordance with this paragraph may be transported by cargo aircraft if approved by the Associate Administrator. Weight >35 kg requires shipment approved by PHMSA and that batteries be discharged to 30% or less. If shipping within equipment, no discharge required. FULL REGULATION, USDOT FULL REGULATION, IATA (1) FULL REGULATION, IATA (2) (behind paywall)	Cells or batteries shall be packed in packagings so that the cells or batteries are protected against damage that may be caused by the movement or placement of the cells or batteries within the packaging. Packagings shall conform to the PG2 performance level. FULL REGULATION, IMDG (behind paywall)	MOST RAIL WILL NOT ACCEPT DDR BATTERIES - Only 1 battery or cell placed in a container. - Each cell or battery must be placed in an individual non-metallic inner packaging that completely encloses the battery. - Each inner packaging placed in a PG1 container. - The inner packagings are surrounded by non-combustable, electrically non-conductive, and absorbing cushioning material. FULL REGULATION, USDOT	Prohibited FULL REGULATION, USDOT	P908: Cells or battery ships in PG2 containers if DDR batteries are not liable to have a thermal event. P911: Where cells or battery are liable to have a thermal event: - Only 1 battery or cell placed in a container. - Each cell or battery must be placed in an individual non-metallic inner packaging that completely encloses the battery. - Each inner packaging placed in a PG1 container. - The inner packagings are surrounded by non-combustable, electrically non-conductive, and absorbing cushioning material. - Venting is required when appropriate. FULL REGULATION, IMDG (behind paywall)
HAZMAT TRAINING REQUIRED?	YES	YES	YES	YES	N/A	YES
SHIPPING CONTAINER REQUIRED?	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.	Each inner packaging must be individually placed in one of the following packagings meeting the applicable requirements of part 178, subparts L, M, P, and Q of this subchapter at the Packing Group 1 level: (i) Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box; (ii) Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum; or (iii) For a single battery, and for a single item of equipment containing cells or batteries, the following rigid large packagings are authorized: (A) Metal (50A, 50B, 50N); (B) Rigid plastic (50H); (C) Plywood (50D); and (4).	Prohibited	The following packagings are authorized provided the general provisions of 4.1.1 and 4.1.3 are met: For cells and batteries and equipment containing cells and batteries: - Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G) - Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2) - Jerricans (3A2, 3B2, 3H2) Packaging shall conform to the PG 2 performance level.

	NICKEL METAL HYDRIDE					
	End-of-Life			Damaged, Defective or Recalled		
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49 CFR 172.102 SP 130	49 CFR 172.102 SP 130; IATA SP A199	49 CFR 172.102 SP 340; IMDG SP 117, 963	49 CFR 173.21(c); 49 CFR 172.102 SP 130	49 CFR 173.21(c); 49 CFR 172.102; IATA SP A199; IATA Section 2.1 Forbidden Dangerous Goods	49 CFR 173.21; 49 CFR 172.102; IMDG SP 117, 963
SECTIONS	SP 130	IATA SP A199	IMDG SP 963	SP 130	IATA SP A199	IMDG SP 117, 963
SIMPLE INTERPRETATION	The cells or batteries must be prepared and packaged for transport in a manner to prevent: - a dangerous evolution of heat, - short circuits, - damage to terminals, - and are subject to the incident reporting in accordance with § 171.16 FULL REGULATION, USDOT	The batteries must be prepared and packaged for tranport in a manner to prevent: (a) a short circuit (b) unintentional activation. The words "Not Restricted" and the Special Provision number must be included in the description of the substance on the Air Waybill. Incident reporting in accordance with 171.15, 171.16 (in U.S.) FULL REGULATION, USDOT FULL REGULATION, IATA (1) FULL REGULATION, IATA (2) (behind paywall)	NiMH cells or batteries packed with or contained in equipment are not subject to the provisions of this Code. For all other NiMH batteries, must be: - securely packed - protected from short circuit - IMO Dangerous Goods Declaration is required FULL REGULATION, USDOT FULL REGULATION, IMDG (behind paywall)	Section 173.21 prohibits the offering for transportation or transportation of electrical devices which are likely to create sparks or generate a dangerous quantity of heat. SP 130 requires the batteries be packaged in a matter and manner to prevent: - a dangerous evolution of heat, - short circuits, - damage to terminals, - and are subject to the incident reporting in accordance with § 171.1.6 FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2)	Prohibited FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2) FULL REGULATION, IATA (behind paywall)	When shipped by vessel in quantities over 100 kg they must be shipped as fully regulated Class 9 hazardous materials/dangerous goods. FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2) FULL REGULATION, IATA (behind paywall)
HAZMAT TRAINING REQUIRED?	NO	NO	YES, if quantity is greater than 100 kg	NO	NO	YES
SHIPPING CONTAINER REQUIRED?	Not required	Not required	Not required	49 CFR § 173.22 Shipper's responsibility and 49 CFR § 173.24 General requirements for packagings and packages	49 CFR § 173.22 Shipper's responsibility and 49 CFR § 173.24 General requirements for packagings and packages	SP 117, 963

