

A Comprehensive Compliance Strategy for the Reduction of DPM

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Components of an Effective DPM Reduction Plan



- Adequate Baseline Sampling
- Laboratory Analysis of Cassettes
- In-depth Analysis of Laboratory Results
- Compliance Strategy Development
- Implementation & Verification (Compliance Monitoring)

Baseline Sampling

- What is “Baseline Sampling”?
 - Initial sampling procedure designed to define current mine conditions
 - Needs to be more in-depth and inclusive than compliance sampling /monitoring
 - Sample as many activities and areas of the underground as is reasonably possible
 - Like a “net”, the more samples taken, the more information is “captured”

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Sample Collection

- Ambient Air Sampling
 - Replicates MSHA sampling as closely as possible
- Record all pertinent data
 - Includes:
 - direction + quantity of airflow
 - ventilation controls and conditions
 - type and number of equipment in area (also engine type and man.)
 - field observations and visible clues
- Maintain Sample Integrity
 - Devise and implement QA plan for sample collection

wearable sampling pump₄

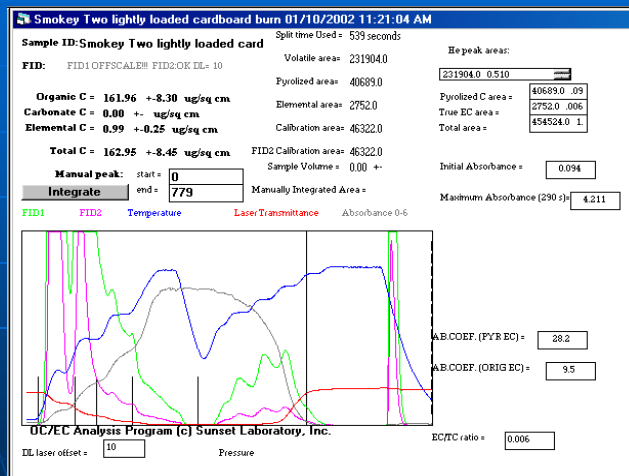
Laboratory Analysis



- NIOSH 5040 Analysis
 - Thermal-optical evolved gas analysis
 - Method prescribed by MSHA for compliance determination
- QA Plan to ensure sample integrity
- Results reported as micrograms of Carbon (OC/EC/TC) ($\mu\text{g C}$) present on filter

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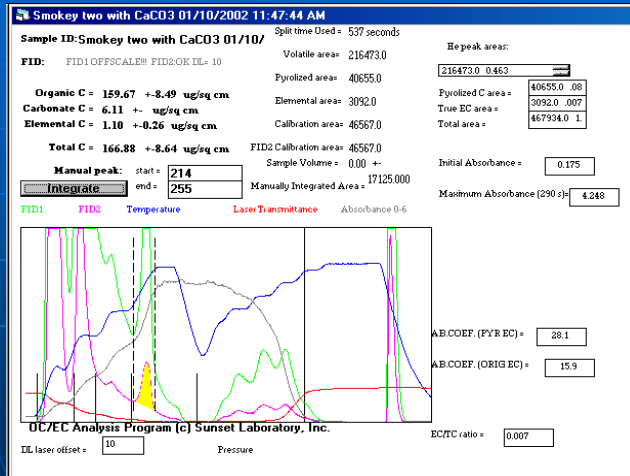
Sample Thermogram



