

# Background and Overview of DOE's Draft Railcar Safety Inspection Protocol

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# Draft Railcar Safety Inspection Protocol

- Objective is to develop a draft railcar safety inspection protocol that would be conducted by upstream inspectors and shared with downstream jurisdictions
- Who currently conducts inspections?
  - Rail Carriers (Railroads)
  - Federal Rail Administration (FRA)
  - State rail inspectors certified by FRA

*“Federal and State rail safety inspectors do not perform safety inspections for railroads. Railroads employ their own inspectors, supervisors, and maintenance personnel. The inspector’s role is to monitor the railroad and industry compliance with rail safety regulations. Given the vastness of the railroad industry compared to the size of the Federal and State inspection force, it is physically impossible for the inspection force to be omnipresent. The inspector’s job is to sample rail carrier compliance and take action to improve compliance where shortcomings are revealed.”<sup>1</sup>*

<sup>1</sup>State Rail Safety Participation Program Manager’s Handbook, April 2016.

# Origins of Draft Protocol

- Analogous to Commercial Vehicle Safety Alliance (CVSA) Level VI truck inspection for Highway Route Controlled Quantity (HRCQ)
- Considerations
  - Rail environment is different than the truck environment
  - Rail operations are different than truck operations
  - Some States do not participate in FRA State Rail Safety Participation Program and therefore do not have qualified inspectors
  - Some States with FRA State Rail Safety Participation Programs do not have inspectors for the motive power and equipment discipline
  - Tribal governments cannot currently participate in the Rail Safety Participation Program

# Draft Railcar Safety Inspection Protocol – Initial Efforts

- Initial inspection protocol development efforts by States over the period 2002 to 2010
- Developed two checklists, locomotive and railcar
  - Based on walk through of FRA regulations
  - Did not have access to manufacturer’s inspection checklists for actual railcars
  - Did not consider availability of monitored parameters and data feeds from Association of American Railroads (AAR) Standard S-2043<sup>1</sup> railcars equipped with safety monitoring system
  - Effort stopped in 2010
- Edwards and Runyon (2009)<sup>2</sup> paper discussed a proposed rail inspection program that would allow acceptance of inspections results by multiple jurisdictions

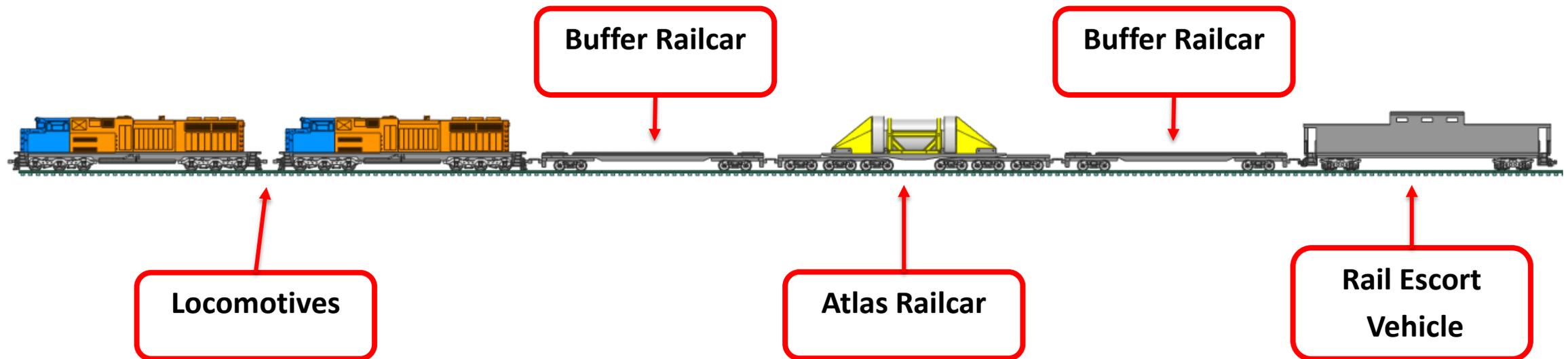
<sup>1</sup>AAR (Association of American Railroads). 2017. “Performance Specification for Trains Used to Carry High-Level Radioactive Material.” Standard S-2043, AAR Manual of Standards and Recommended Practices, Section C, Car Construction Fundamentals and Details. AAR Circular Letter C-12956, September 21, 2017. Association of American Railroads, Washington, D.C.

<sup>2</sup>Edwards P and T Runyon. 2009. Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel: Proposed Rail Inspection Program to Promote Reciprocity. Waste Management 2009, March 1-5, 2009, Phoenix, Arizona.