Li-Ion

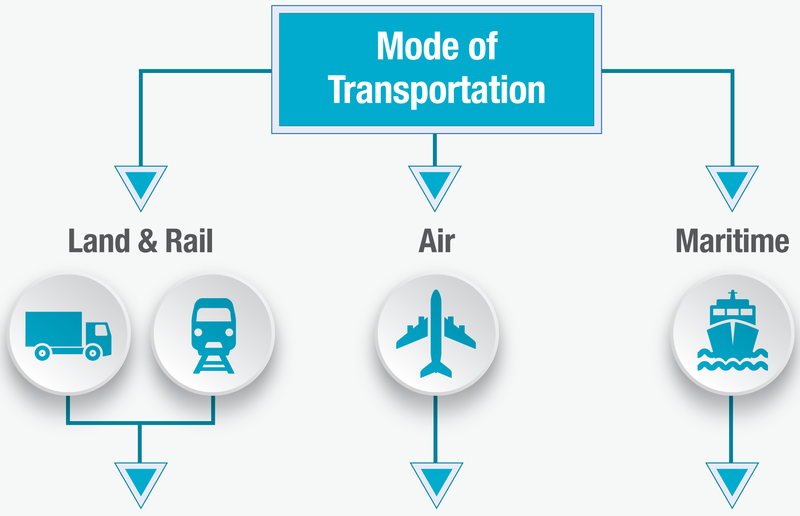
End-of-Life (EOL)



	Land & Rail	Air	Maritime
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49CFR 173.185 (a)(b)(d)	49CFR 173.185 (a)(b)(d); IATA 965	SP 188, 230-IMDG 39-18; P 903, 909
SECTIONS	(a)(b)(d)	IATA 965	IMDG P 903, 909
SIMPLE INTERPRETATION	Lithium batteries that weigh 12 kg (26.5 lbs) or more and have a strong, impact-resistant outer casing and assemblies of such batteries, may be packed in strong outer packagings; in protective enclosures (for example, in fully enclosed or wooden slatted crates); or on pallets or other handling devices. FULL REGULATION, USDOT	Do not pack lithium cells and batteries with explosives and flammable liquids and/or solids. Batteries or battery assemblies packaged in accordance with this paragraph may be transported by cargo aircraft if approved by the Associate Administrator. Weight >35 kg requires shipment approved by PHMSA and that batteries be discharged to 30% or less. If shipping within equipment, no discharge required. FULL REGULATION, USDOT FULL REGULATION, IATA (1) FULL REGULATION, IATA (2) (behind paywall)	Cells or batteries shall be packed in packagings so that the cells or batteries are protected against damage that may be caused by the movement or placement of the cells or batteries within the packaging. Packagings shall conform to the PG2 performance level. FULL REGULATION, IMDG (behind paywall)
HAZMAT TRAINING REQUIRED?	YES	YES	YES
SHIPPING CONTAINER REQUIRED?	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.	Only where battery pack does not provide for its own outer containment. If one or more sides of the battery pack does not have its own containment, then yes a shipping container is required.

