

The Role of an Emissions Based Maintenance Program in Underground Mining

By

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What are the Goals?

1. Provide our miners with the best working environment possible. “Compliance”.
2. Keep diesel powered equipment running as efficient as possible.
3. Use diesel emissions as a measure of performance.
4. Maintain our fleets at or below engine approval emissions.

Top down or bottom UP.

1. No plan will work going from the bottom up.
2. First and foremost, Upper Management needs to push and support an Emission Based Maintenance Program.
3. Without Upper Management drive the EBMP will fail.

What is Maintenance?



According to Mr. Webster

- Maintenance is:

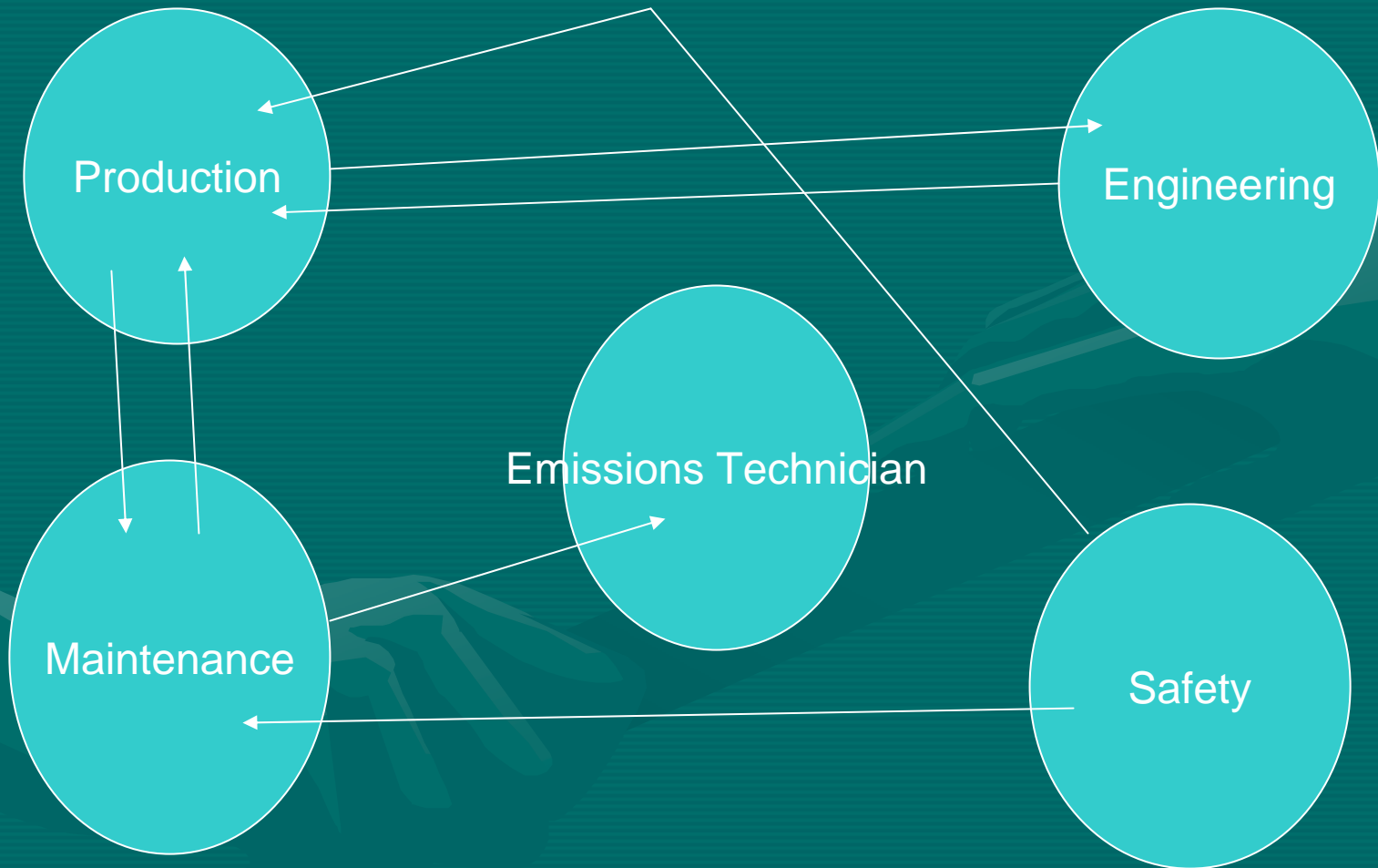
1. To keep in an existing state.
2. To preserve from failure or decline.
3. To continue or preserve; keep up.
4. To support or provide for.