# Draft Inspection Protocol Topics

- Representative train
- Simplified concept of operations
- Transportation mode options
- Simplified origin and destination site activities
- Inspection requirements
  - Federal Railroad Administration
  - Pipeline and Hazardous Materials Safety Administration
  - Association of American Railroads Interchange Requirements
  - AAR Standard S-2043 inspection requirements
- Content of draft inspection protocol
- Additional items for discussion with the National Transportation Stakeholders Forum  
SNF Rail/Routing Ad Hoc Working Group

# Representative Train with Atlas Railcar, Buffer Railcars, and Rail Escort Vehicle



Note: Train may contain 1-7 cask-carrying railcars and may have buffer railcars between cask-carrying railcars.

# Photos of Railcars



**Rail Escort Vehicle**



**Atlas Railcar  
(with test weight)**

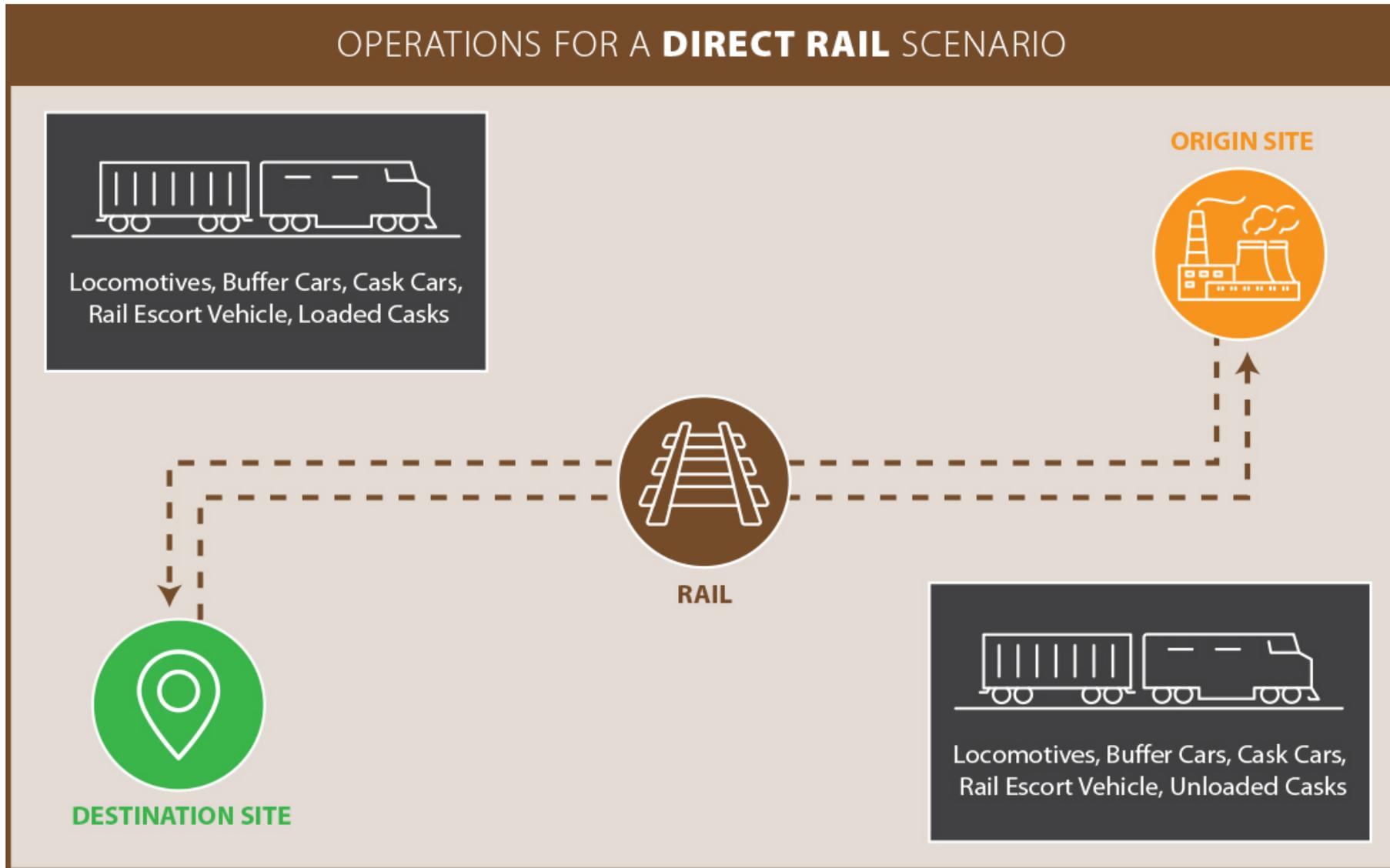


**Buffer Railcar**

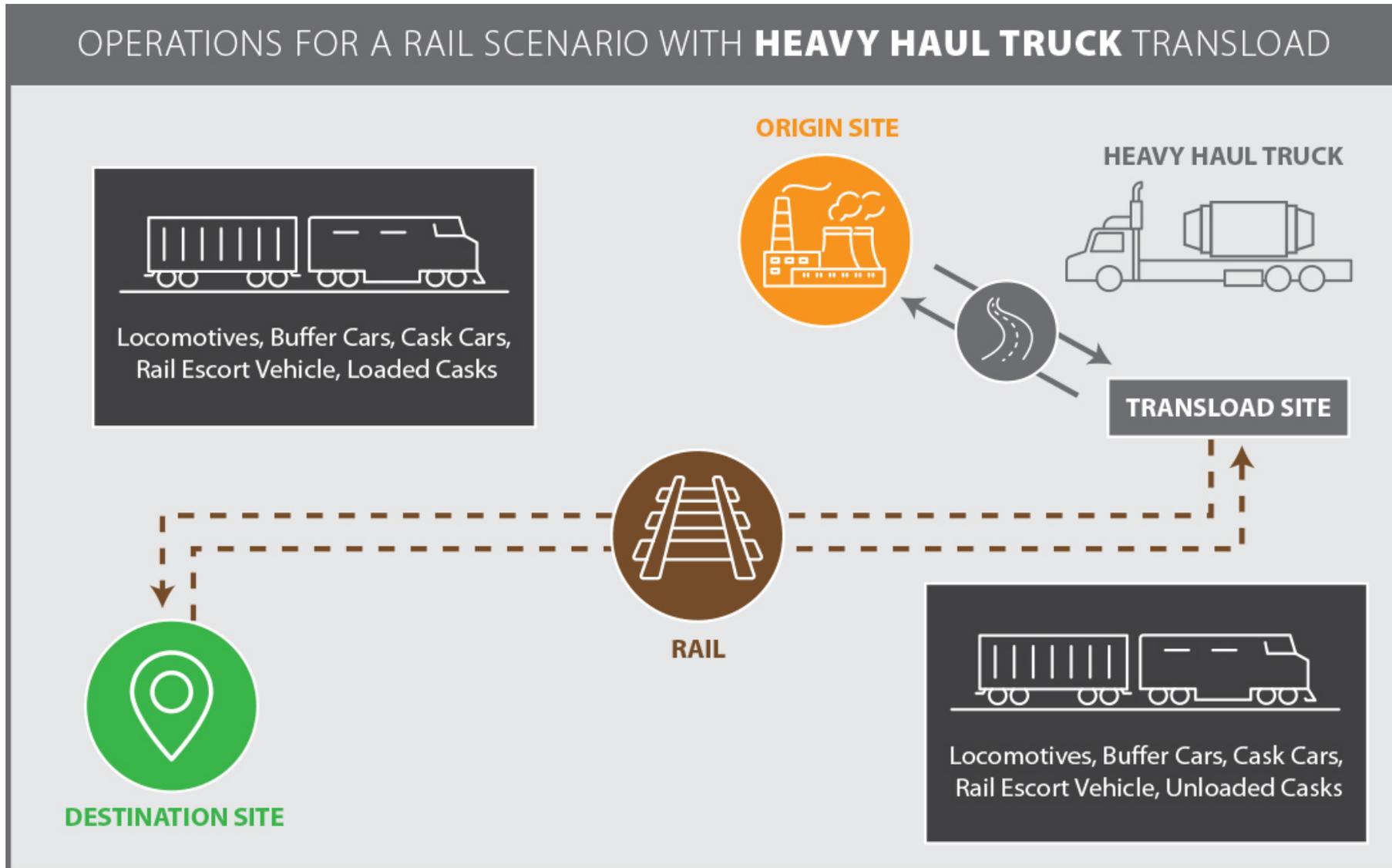
# Simplified Concept of Operations

- Simplified concept of operations developed to provide framework for development of draft inspection protocol
- Direct Rail
- Heavy Haul Truck Transload to Rail Variation
- Barge Transload to Rail Variation
- Other variations in operations are possible but are not discussed today and would not affect the overall framework of the draft protocol