Li-Ion

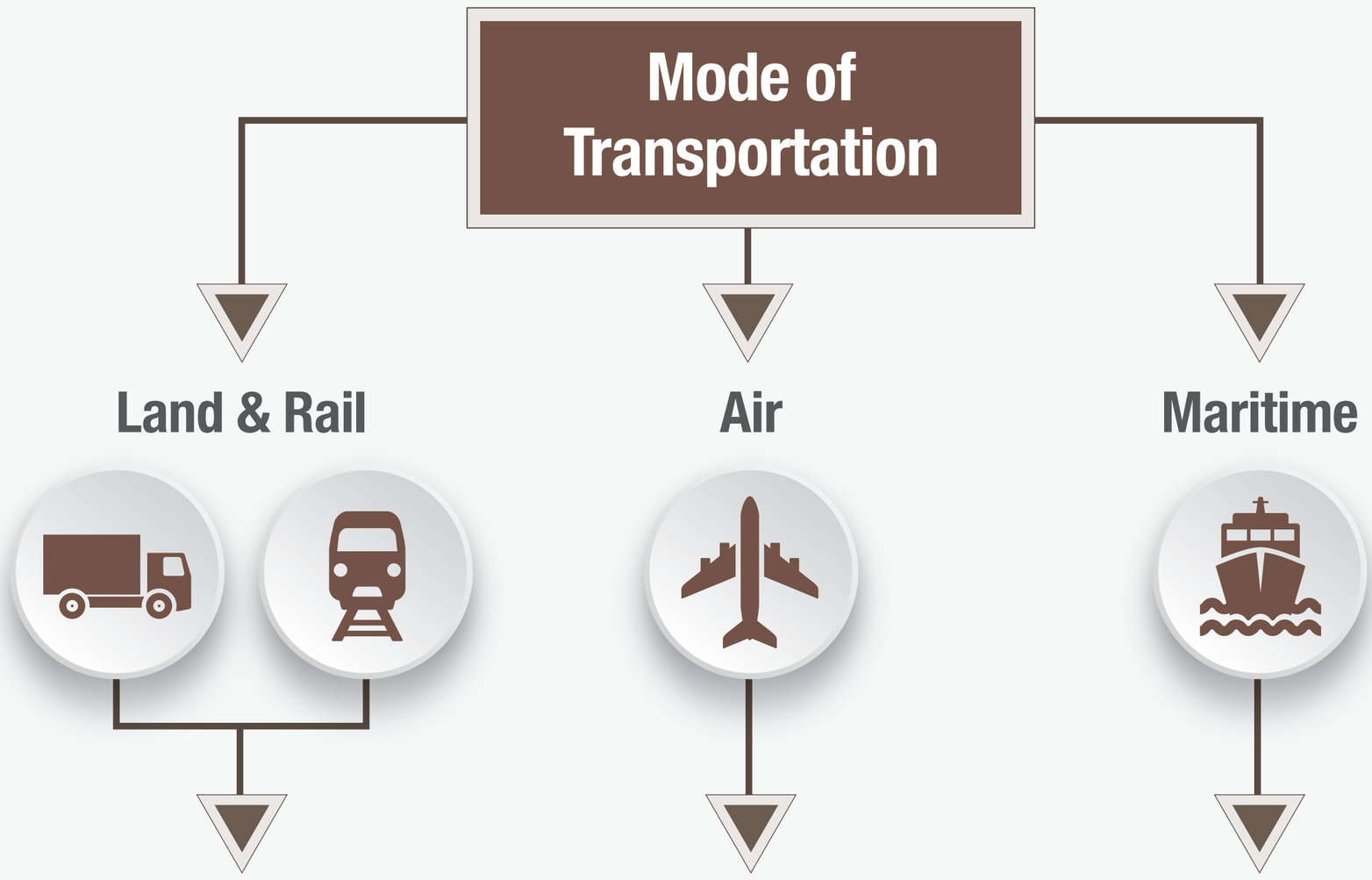
Damaged, Defective or Recalled (DDR)