Synonyms; preservation, up keep, repairs, and continuance.

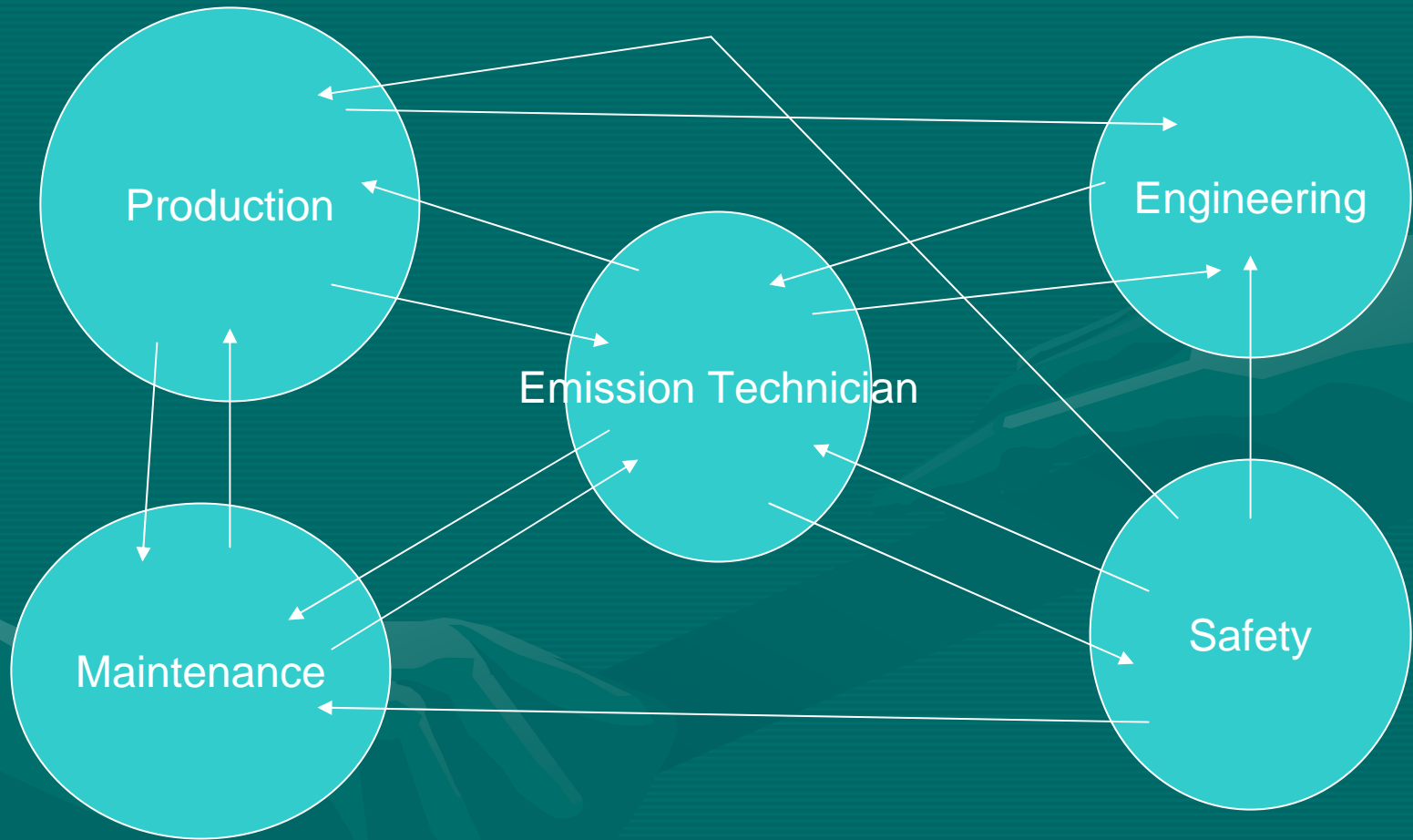
A change of Paradigm.