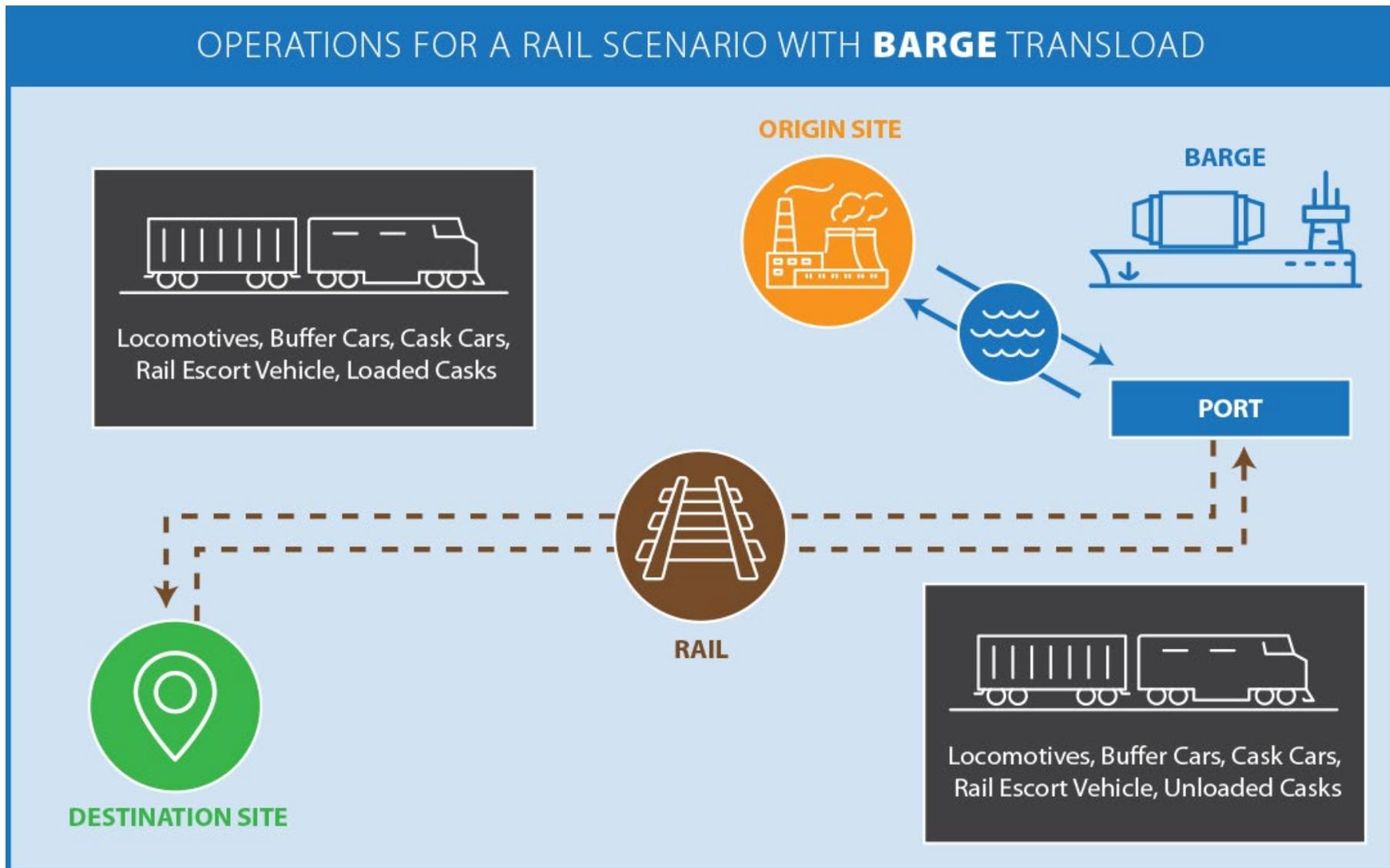
# Simplified Direct Rail Concept of Operations



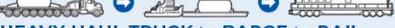
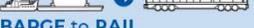
# Simplified Heavy Haul Truck Transload to Rail Variation



