

Direct Reading Monitors and What They Mean to the Worker

Direct Reading Exposure Assessment Methods Workshop

Washington, DC
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DISCLAIMER: The findings and conclusion in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination policy.

Overview

- Workshop is to think about how the emerging DRM technologies might improve worker health
- Present topics for discussion and thought in breakout sessions from the perspective of impact on the worker

Distinguish different needs direct reading monitors

Immediate

- Short term threats to life
 - Explosive gases
 - Toxic materials.
 - Suffocation hazards
- Need obvious for current threat
- Mature stage of development

Indirect

- Long term threats to health
 - Cancer
 - Silicosis
 - Coal workers pneumoconiosis
 - Noise
- Need seems less obvious

Why are direct or short term measurements relevant to long term health issues?

- Historically periodic hazard assessment of work place is generally adequate.
 - Measure levels
 - Identify sources
 - Develop engineering controls for sources
 - Periodic monitor levels.
- Periodic assessment approach becomes less effective when
 - Workplaces continually move
 - Mining
 - Construction
 - Agriculture
 - Contaminant changes spatially or temporally

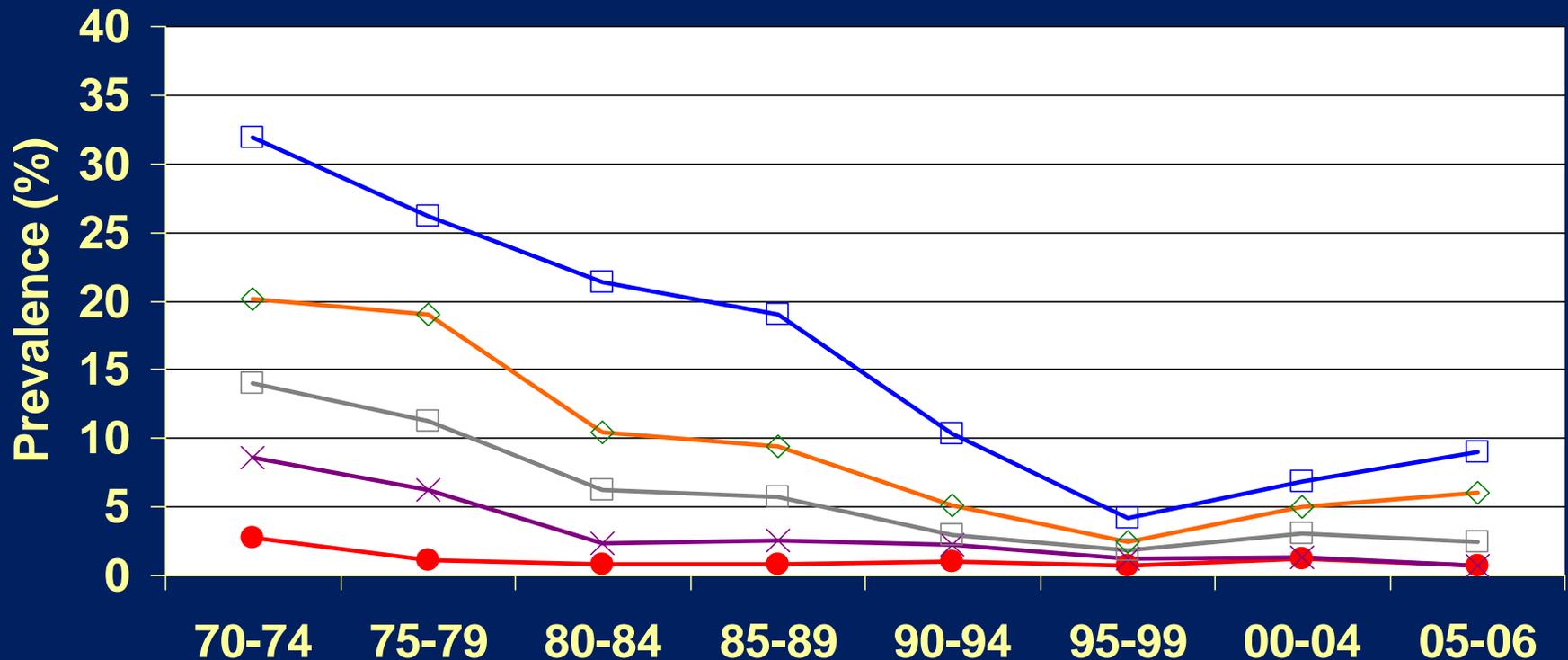
Mining as an example -- Current practice in mining is periodic

- Mines submit a ventilation control plan that lists what engineering controls are to be in place
- Mines measure dust levels every 2 months for 5 consecutive shifts.
- Inspectors monitor compliance with engineering aspects of the plan on a more frequent basis

Results of this strategy

Trends in coal workers' pneumoconiosis prevalence by tenure among examinees employed at underground coal mines, U.S. National Coal Workers' X-Ray Surveillance Program, 1970-2006

Category 1/0 +



Tenure (yrs):

