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Rail Transportation of SNF

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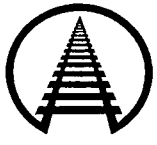
Association of American Railroads

Nuclear Waste Technical Review
Board July 10, 2000

Outline of AAR Activities

- Rail Industry Goal
  - "A dedicated cask / car / train system that ensures cask integrity in the railroad operating environment and allows timetable speeds with no restrictions on meets and passes."
- Performance Standard for SNF Trains
- Modal Study



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Performance Standard for Spent Nuclear Fuel Trains

- First draft December 1998
- Approved by the Equipment Engineering Committee at their March 2000 meeting
- Includes all cars in the trains including buffer cars, personnel cars
- Requires modeling before construction
- Requires full scale dynamic testing of each car and the train
- Circular letter C-9149 issued May 23, 2000
- Comments due June 26, 2000, effective 9/1/00.

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Design Requirements

- Structural analysis
  - Standard AAR Freight load cases
  - Load cases for passenger cars
  - Crash worthiness
  - Securement system design (Rule 88-A.15.c)
    - Longitudinal 7.5, Vertical 2.0, Lateral 2.0
  - Fatigue design
  - Weld analysis

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Design Requirements (cont.)

- Non Structural Static Analysis
  - Truck twist equalization
  - Car body twist equalization
  - Truck warp restraint
  - Static curve stability
  - Curve negotiation

Design Requirements (cont.)

- Dynamic Analysis
  - Perturbed track performance
    - Twist and roll
    - Pitch and bounce
    - Yaw and sway
    - Dynamic curving
  - Perturbed Special Cases
    - Single bump
    - Curving with single bump perturbation

Design Requirements (cont.)

- Dynamic Analysis (cont.)
  - Unperturbed track Performance
    - Hunting
    - Constant curving
    - Curving w/ various lubrication conditions
    - Limiting spiral negotiation
    - Turnouts and crossovers
  - Ride quality
  - Buff and draft curving

Design Requirements (cont.)

- Dynamic Analysis (cont.)
  - Braking effects on steering
  - Worn component simulations
- Brake System Design
  - Electronically Controlled Pneumatic Brakes
  - Brake ratios and shoe force variations
  - Jerk rates

System safety monitoring:

- Location
- Truck hunting
- Wheel flats
- Braking performance
- Vertical acceleration
- Longitudinal acceleration
- Ride quality Braking performance

-Speed
-Rocking
-Bearing condition
-Ride quality
-Lateral acceleration

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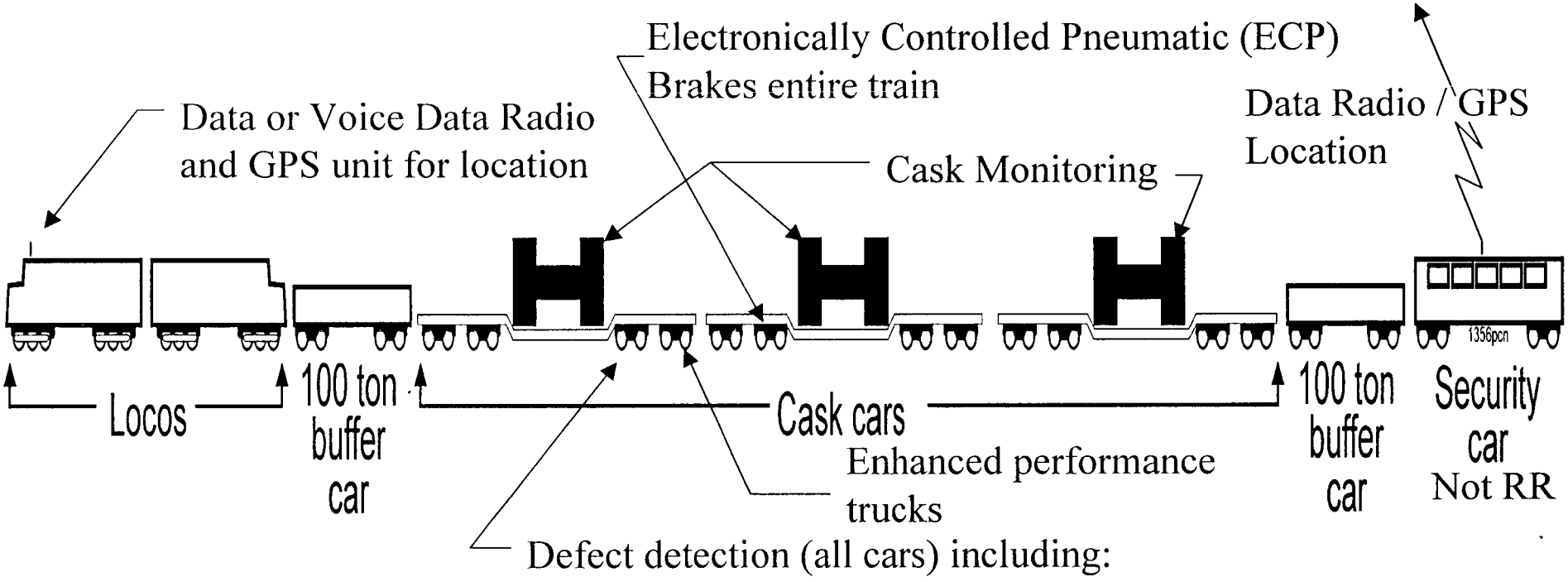
Diagram of Typical SNF Dedicated Train



Truck hunting, rocking, wheel flats, bearing condition, ride quality, braking performance, vertical acceleration, and longitudinal acceleration.