# Simplified Barge Transload to Rail Variation



# Transportation Mode Options

SITE	TRANSPORTATION MODE OPTIONS	
Maine Yankee	 DIRECT RAIL	 BARGE to RAIL
Yankee Rowe	 HEAVY HAUL TRUCK to RAIL	
Connecticut Yankee	 BARGE to RAIL	 HEAVY HAUL TRUCK to RAIL
Humbolt Bay	 HEAVY HAUL TRUCK to RAIL	 HEAVY HAUL TRUCK to BARGE to RAIL
Big Rock Point	 HEAVY HAUL TRUCK to RAIL	 BARGE to RAIL
Rancho Seco	 DIRECT RAIL	
Trojan	 DIRECT RAIL	 BARGE to RAIL
La Crosse	 DIRECT RAIL	 BARGE to RAIL
Zion	 DIRECT RAIL	 BARGE to RAIL
Crystal River	 DIRECT RAIL	 BARGE to RAIL
Kewaunee	 HEAVY HAUL TRUCK to RAIL	 HEAVY HAUL TRUCK to BARGE to RAIL
San Onofre	 DIRECT RAIL	 HEAVY HAUL TRUCK to BARGE to RAIL
Vermont Yankee	 DIRECT RAIL	
Fort Calhoun	 DIRECT RAIL	 BARGE to RAIL
Oyster Creek	 BARGE to RAIL	 HEAVY HAUL TRUCK to RAIL
Pilgrim	 BARGE to RAIL	 HEAVY HAUL TRUCK to RAIL

# Simplified Destination Site Activities

- Place unloaded transportation casks onto cask-carrying railcars
- Assemble buffer cars, cask-carrying cars, rail escort vehicle into a train
- Inspect train before it departs for origin site
  - See Motive Power and Equipment Manual<sup>1</sup> and AAR S-2043
- Fix minor defects before departure
- Cars with serious defects pulled out of service, sent for repair

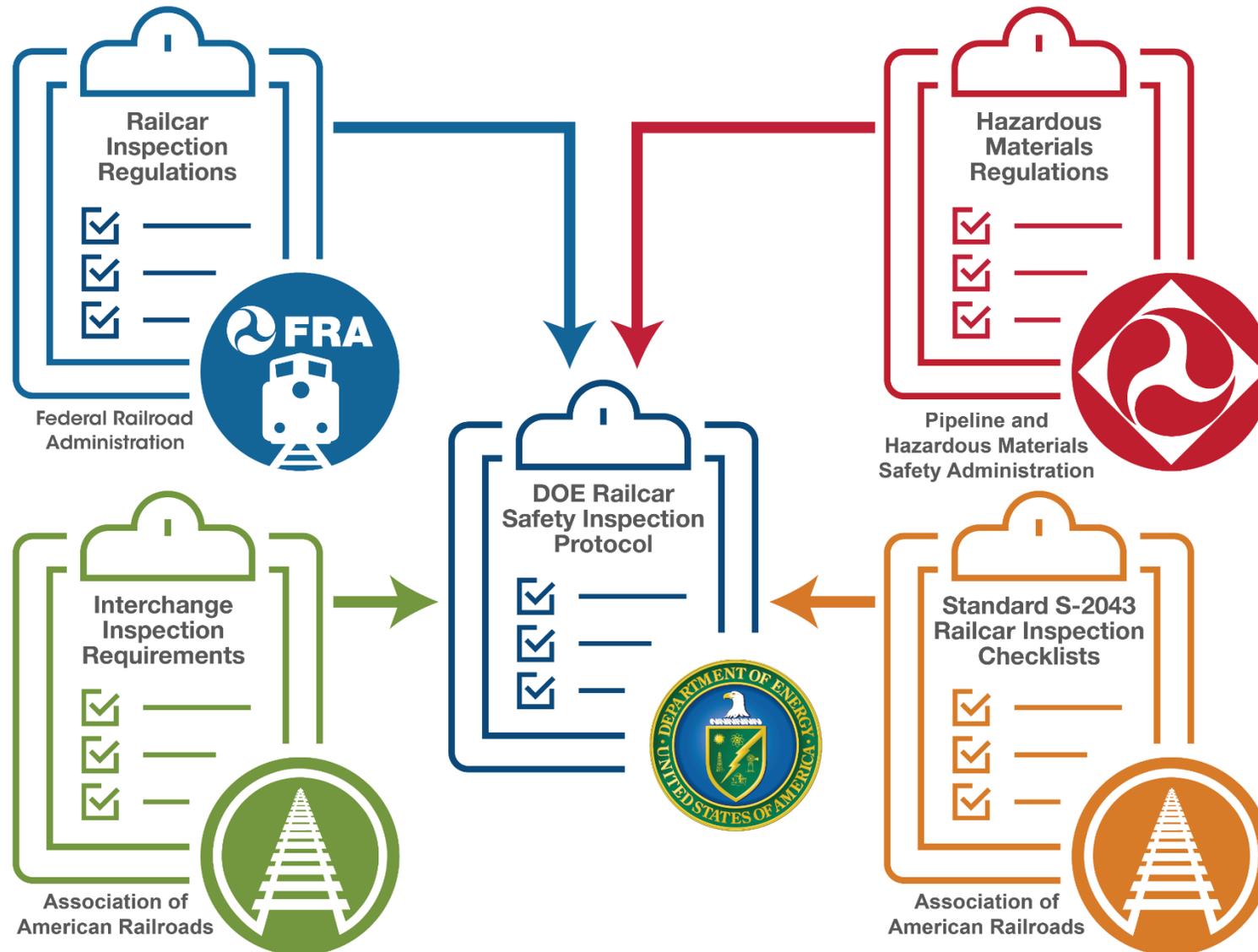
<sup>1</sup>FRA (Federal Railroad Administration). 2012. Motive Power and Equipment Compliance Manual. U.S. Department of Transportation, Federal Railroad Administration, Washington, DC. July.