● 0-9

× 10-14

□ 15-19

◇ 20-24

□ 25+

In response -

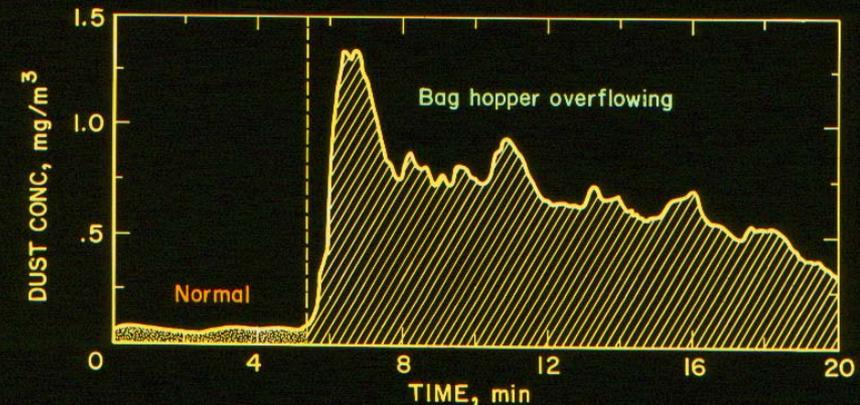
- Sec. Labor commissioned panel in 1996
 - Labor
 - Industry
 - Government
 - Academia
- Panel made recommendations
- Recommendations relevant to DRM's
 - Continuous and accurate monitors should be used
 - More frequent sampling
 - Structured training related to dust control issues
 - Increase miners participation in dust sampling program
 - Explore innovative ways to enhance compliance
 - Improve confidence in mine dust sampling program

DRM Issues for discussion

1. Continuous monitoring
2. Frequency of sampling
3. Worker participation and training
4. Verify exposures
5. Innovative approaches

1. Continuous Monitoring

- IH professionals already use available DRMs
 - Identify sources
 - Decide where to sample
 - Where to direct resources
- Requires skill to use and interpret
- Are available DRMs easy to use?
 - Accurate
 - Unambiguous results



Worker need -- continuous monitoring

- Prime objective – make sampling invisible to user
 - Do not get in the way
 - Keep light weight and streamline
 - Integrate into work environment
- Provide simple interface
 - To use
 - To understand
- Accuracy may depend on use
 - Less accurate for warnings
 - Greater accuracy for compliance
- Intuitive – No “interpretation” of the meaning of the data



2. Frequency of sampling

Depends on hazard

- Lower frequency sampling
 - Low historical levels
 - Low toxicity
 - Adequate engineering controls
- Higher frequency sampling
 - High toxic hazard
 - Exposures are at the limits of engineering controls
 - High variability of hazard – mobile work places
 - Compliance history
- Cost

Workers perspective -- frequency of sampling

- Priorities
 - No interference with work
 - Protect my job
 - Protect health
- Do not over do it –
- Enable worker and management to manage risk