1. Redefine department roles.
 - a. The Maintenance department, Safety, Engineering, Production and Purchasing. Multi-Departmental Approach. “Who’s on First”?
2. How and what we do on a PM service.
3. How maintenance personal are assigned.
4. Involvement in purchases by Maintenance.

The way AWBG Started.



Where we are now.



A change of Paradigm.

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

Albert Einstein

Emissions Based Maintenance Program.

1. Set up a team of Emissions Technicians at each mine. “Multiple mines”.
2. Establish Baseline emissions. Understand what you are looking at. “Pass on the Results”.
3. Find out where you should be. “Pass on the Results”.
4. Get there. “Pass on the Results”.
5. Improve.

What are Diesel Emissions?

1. Gaseous

- A. Carbon Monoxide “CO” 50ppm TLV
- B. Nitric Oxide “NO” 25ppm TLV
- C. Nitrogen Dioxide “NO₂” 5ppm TLV

2. Particulate Mater “DPM”

- A. Elemental Carbon “EC”
- B. Organic Carbon “OC”
- C. Total Carbon “EC + OC = TC”
- D. Whole Diesel Particulate Mater

3. A “tip”, CO will usually track with DPM.

Baseline

UNIT	BASELINE	% CHANGE	15-Oct-06	8-Oct-06	1-Oct-06	24-Sep-06	17-Sep-06	10-Sep-06
LD001	247.2	23.5%	323	328	200	234	251	185
LD002	206.5	-19.4%	173	198	219	213	251	185
LD003	247.8	-14.2%	217	210	174	315	322	242
LD005	299.5	0.5%	301	261	319	303	324	289
LD006	341.3	-36.0%	251	375	356	351	256	459
UV026	132.8	21.4%	169	185	101	121	117	104

So what is High CO??

TORQUE CURVE TEST ALL TESTS AT FULL THROTTLE		
MSHA # :	7E-B004-0	
Engine:	Caterpillar 3304 PCNA	
Engine Rating:	100 HP @ 2200 RPM	
Engine Speed, RPM	CO, ppm	CO2, %
2200	392	10.8
2100	394	10.9
2000	352	10.8
1900	348	10.7
1800	330	10.6
1700	332	10.5
1600	315	10.4
1500	313	10.3
1400	314	10.2

TORQUE CURVE TEST - ALL TESTS AT FULL THROTTLE		
MSHA # :	7E-B083	
Engine:	Diamler Chrysler OM 906	
Engine Rating:	201 HP @ 2200 RPM	
Engine Speed, RPM	CO, ppm	CO2, %
2200	71	7.09
2000	130	7.48
1800	134	7.85
1600	145	8.59
1400	446	9.76
1200	1575	10.98