# Simplified Origin Site Activities

- Load transportation casks
- Place loaded transportation casks onto cask-carrying railcars
- Assemble buffer cars, cask-carrying cars, rail escort vehicle into a train
- Inspect train before it departs for destination site
  - See Motive Power and Equipment Manual<sup>1</sup> and AAR S-2043
- Fix minor defects before departure
- Cars with serious defects pulled out of service, sent to repair shop
  - Shipment is delayed until replacement equipment arrives, or
  - Partial shipment departs

<sup>1</sup>FRA (Federal Railroad Administration). 2012. Motive Power and Equipment Compliance Manual. U.S. Department of Transportation, Federal Railroad Administration, Washington, DC. July.

# Draft Railcar Safety Inspection Protocol Integrates Inspections Required By Several Entities



# Federal Railroad Administration (FRA) Railcar Inspection Regulations

- Locomotive Inspection Requirements
  - 49 CFR Part 229 – Railroad Locomotive Safety Standards (“Blue Card”)
- Freight Railcar Inspection Requirements
  - 49 CFR Part 215 – Railroad Freight Car Safety Standards
  - 49 CFR Part 224 – Reflectorization of Rail Freight Rolling Stock
  - 49 CFR Part 231 – Railroad Safety Appliance Standards
  - 49 CFR Part 232 – Brake System Safety Standards for Freight and Other Non-Passenger Trains and Equipment; End-Of-Train Devices



# Pipeline and Hazardous Materials Safety Administration and Federal Motor Carrier Safety Administration Regulations

- Hazardous materials transportation regulated by the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Regulations include
  - 49 CFR Part 171 – General Information, Regulations, and Definitions
  - 49 CFR Part 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans
  - 49 CFR Part 173 – Shippers – General Requirements for Shipments and Packagings
  - 49 CFR Part 174 – Carriage by Rail
  - 49 CFR Part 175 – Carriage by Aircraft
  - 49 CFR Part 176 – Carriage by Vessel
  - 49 CFR Part 177 – Carriage by Public Highway
  - 49 CFR Part 178 – Specifications for Packagings
- DOT Federal Motor Carrier Safety Administration (FMCSA) has requirements that apply to transporting radioactive materials by highway. These requirements include:
  - 49 CFR Part 385, Safety Fitness Procedures, Subpart E ( § 385.401- § 385.423), Hazardous Materials Safety Permits
  - 49 CFR Part 397, Transportation of Hazardous Materials; Driving and Parking Rules, Subpart D ( § 397.101- § 397.103), Routing of Class 7 (Radioactive) Materials

# Association of American Railroads (AAR) Interchange Inspection Requirements

- Most freight railcars are interchangeable among railroads
  - This is possible because the basic dimensions, design criteria, construction, and maintenance standards for railcars are specified by the AAR
- AAR interchange requirements are contained in the Field Manual of the AAR Interchange Rules
- Components covered in the Field Manual include:
  - Air brake equipment (Rules 3-13)
  - Couplers, yokes, draft gear, uncoupling levers, and support brackets (Rules 16-23)
  - Roller bearings and adapters (Rules 36 and 37)
  - Wheels and axles (Rules 41, 43, and 44)
  - Truck components (Rules 46-48, 50, and 53)
  - Sills (Rules 57-59)
  - Center plates and side bearings (Rules 60-62)
  - General repairs (Rules 63-82).