	Land & Rail	Air	Maritime
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49CFR 173.185 (f)	49CFR 173.185 (f)	SP 188, 230-IMDG 39-18; P 904, 908, 911
SECTIONS	(f)	(f)	IMDG P 908, 911
SIMPLE INTERPRETATION	**MOST RAIL WILL NOT ACCEPT DDR BATTERIES** - Only 1 battery or cell placed in a container. - Each cell or battery must be placed in an individual non-metallic inner packaging that completely encloses the battery. - Each inner packaging placed in a PG1 container. - The inner packagings are surrounded by non-combustable, electrically non-conductive, and absorbing cushioning material. **FULL REGULATION, USDOT**	**Prohibited** **FULL REGULATION, USDOT**	P908: Cells or battery ships in PG2 containers if DDR batteries are not liable to have a thermal event. P911: Where cells or battery are liable to have a thermal event: - Only 1 battery or cell placed in a container. - Each cell or battery must be placed in an individual non-metallic inner packaging that completely encloses the battery. - Each inner packaging placed in a PG1 container. - The inner packagings are surrounded by non-combustable, electrically non-conductive, and absorbing cushioning material. - Venting is required when appropriate. **FULL REGULATION, IMDG** (behind paywall)
HAZMAT TRAINING REQUIRED?	YES	N/A	YES
SHIPPING CONTAINER REQUIRED?	Each inner packaging must be individually placed in one of the following packagings meeting the applicable requirements of part 178, subparts L, M, P, and Q of this subchapter at the Packing Group 1 level: (i) Metal (4A, 4B, 4N), wooden (4C1, 4C2, 4D, 4F), or solid plastic (4H2) box; (ii) Metal (1A2, 1B2, 1N2), plywood (1D), or plastic (1H2) drum; or (iii) For a single battery, and for a single item of equipment containing cells or batteries, the following rigid large packagings are authorized: (A) Metal (50A, 50B, 50N); (B) Rigid plastic (50H); (C) Plywood (50D); and (4).	**Prohibited**	The following packagings are authorized provided the general provisions of 4.1.1 and 4.1.3 are met: For cells and batteries and equipment containing cells and batteries: - Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G) - Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2) - Jerricans (3A2, 3B2, 3H2) Packaging shall conform to the PG 2 performance level.

NiMH

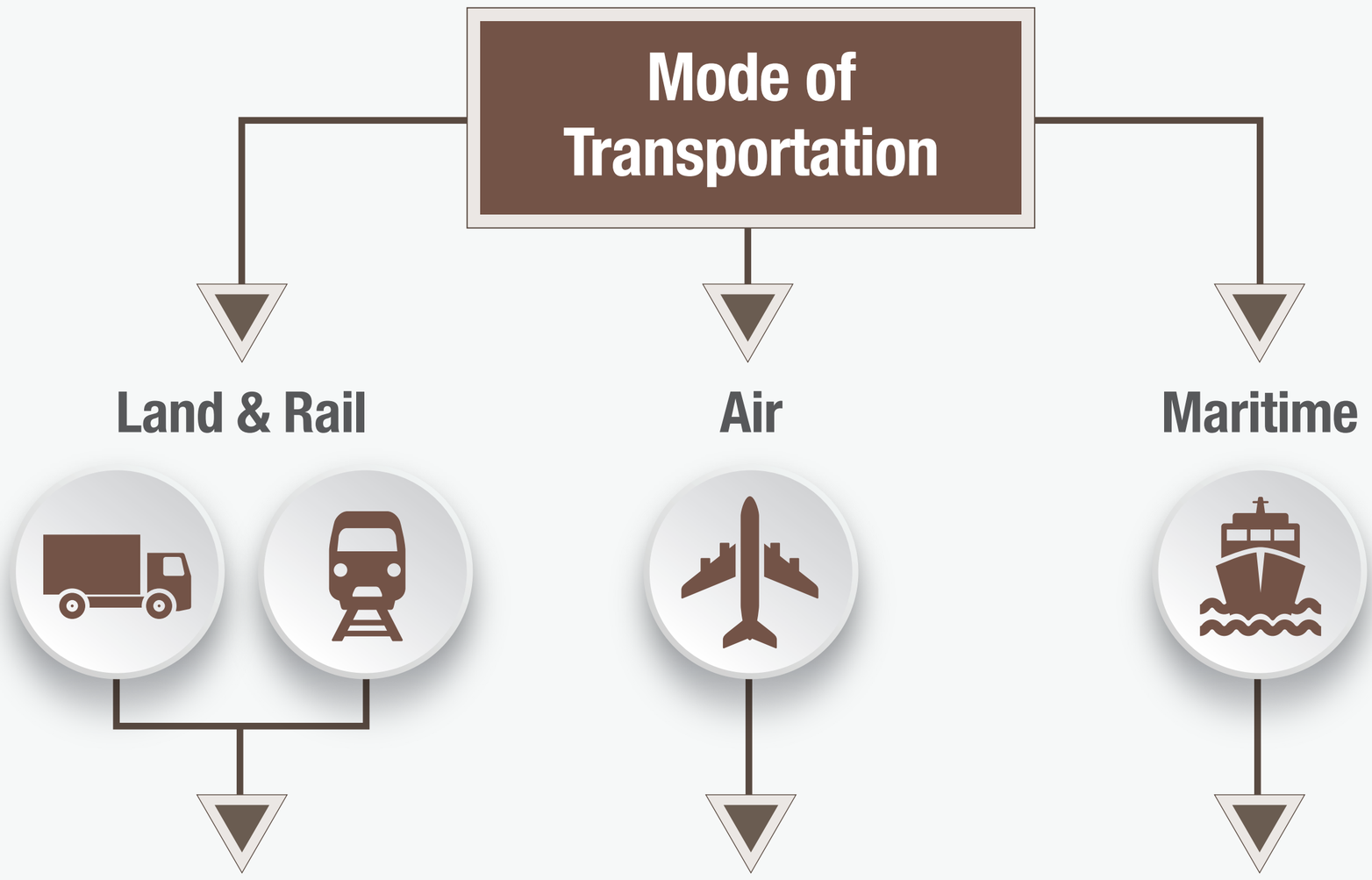
End-of-Life (EOL)



