



AAR Standards Activities Update for the FRA Decarbonization Workshop

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The AAR is working through the following groups.

- The Locomotive Committee (LC)
- The Decarbonization Working Group (DW/G)
- The Regulatory Modifications Task Force (RegMod Task Force)
- AAR's Government Affairs plays a considerable role in identifying opportunities for roads to find funding for research, retrofit programs and infrastructure projects. All of which may contribute to the lessons learned which can inform standard development.

The Locomotive Committee mission.



Develop, maintain, and enhance locomotive interchange standards and rules to ensure network interoperability and safe, reliable performance.

TAGs & Task Forces supporting the LC

Active TAGs reporting to or updating the Locomotive Committee.

- Regulatory Modifications (RegMod) TAG
 - LM-005
- Locomotive Charging Interface Standard (LCIS) Development Task Force (currently paused)
 - LM-053

Task Forces soon to be convened.

- T-I Interoperable Fuel Tenders for Locomotives, M-1004
 - *The task force will be adding Hydrogen – H2*
LM- 121 & LM-126
- T-II Interoperable Battery Tenders for Locomotives (Reserved)
 - *Developing the Battery Electric Locomotive (BEL) specification*
 - LM-053, LM- 121, LM-126

M-1004 Interoperable Fuel Tenders for Locomotives

The development timeline.

- The Natural Gas Fuel Tender TAG is formed October 2012
 - LC Docket LM-121 NGFT is created
- 1st TAG meeting held January 2013 in Edmonton, AB
 - M-1004 + 6 standards for hoses, cables & safety appliances
- M-1004 implemented Aug 2017 (C-12938) for LNG
- M-1004 implemented Sep 2019 (C-13408) for CNG
- Reorganized, renamed & published as 3 separate volumes
 - T-I, T-II & T-III May 2023 (C-14143)
- New work begins on T-I to add hydrogen
- T-II work will begin to add BELs

Highlight: Battery Electric Locomotives

- A charging interface standard Task Force for the contact was formed but is currently paused after identifying the following input needed for standard development.
 - Railroad use cases
 - Requirements surveys of the OEMs
 - An economic impact study of rail infrastructure, grid power requirements, state/local regulations and possible partnerships.



Highlight: Hydrogen Propelled Locomotives

- Soon to be developed and added to specification T-1 , M-1004
 - Hydrogen fuel tender specifications
- On-board fuel cell propulsion (shown)
 - Standard ownership & enforcement TBD
 - Development is pending



AAR Decarbonization Work Group

The DWG is comprised of the environmental leads from the Class I railroads. The Group is managed by AAR Environmental Attorney Theresa Romanosky.

Of note, the DWG has a matrix document (created and shared by the Union Pacific) to identify and monitor the testing of various biodiesel and renewable diesel blends across several engine families. The intention is to 'divide and conquer' the various tests to mitigate possible overlap and better allocate testing resources.

After over a year of calls to identify the various charging technologies for BELs, the LC decided pause the work of the LCIS Task Force and the road-only conversations to work with the DWG to coordinate direction and avoid duplication of efforts.

The current iteration of BELs will be primarily in yard switching service and NOT interchanged between roads. The plans the following.

- Assist in the development of new test plans & initiate pilot studies where informational gaps exist
- Monitor in-progress studies
- Analyze the results and recommendations
- Develop supporting standards and best practices

Regulatory Modification

eABS (AAR proposal -- input provided in comments to FRA NPRM)									
	Avg train stop duration (hrs)	Gallons/hr idle locomotive	Avg # locos/train	# idling events/yr	Train Stops Saved	fuel consumed/ event	Gallons fuel/yr	Lbs CO2/ gallon Diesel	Tons CO2/Yr
1. Set Outs/Pick Ups	2	4.3	2.94	120,991	63,762	25.28	1,612,165	22.38	18,043
	Avg duration (minutes)				Train Stops Saved	fuel consumed/ event	Gallons fuel/yr	Lbs CO2/ gallon Diesel	Tons CO2/Yr
... Train Acceleration	5.81				63,762	30.8	1,963,878	22.38	21,980
	Avg train stop duration (hrs)	Gallons/hr idle locomotive	Avg # locos/train		Brake tests saved	fuel consumed/ event	Gallons fuel/yr	Lbs CO2/ gallon Diesel	Tons CO2/Yr
2. Mileage Increase	2	4.3	2.94		45,000	25.28	1,137,780	22.384	12,734
TOTAL unlimited Set Outs & Pick Ups and Mileage Increase									52,757
24 Hrs Off Air (Using FRA Assumptions Final Rule Economic Analysis)									
	Avg Annual Hrs	Gallons/hr idle locomotive					Gallons fuel/yr	Lbs CO2/ gallon Diesel	Tons CO2/Yr
1. Idling Locomotives	316,800	4.3					1,362,240	22.384	15,246
	Avg Annual Events	Gallons/hr idle locomotive	Locomotives/train				Gallons fuel/yr	Lbs CO2/ gallon Diesel	Tons CO2/Yr
2. Brake Tests	110,641	4.3	2				951,513	22.384	10,649
Total 24 Hrs Off Air									25,896

A breakdown of the CO2 emissions savings for the 2 rules.

The total for both is 78,653 tons/yr.*

*Note that the number will fluctuate if movements change.

For *Idling Locomotives*,
 316,800 = 40 locomotives,
 22 hrs./day, 360 days/yr.

With Other AAR Committees & Working Groups

- Asset Health Strategy Committee (AHSC)
- Decarbonization Working Group (DWG)
- Operating Practices Committee (OPC)
- Quality Assurance Committee (QAC)
- Railroad Electronics Standards Committee (RESC)

Government Organizations

- Federal Railroad Administration (FRA)
- Environmental Protection Agency (EPA)
- Department of Energy (DOE)
- Transport Canada (TC)

Other Trade & Volunteer Associations



Railway Association of Canada (RAC)

The LC monitors and receives updates on the development of decarbonization related regulations.



American Short Line Railroad Association (ASLRRRA)

The LC is monitoring short line grants & programs to reduce yard asset emissions

Pilot programs include Hydrogen injection & after treatments



CSA Group (formerly the Canadian Standards Association (CSA))

Creates voluntary standards

Note – the AAR has not yet collaborated with the CSA but intends to explore the possibility.

Other Trade & Volunteer Associations



Locomotive Maintenance Officers Association (LMOA)

Yearly research papers authored

Some on behalf of the LC

The LC will review the 2023
papers upon publication for
standards development input

Review of 2023 papers

❖ Joint Paper – Low Carbon Energy Sources

- Motivation, Approach,
& State of the Industry –
 - Bebe / Heywood /
Ruch
- Battery Electric
 - Cleveland
- Hydrogen
 - Hedrick / Fritz
- Methanol
 - Dillen
- Ammonia
 - Heywood
- Natural Gas
 - ?



Thank you!

- AAR BEL Charging TAG Introduction – Michael Cleveland/BNSF - Presented May 17, 2021 - AAR LC Locomotive Charging Interface Standard Development Task Force webinar (slide 6 notes from LMOA abstract 2021)
- Locomotive Maintenance Officers Association (LMOA) – LMOA 2023 Executive Summaries Presentation received by the AAR Locomotive Committee 2023 (slide 13)



Questions?



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