# AAR Standard S-2043 Railcar Inspection Checklists

- Appendix A in AAR Standard S-2043 contains maintenance standards and recommended practices for trains used to carry SNF, including inspection requirements.
- Specific inspection checklists have been developed for the Atlas railcar and buffer railcar
- Inspection checklist for the Rail Escort Vehicle (REV) is under development

<i>ATLAS RAILCAR INSPECTION CHECKLIST SIGN-OFF</i>					
<i>Description of Inspection Item</i>	<i>Recorded Dates, Measurements, or Remarks</i>		<i>Condition**</i>		<i>Signature*</i>
	<i>A End of Car</i>	<i>B End of Car</i>	<i>Passed</i>	<i>Discrepant ***</i>	
Verify railcars are equipped with bottom-shelf or F-head coupler					
Visually inspect couplers and yokes for cracks, wear, missing sections, distortions					
Broken, bent, cracked or missing knuckle pins					
Side clearance coupler must be capable of movement in a horizontal plane					
Striker castings for cracks or breaks					
End-of-Car Cushioning Units:					
• check for broken springs					
• missing components on restoring mechanism					
• excessive oil leak(s) on carrier plate					
• is cotter pin installed through slotted castle nut					
• inspect and confirm the indicator pin on gas end-of-car cushioning device has acceptable pressure					
• perform visual inspection for damaged or missing parts in accordance with AAR Interchange Rule 59.A.					
Check for bent or broken uncoupling levers and proper operation					
Record coupler toggle clearance (REG. 0.25 to 0.50 in.)					
Record height of couplers from top of rail E: 32.5 – 34.5 in. L: 31.5 – 33.5 in.					
Check coupler for worn or distorted contour					
Check coupler shank for wear					

# Draft Railcar Safety Inspection Protocol

- Objective is to share inspection reports with States and Tribes along rail transportation routes
- Inspectors under contract to DOE would prepare an inspection report for DOE that would be provided by DOE to States and Tribes along the transportation route, potentially through the TRANSCOM system
  - DOE contract for inspections would include inspections at the origin site, transload location, or port
- States and Tribes would not need to be participants in the FRA State Rail Safety Inspection Program to receive the inspection reports.
- Inspection reports would be of a consistent format and would cover the locomotives, cask-carrying railcars, buffer railcars, the REV, and would include the results of hazardous materials inspections and requirements (e.g., radiation and contamination surveys, marking, labeling, placarding, etc.)
- The inspections conducted for DOE would not replace regulatory inspections conducted by the FRA, States, or rail carriers
  - Rather, the inspections would be extra-regulatory and specifically structured to promote inspection reciprocity among States and Tribes along transportation routes

# Draft Railcar Safety Inspection Protocol (Continued)

- Specific examples of activities that would be included in the inspection report would include
  - Verification that the locomotive Blue Card is current.
  - Verification or observation that the daily locomotive inspection has been performed.
  - Observation of the inspections of the locomotives, Atlas railcar, buffer railcar, and REV by the FRA, State, or rail carrier.
  - Verification of cask-carrying railcar, buffer railcar, and REV annual inspections.
  - Observation of the Class I brake test.
  - Conducting independent inspections of the cask-carrying railcar, buffer railcar, and REV. Independent inspections would have to be conducted so that the impact to rail carrier operations was minimized and radiation doses to inspectors was As Low As Reasonably Achievable (ALARA).
  - Verification of the “first use” and “each use” requirements contained in 49 CFR 173.474 and 49 CFR 173.475.
  - Verification of the shipping papers.
  - Verification of the marking, labeling, and placarding of the transportation cask and cask-carrying railcar.
  - Observation of radiation and contamination surveys conducted of the transportation casks.
  - Conducting independent radiation and contamination surveys of the transportation casks. Independent radiation and contamination surveys would have to be conducted so that the impact to rail carrier operations was minimized. Independent surveys would also have to be conducted so that the radiation doses to inspectors was ALARA.

