

MAINTENANCE OF HEAVY-DUTY DIESEL POWERED EQUIPMENT

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1

WHAT IS MAINTENANCE ?

- Webster defines maintenance as keeping equipment in existing state, to preserve from decline or failure
- If this interpretation is correct mines can not use maintenance to improve existing conditions!!!

2

MAINTENANCE “+” PROGRAM

- Continue regular preventive maintenance (PM) program
- Plus 100% buy in from management
- Plus emission reduction program
- Plus training
- Plus culture change

3

WHY MAINTENANCE “+”

- To provide our people with the best work environment
- To make our equipment as efficient as possible
- To keep costs as low as possible

4

CANYON FUEL COMPANY'S EMISSION REDUCTION PROGRAM

- Establish a baseline
- Find out where we should be
- Find a way to get there
- Get there
- Improve

5

ANALYZER



6

BASELINE EMISSIONS

- November 1997
 - 1597 ppm Carbon Monoxide
 - 947 ppm NO_x
- These results were with engines and drive trains set to OEM specifications

7

WHERE SHOULD WE BE?

8

WHERE ARE WE NOW?

- Last week
 - 154 ppm CO
 - 402 ppm NO_x
- A 90% reduction in CO and 50% reduction in NO_x
- 58% below certification levels
- These results are obtained with NO ENGINE OR DRIVE TRAIN SET AT OEM SPEC'S.

9

HOW DID WE GET THERE?

- 100 % buy in from management!!!
- Asking questions about engines, torque converters and transmissions
- Optimizing the drive train components for the duty cycle and mine elevation
- Having teams of highly trained technicians at each mine site

10

COMPONENT INTERACTION

- Engine with torque converter
- Torque converter with transmission
- Engine, torque converter, and transmission with vehicle

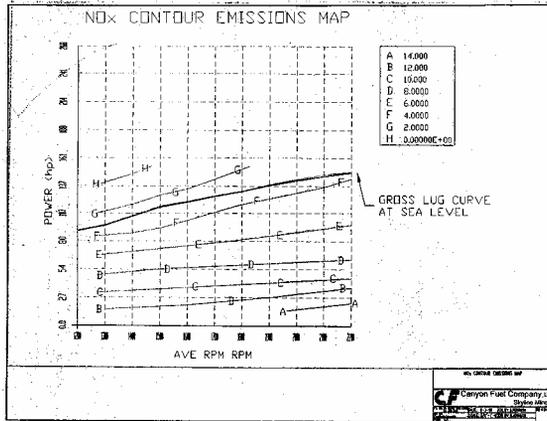
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NEW TOOLS TO USE

- Emissions contour map
- Torque absorption chart

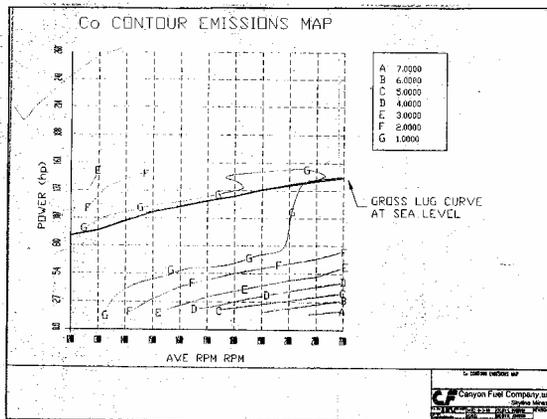
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NO_x CONTOUR MAP



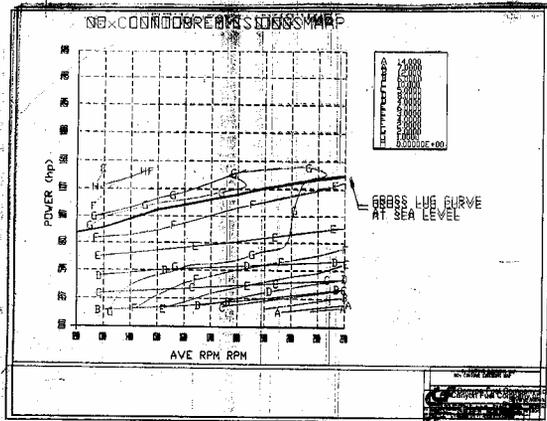
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CO CONTOUR MAP

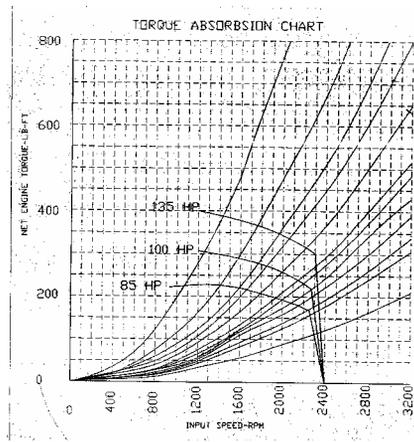


14

NO_x AND CO MAPS



TORQUE ABSORPTION CHART



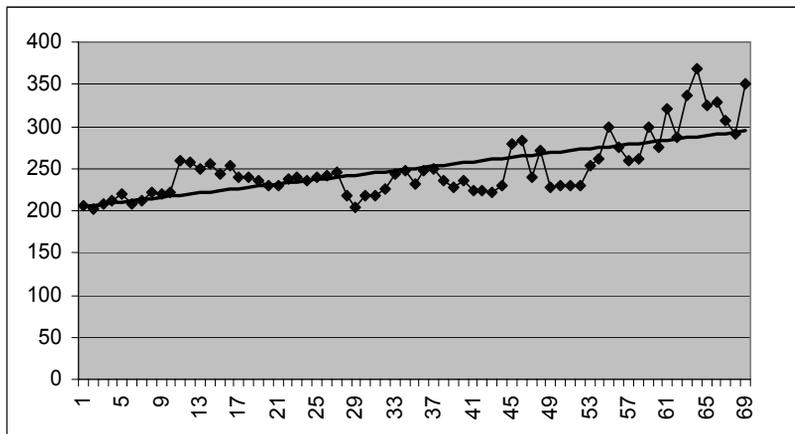
IMPROVEMENT

- Insanity is: endlessly performing the same procedures, expecting different results.

Albert Einstein

17

IMPROVEMENT



18

TRAINING

- Engine training
- Drive train training
- Emission's training
- Vehicle systems training

19

CULTURE CHANGE

- Life will not be the same
- It will take more work, time and money
- It will improve the quality of the underground environment
- It can happen

20

QUESTIONS?