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**FPC® CATALYST CARBON MASS BALANCE TEST**  
**OF FOUR NORMALLY ASPIRATED SD-9 LOCOMOTIVES**  
**Prepared for**  
**MONTANA RAIL LINK**  
**and**  
**WASHINGTON CENTRAL RAILROAD COMPANY**



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## **THE MONTANA RAIL LINK AND WASHINGTON CENTRAL RAILROAD COMPANY MULTIPLE ENGINE FIELD TEST**

Montana Rail Link (MRL) is a regional railroad operating some 140 locomotives out of Missoula, MT. The fleet is compromised primarily of GP9, SD40 & SD45 locomotives powered by EMD engines.

Washington Central Railroad Company (WCRC) is a shortline railroad operating some 13 locomotives out of Yakima and Moses Lake, WA. The fleet is comprised primarily of SW1200RS and GP38 locomotives. WCRC leased four SD9 locomotives from MRL for six weeks in October and November 1996. MRL and WCRC made a decision to evaluate the effect of FPC<sup>®</sup> Catalyst upon wayside fires, fuel economy and smoke emissions by testing a fleet of the four MRL SD9 locomotives.

The test locomotives were first tested at multiple notch settings (2, 4 and 6) while loaded to 100% with baseline or untreated fuel (see Table 1 and Figure 1). Smoke levels were tested at notch settings Idle, 2, 4, 6, and 8 (see Table 2 and Figure 2). A loadbox was used for the purpose of loading the engines. The test locomotives were then run on fuel with FPC<sup>®</sup> Catalyst for approximately six weeks. At the end of the six week conditioning period, the four original locomotives were retested at identical load, rack settings, voltage output and notch settings. Final test results were obtained using the data from all four locomotives.

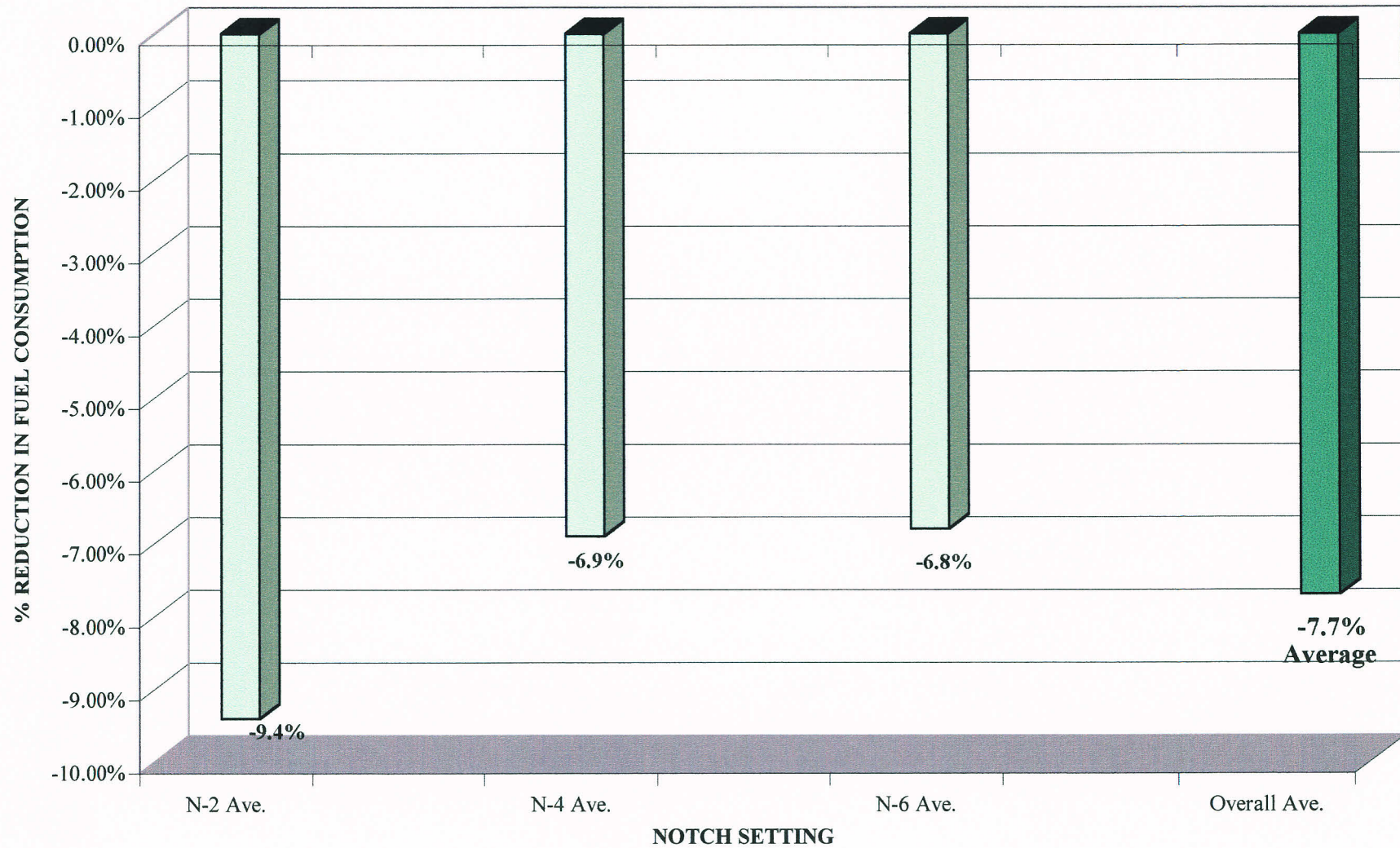
**TABLE 1. FUEL PERFORMANCE FACTORS/FUEL MASS FLOW RATES (PF'S)**  
**Montana Rail Link**  
**SD-9 Locomotives**