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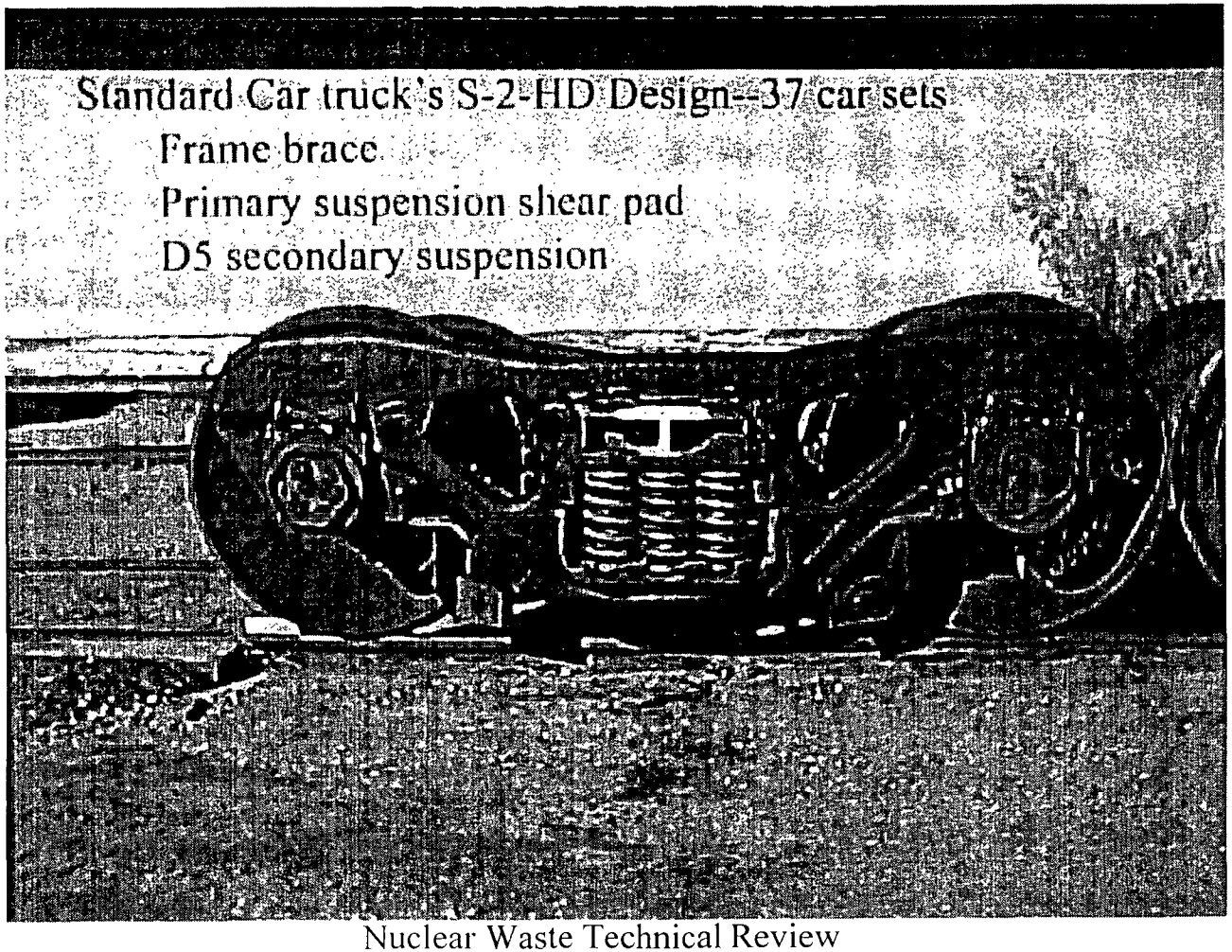
Enhanced Performance Trucks



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Approval Process

- AAR's Equipment Engineering Committee (EEC) governing body
- Preliminary design review
- Submittal of full scale test reports
  - Individual cars
  - Multiple cars
  - Post test analysis
- Final design and approval
  - Conditional
  - Full approval (100,000 miles of operation)

Modal Study

- Are impact limiters are designed to stay on the cask in the event of an impact?
- Crush loads are a real possibility on rail accidents.
- Study needs to update credible severe accidents.
- Relate the forces involved in railroad accidents to those the cask is tested for.

Modal Study (cont.)

- Update the modeling techniques used in the study.
- Wayside conditions in the modal study were based on highway conditions, not rail.
- Comments filed with NRC in January 2000 as input to the rewrite of the Modal Study