# Additional Items for Discussion with the NTSF SNF Rail/Routing Ad Hoc Working Group (1)

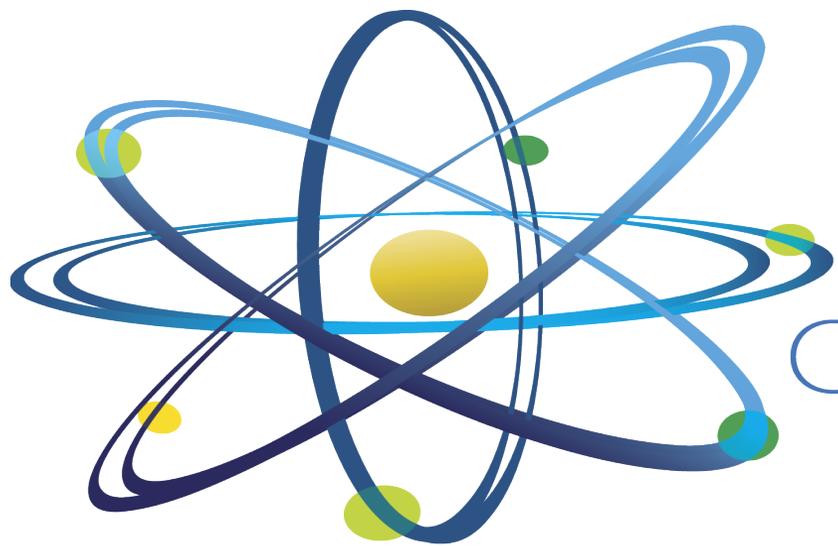
- Providing AAR Standard S-2043 information through the TRANSCOM system
  - DOE is evaluating the feasibility of providing access to the AAR Standard S-2043 safety monitoring system information through the TRANSCOM system.
  - Determining which State and Tribal personnel have access to the S-2043 safety monitoring system information and which specific S-2043 safety monitoring system information will be accessible will likely be part of security protocols for DOE shipments that have yet to be developed.
- Feasibility of providing a data feed containing radiation dose rate measurements
  - AAR Standard S-2043 does not include a requirement for measuring radiation dose rates from transportation casks.
  - DOE will continue to consider the feasibility of providing information on radiation dose rate measurements through a data feed.
- Role of the U.S. Nuclear Regulatory Commission
  - The Draft Inspection Protocol assumes that DOE is the shipper of the SNF, and shipments are not subject to NRC regulation (but will meet the level of protection required for comparable NRC-regulated shipments). However, NRC regulates the activities of its licensees, and NRC may conduct onsite transportation-related inspections at nuclear power plant sites. Incorporation of these NRC inspections into the Draft Inspection Protocol should be considered by the NTSF SNF Rail/Routing Ad Hoc Working Group in coordination with NRC staff.

# Additional Items for Discussion with the NTSF SNF Rail/Routing Ad Hoc Working Group (2)

- Out-of-Service Criteria
  - The CVSA Level VI truck inspection procedures require that a vehicle inspected at a point of origin be defect-free before departure.
  - Not all defects noted in rail inspections are non-complying conditions which would result in a railcar or locomotive being placed out of service. Potential examples could include lack of operational ditch lights, horn, bell, gauge lights, and the engineer's overhead cab light, when present in trailing power units.
  - Developing a list of inspection items and out-of-service criteria similar to those incorporated in the CVSA inspection procedures to accompany the Draft Inspection Protocol should be considered by the NTSF SNF Rail/Routing Ad Hoc Working Group.
  - In developing a list of inspection items and out-of-service criteria, the issue of whether railcars with defects that are not non-complying conditions are acceptable for transport should be considered.

# Additional Items for Discussion with the NTSF SNF Rail/Routing Ad Hoc Working Group (3)

- Protocol for further inspections or stopping a train
  - Decisions on where and when to conduct further train inspections or stop a train in response to data from the AAR Standard S-2043 safety monitoring system should not be based solely on safety and would need to consider security.
  - The development of a protocol for conducting further train inspections or for stopping a train should be considered by the NTSF SNF Rail/Routing Ad Hoc Working Group. This protocol would include both safety and security attributes.
- En route inspections
  - The majority of en route inspections are conducted by the rail carriers.
  - The Draft Inspection Protocol does not include provisions for en route inspections due to the complexity associated with having DOE contractor inspectors present at the necessary time and location to verify or observe these inspections.
  - Appropriate State and Tribal personnel along transportation routes could be given access to information from the safety monitoring system required by AAR Standard S-2043. The feasibility of expanding the Draft Inspection Protocol to include en route inspections could be considered by the NTSF SNF Rail/Routing Ad Hoc Working Group.
- Development of inspection forms
  - Electronic forms to document the inspections discussed in this Draft Inspection Protocol have not been developed.
  - These forms would be based on the checklists presented previously and are envisioned to be a combination of checklists and measured values for parameters such as radiation dose rates or contamination levels.



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# AAR S-2043 Monitored Parameters

- Location – identified by GPS coordinates
- Speed – train speed
- Truck hunting – lateral instability of the railcar
- Rocking – side-to-side rocking motion causing excessive roll angles
- Wheel flats – vertical wheel impacts caused by flat spots on the wheels
- Bearing condition – bearing temperature or alternative method
- Ride quality – RMS acceleration of car body in three axes
- Braking performance – brake cylinder pressure
- Vertical acceleration – caused by worn or damaged suspension components
- Lateral acceleration – caused by worn or damaged suspension components
- Longitudinal acceleration – caused by train handling or draft gear failure