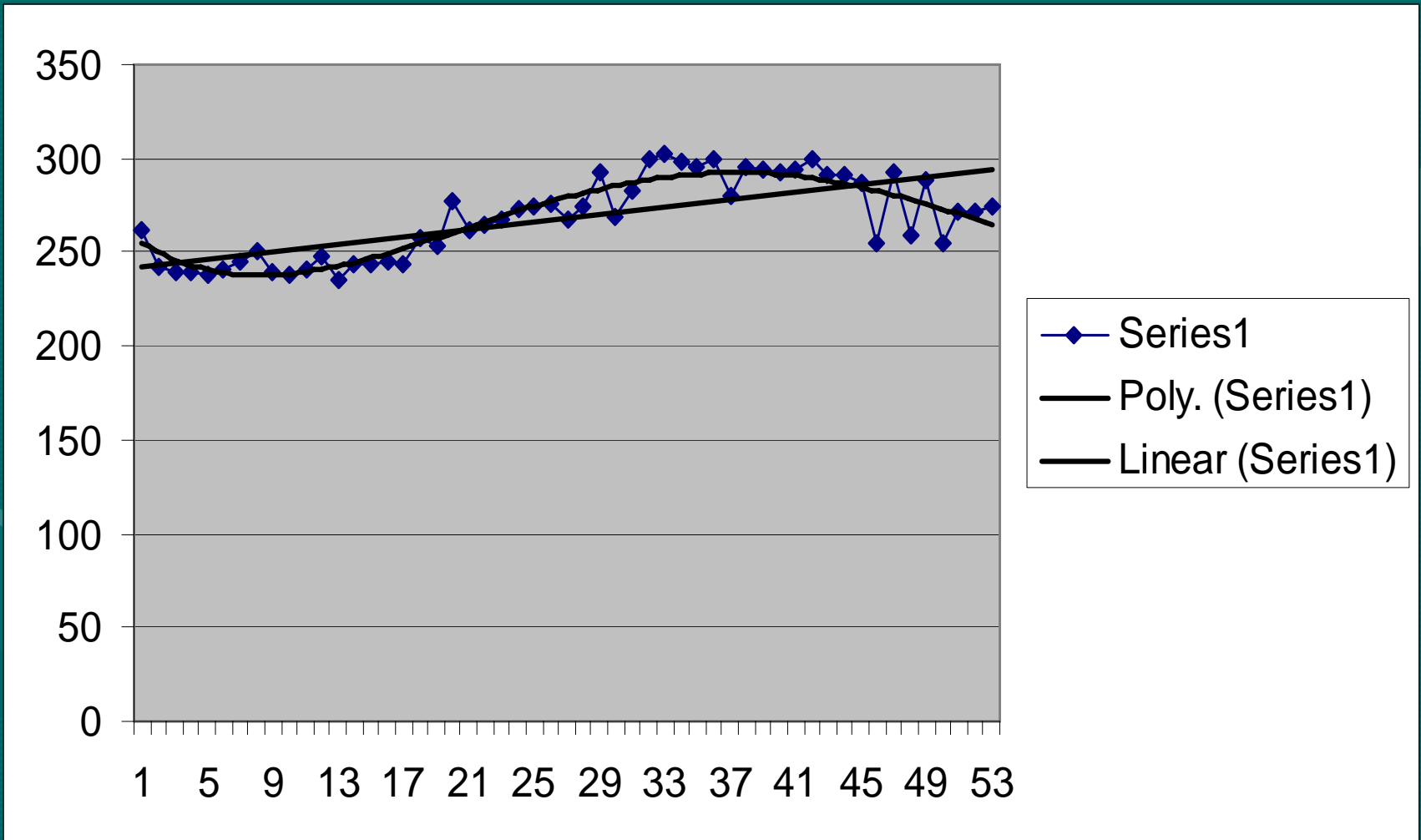
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Passing on the information.

<u>DATA</u>	<u>UNIT</u>	<u>DATE</u>	<u>HR'S</u>	<u>O2</u>	<u>CO</u>	<u>C02</u>	<u>NOX</u>	<u>NO2</u>	<u>NO</u>	<u>CO BASE</u>	<u>OVER LIMI T</u>	<u>CO +20% OF BASE</u>
1	CH524	5-May-07	825	6.4	145	10.8	429	23	429	178		214
3	CH527	7-May-07	1787	6.5	421	10.7	231	21	253	255	421	307
4	CH531	9-May-07	628	6.9	312	10.4	331	15	347	362		434
5	CH532	6-May-07	4267	7.3	388	10.1	457	39	496	316	388	379
6	CH533	6-May-07	2149	9.7	214	8.3	439	45	485	212		255
8	LD001	5-May-07	81	6.4	229	10.7	520	34	554	291		349
9	LD002	7-May-07	5762	4.7	317	12.1	221	10	231	207	317	249

Improvement!



Questions?