Results of NIOSH 5040 Analysis of a sample cassette

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Sample Thermogram



Duplicate sample showing carbonate interference and correction

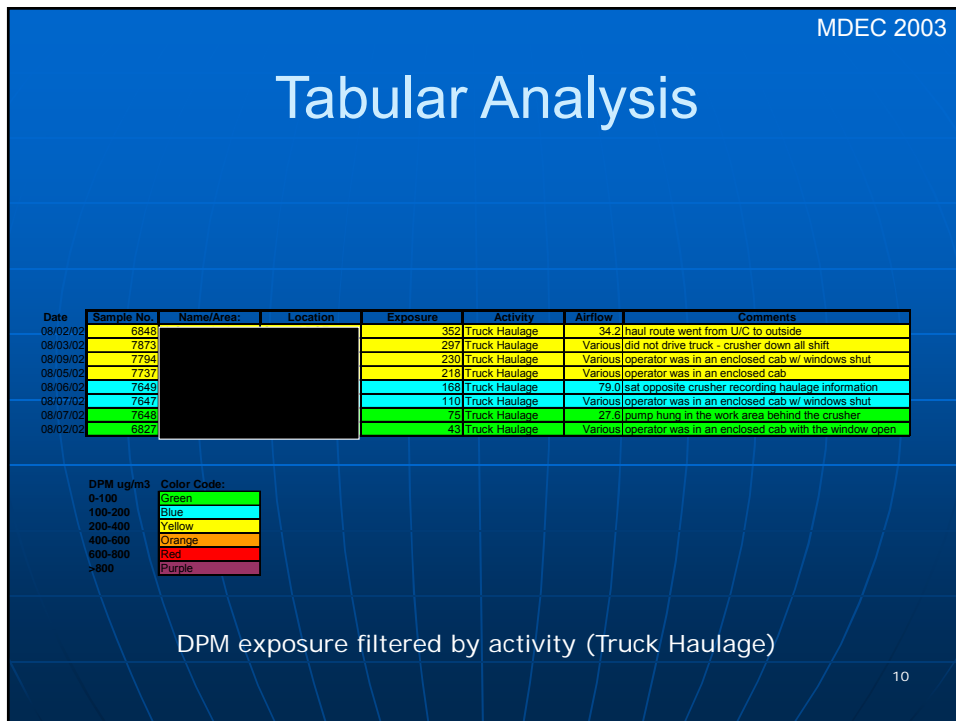
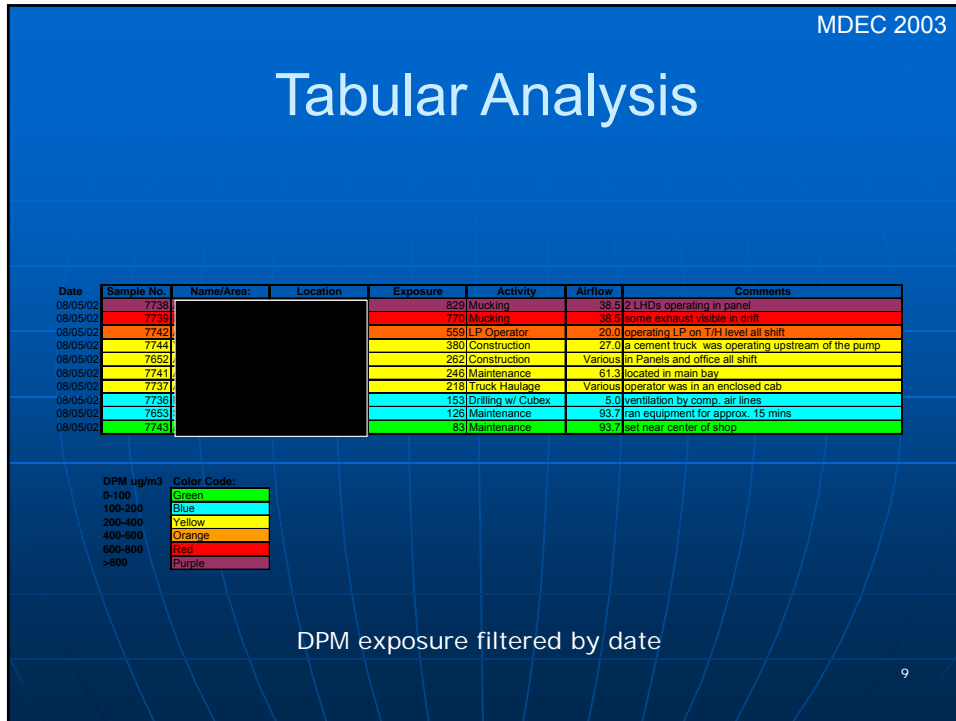
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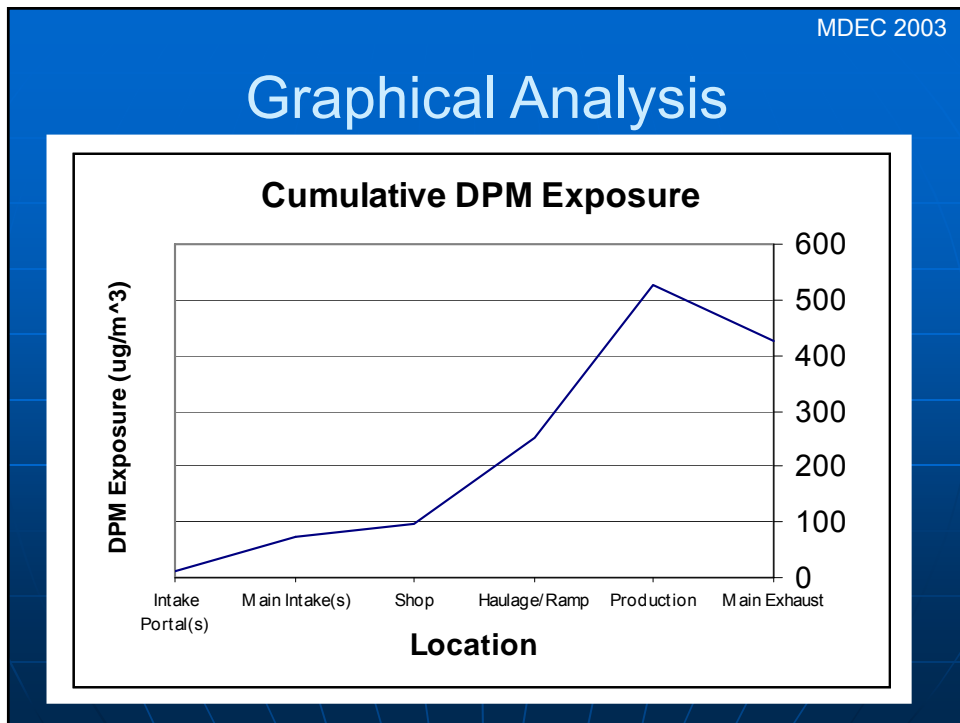
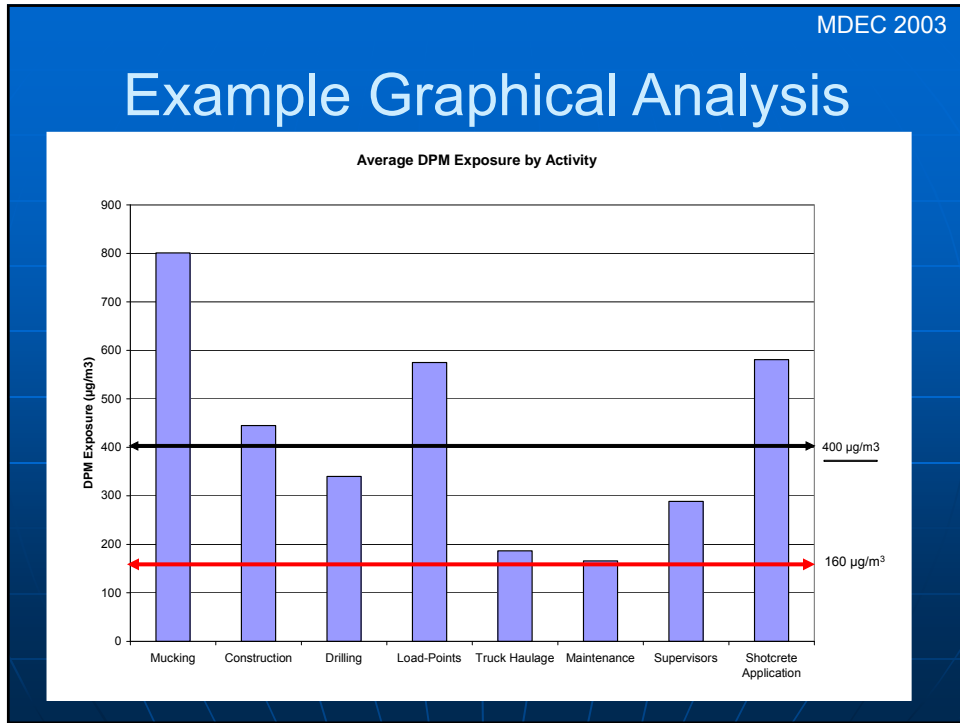
Analysis of Results

- Critical, but often overlooked step
- Requires coordination of sampling data with laboratory results
- Analysis should go beyond simple "in or out" compliance determination
- Identify trends in exposure levels, based on equipment, location, ventilation rates, activity, etc.
- Use graphs/charts to aid analysis



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Compliance Strategy Development



- Based on knowledge (data) from each specific environment
- Approach tailors specific solutions to specific concerns
- Incorporates a wide-range of options for DPM reduction
- Provides most efficient and cost-effective application of resources

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Matching Solutions to Problems


<u>Potential Issue(s):</u>	<u>Potential Solution(s):</u>
Consistently high, Mine-wide exposures	<ul style="list-style-type: none"> → Engine Replacement → Fuel Change → Increase Aux. Ventilation → Boost Mine Ventilation System → Exhaust After-treatment → Maintenance Program Audit → New Equipment Purchase
High exposures in isolated stope(s)	
Problematic LHD or haul truck	
Spotty exposure levels throughout the mine	

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Monitoring & Verification of Control Performance

- Once DPM Reduction Plan is implemented, sampling should continue
- Allows for extended compliance monitoring
- Verifies performance of controls
- Identifies additional concerns or opportunities for system improvement
- Iterative approach, "evaluation, recommendation, verification."



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Questions?



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