	Land & Rail	Air	Maritime
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49 CFR 172.102 SP 130	49 CFR 172.102 SP 130; IATA SP A199	49 CFR 172.102 SP 340; IMDG SP 117, 963
SECTIONS	SP 130	IATA SP A199	IMDG SP 963
SIMPLE INTERPRETATION	The cells or batteries must be prepared and packaged for transport in a manner to prevent: - a dangerous evolution of heat, - short circuits, - damage to terminals, - and are subject to the incident reporting in accordance with § 171.16	The batteries must be prepared and packaged for tranport in a manner to prevent: (a) a short circuit (b) unintentional activation. The words “Not Restricted” and the Special Provision number must be included in the description of the substance on the Air Waybill. Incident reporting in accordance with 171.15, 171.16 (in U.S.)	NiMH cells or batteries packed with or contained in equipment are not subject to the provisions of this Code. For all other NiMH batteries, must be: - securely packed - protected from short circuit - IMO Dangerous Goods Declaration is required
	FULL REGULATION, USDOT	**FULL REGULATION, IATA (1)** **FULL REGULATION, IATA (2)** (behind paywall)	**FULL REGULATION, USDOT** **FULL REGULATION, IMDG** (behind paywall)
HAZMAT TRAINING REQUIRED?	NO	NO	YES, if quantity is greater than 100 kg
SHIPPING CONTAINER REQUIRED?	Not required	Not required	Not required

NiMH

Damaged, Defective or Recalled (DDR)



	Land & Rail	Air	Maritime
REGULATOR	USDOT	USDOT; IATA	USDOT-coastal waters; IMDG-international waters
REGULATIONS	49 CFR 173.21(c); 49 CFR 172.102 SP 130	49 CFR 173.21(c); 49 CFR 172.102; IATA SP A199; IATA Section 2.1 Forbidden Dangerous Goods	49 CFR 173.21; 49 CFR 172.102; IMDG SP 117, 963
SECTIONS	SP 130	IATA SP A199	IMDG SP 117, 963
SIMPLE INTERPRETATION	Section 173.21 prohibits the offering for transportation or transportation of electrical devices which are likely to create sparks or generate a dangerous quantity of heat. SP 130 requires the batteries be packaged in a matter and manner to prevent: - a dangerous evolution of heat, - short circuits, - damage to terminals, - and are subject to the incident reporting in accordance with § 171.1.6 FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2)	**Prohibited** FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2) FULL REGULATION, IATA (behind paywall)	When shipped by vessel in quantities over 100 kg they must be shipped as fully regulated Class 9 hazardous materials/dangerous goods. FULL REGULATION, USDOT (1) FULL REGULATION, USDOT (2) FULL REGULATION, IATA (behind paywall)
HAZMAT TRAINING REQUIRED?	NO	NO	YES
SHIPPING CONTAINER REQUIRED?	49 CFR § 173.22 Shipper's responsibility and 49 CFR § 173.24 General requirements for packagings and packages	49 CFR § 173.22 Shipper's responsibility and 49 CFR § 173.24 General requirements for packagings and packages	SP 117, 963

Additional Regulations & Resources

Shippers of EV batteries also need to be aware of the following noteworthy regulations that impact or relate to the handling of EV batteries.