<u>Unit No.</u>	<u>Notch</u>	<u>Baseline PF</u>	(1) <u>Treated PF</u>	<u>Percent Improvement</u>
600	2	62,141	69,243	11.43%
600	4	19,048	20,653	8.43%
600	6	10,913	11,594	6.23%
			<b>Average=</b>	<b>8.70%</b>
606	2	57,014	62,257	9.20%
606	4	18,308	19,370	5.80%
606	6	10,943	11,609	6.08%
			<b>Average=</b>	<b>7.03%</b>
607	2	72,522	79,132	9.12%
607	4	18,109	19,300	6.57%
607	6	10,602	11,521	8.67%
			<b>Average=</b>	<b>8.12%</b>
608	2	51,690	55,729	7.81%
608	4	19,032	20,315	6.74%
608	6	11,135	11,843	6.36%
			<b>Average=</b>	<b>6.97%</b>
			<b>Test Average=</b>	<b>7.71%</b>

(1) Includes corrections for differences in barometric pressure and fuel density between baseline and treated conditions.

Note: An increase in PF equates to a reduction in fuel consumption since the PF is a measure of the length of time needed to consume a unit volume of fuel. Therefore, the higher the PF, the longer the engine ran on the same quantity of fuel.

FIGURE 1  
**MONTANA RAIL LINK**  
**REDUCTION IN FUEL CONSUMPTION WITH FPC CATALYST**



**TABLE 2. SMOKE DENSITY (SD) NUMBERS****Montana Rail Link****SD-9 Locomotives**

<u>Unit No.</u>	<u>Notch</u>	<u>Ave. Baseline SD</u>		<u>Ave. Treated SD</u>		<u>% Change</u>		<u>% Change Average</u>
		<u>Front Stack</u>	<u>Rear Stack</u>	<u>Front Stack</u>	<u>Rear Stack</u>	<u>Front</u>	<u>Rear</u>	
600	idle	3.50	4.25	2.00	3.00	42.9%	29.4%	36.1%
600	2	5.00	5.00	3.50	4.00	30.0%	20.0%	25.0%
600	4	6.25	7.50	5.00	6.00	20.0%	20.0%	20.0%
600	6	8.25	9.00	6.50	7.50	21.2%	16.7%	18.9%
600	8	9.25*	9.50*	7.75	8.00	16.2%	15.8%	16.0%
<b>Average</b>								<b>23.2%</b>
606	idle	3.50	3.00	2.00	1.75	42.9%	41.7%	42.3%
606	2	3.50	3.50	2.50	2.50	28.6%	28.6%	28.6%
606	4	4.00	5.50	3.50	4.00	12.5%	27.3%	19.9%
606	6	8.50	7.00	5.75	5.25	32.4%	25.0%	28.7%
606	8	9.00	9.50*	7.50	7.50	16.7%	21.0%	18.8%
<b>Average</b>								<b>27.6%</b>
607	idle	4.00	3.00	2.50	2.50	37.5%	16.7%	27.1%
607	2	4.00	4.50	3.00	2.50	25.0%	44.4%	34.7%
607	4	6.75	6.00	5.00	5.00	25.9%	16.7%	21.3%
607	6	9.50*	7.75	6.00	6.00	36.8%	22.6%	29.7%
607	8	9.25*	9.50*	7.50	7.50	18.9%	21.0%	20.0%
<b>Average</b>								<b>26.5%</b>
608	idle	3.25	3.00	1.75	2.00	46.2%	33.3%	39.7%
608	2	4.50	4.00	2.50	2.75	44.4%	31.3%	37.8%
608	4	6.00	6.75	3.75	4.75	37.5%	29.6%	33.6%
608	6	7.75	9.00	5.75	6.75	25.8%	25.0%	25.4%
608	8	9.25*	9.00	7.50	8.00	18.9%	11.1%	15.0%
<b>Average</b>								<b>30.3%</b>
<b>Test Average</b>								<b>26.9%</b>

\* Smoke density scale ranges from 0-9 (lightest - darkest). Numbers off the scale (darker than 9.00) are assigned a value of 9.50. Two smokespots are taken and averaged for each notch setting and location, i.e., front and rear stacks.

EXAMPLE: A 9.00 and a 9.50 (off scale) at the rear stack would average 9.25.

FIGURE 2

# MONTANA RAIL LINK

## REDUCTION IN SMOKE LEVELS WITH FPC CATALYST