UNIVERSAL WASTE LAW	40 CFR 273.9 - Standards for Battery Management as Universal Waste. Batteries may be considered hazardous based on ignitability, corrosivity, reactivity or toxicity. Waste loads may contain mixed chemistries as per 173.166 and 173.159e. 273.11 & 273.31 Prohibitions: Small and Large quantity handlers of universal waste are prohibited from disposing of universal waste. Batteries deemed as R&D input or 'parts' are considered hazardous materials and not waste. Waste loads may contain mixed chemistries as per 173.166 and 173.159e.	Ignitability: It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard. **Corrosivity** (261.22.a.1): It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, as determined by a pH meter using Method 9040C in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in § 260.11 of this chapter. Reactivity (261.23.a): (a) A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties: (1) It is normally unstable and readily undergoes violent change without detonating. (2) It reacts violently with water. (3) It forms potentially explosive mixtures with water. (4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment. (5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment. (6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement. (7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure. (8) It is a forbidden explosive as defined in 49 CFR 173.54, or is a Division 1.1, 1.2 or 1.3 explosive as defined in 49 CFR 173.50 and 173.53. C26.
ACCUMULATION LAW	If hazardous, the following accumulation timelines apply: **Large Quantity Generators** (LQGs) generate 1,000 kilograms (about 2,200 lbs) or more per month of hazardous waste, more than one kilogram per month of acutely hazardous waste, or more than 100 kilograms per month of acute spill residue or soil. 273.35: A large quantity handler of universal waste may accumulate universal waste for no longer than one year from the date the universal waste is generated, or received from another handler, unless the requirements of paragraph (b) of this section are met. **Small Quantity Generators** (SQGs) generate more than 100 kilograms, but less than 1,000 kilograms, of hazardous waste per month. 273.15: A small quantity handler of universal waste may accumulate universal waste for no longer than one year from the date the universal waste is generated, or received from another handler, unless the requirements of paragraph (b) of this section are met. **Very Small Quantity Generators** (VSQGs) generate 100 kilograms or less per month of hazardous waste, or one kilogram or less per month of acutely hazardous waste, or less than 100 kilograms per month of acute spill residue or soil. 262.14: Not subject to the requirements unless exceeding noted limitations. www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-273/subpart-A/section-273.2#p-273.2© **Accumulation Chart:** www.epa.gov/hw/differences-between-universal-waste-and-hazardous-waste-regulations	

Additional Regulations & Resources

LEAD ACID BATTERY EXEMPTION	www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-266/subpart-G#p-266.80(a)
IATA	www.iata.org/contentassets/05e6d8742b0047259bf3a700bc9d42b9/lithium-battery-guidance-document-2021.pdf
PHMSA	www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2021-09/Lithium-Battery-Guide.pdf
BATTERIES TRANSPORT	www.batteriestransport.org
TERMINOLOGY	**EOL** - End-of-life **DDR** - Damaged, defective, or recalled **USDOT** - United States Department of Transportation **IATA** - International Air Transport Association **PHMSA** - Pipeline and Hazardous Materials Safety Administration **IMDG** - The International Maritime Dangerous Goods Code **IMO** - International Maritime Organization **UN** - United Nations **CFR** - Code of Federal Regulations **SP** - Special provision **Li-Ion** - Lithium Ion battery chemistry **NiMH** - Nickel Metal Hydride battery chemistry **HAZMAT** - Hazardous material(s) **PG1** - Packing group class 1 (or I) **PG2** - Packing group class 2 (or II)
ACKNOWLEDGMENT	Developed by Suppliers Partnership and Call2Recycle, with input from Battery Solutions and TerraCycle.
DISCLAIMER	This document is provided for educational purposes only. The information included is based on the professional judgment of the individual authors as of December 2021 and may be used at your discretion. SP and its member companies make no warranty, expressed or implied, and assume no liability for any form of damage that may result from use of this document. It is the responsibility of every company handling EV batteries to understand and comply with all applicable laws and regulations.