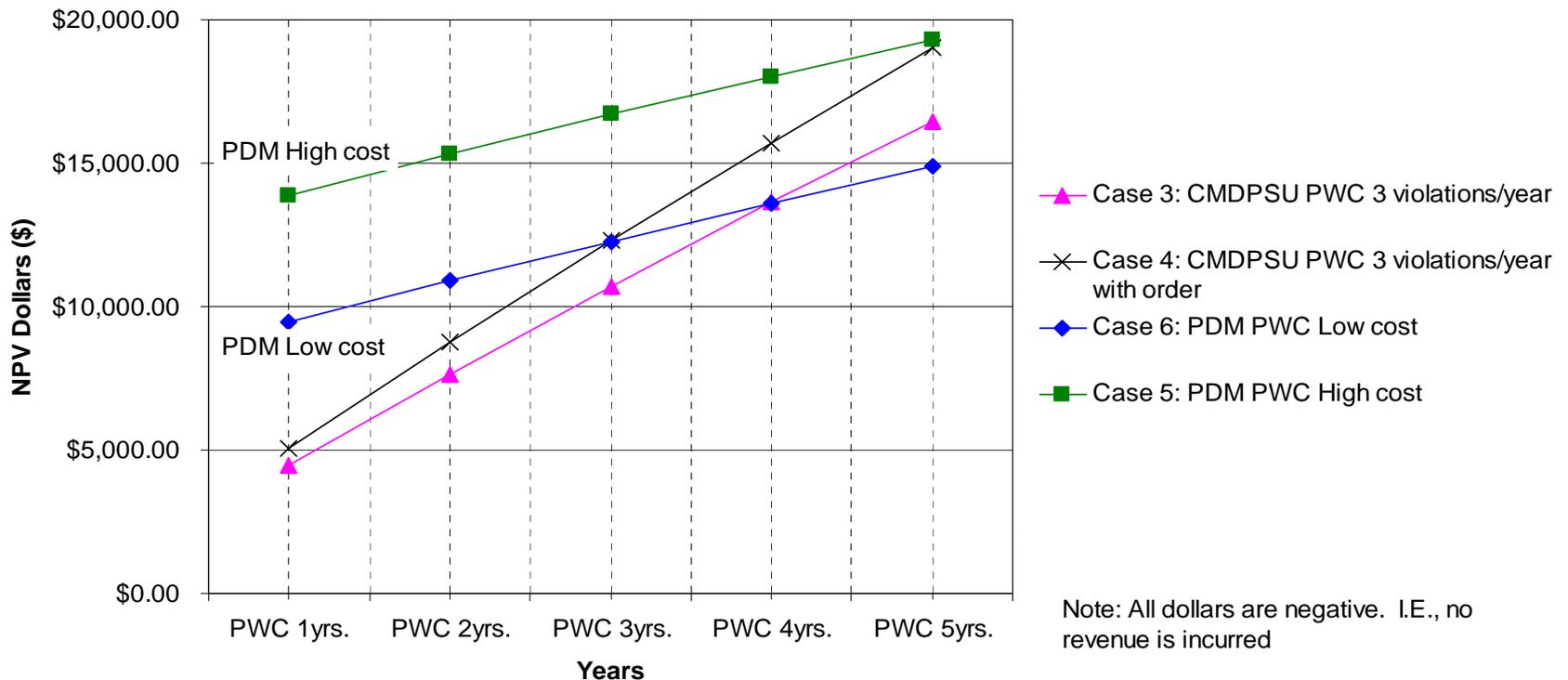
DRM Cost Analysis

- Conduct a ROSHI analysis
- DRM versus reference methods
 - Purchase price
 - Operating cost
 - Labor
 - Material
 - Citation cost avoidance - time
 - Sampling schemes
 - Continuous
 - Intermittent
 - Operating life



Example of PDM Cost Analysis – Engineering analysis from company perspective

CUMULATIVE PRESENT WORTH COST (PWC) CURVES -CMDPSU and PDM
Minimum Required Sampling for Both Sampling Systems
(One Shift per Day)



Economic Analysis

- Future economic evaluation of DRM's should examine societal costs and benefits
 - Cost of illness to federal & state govt. – workers comp
 - Medical costs of associated illness (COPD)
 - Insurance costs



3. Worker participation and training

- Modern workforce is better educated
- Level of participation will vary
 - Very involved
 - Could care less
- Functionality
 - Objective is not another decimal point in accuracy, but to prevent worker overexposure
 - How accurate is accurate enough
 - Understand the other errors
 - Appropriate trade off analysis to decide
- DRM as a tool to educate

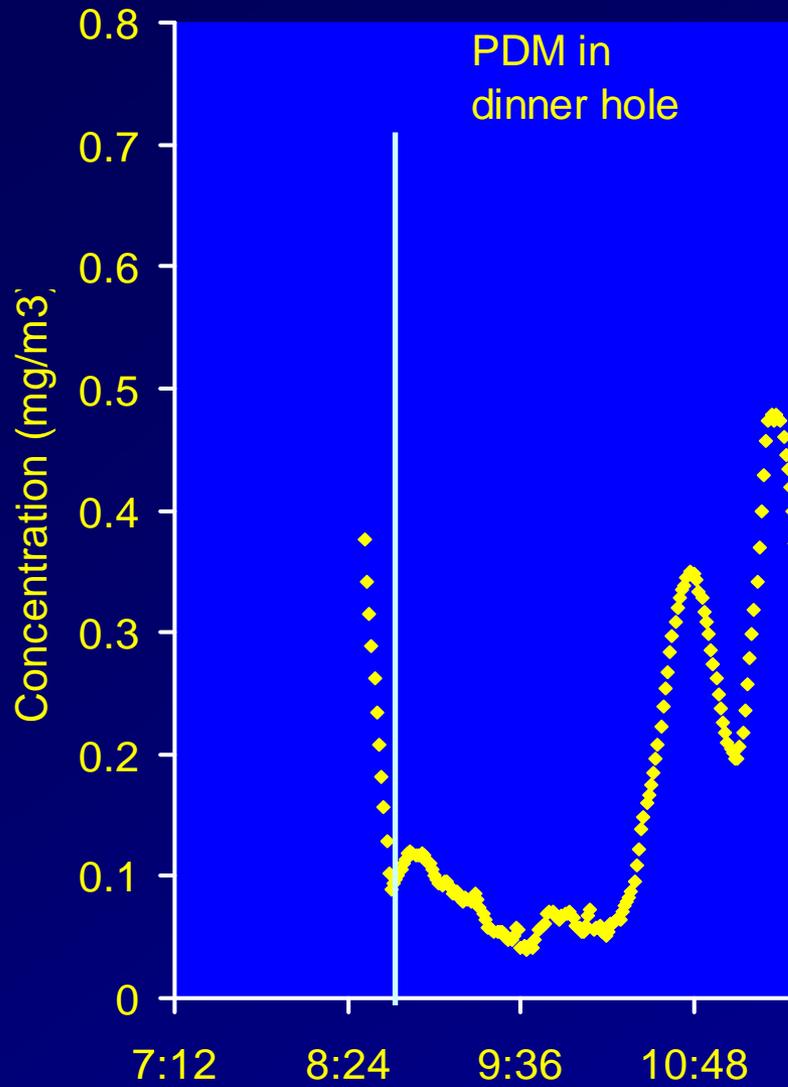
Participation through Partnership

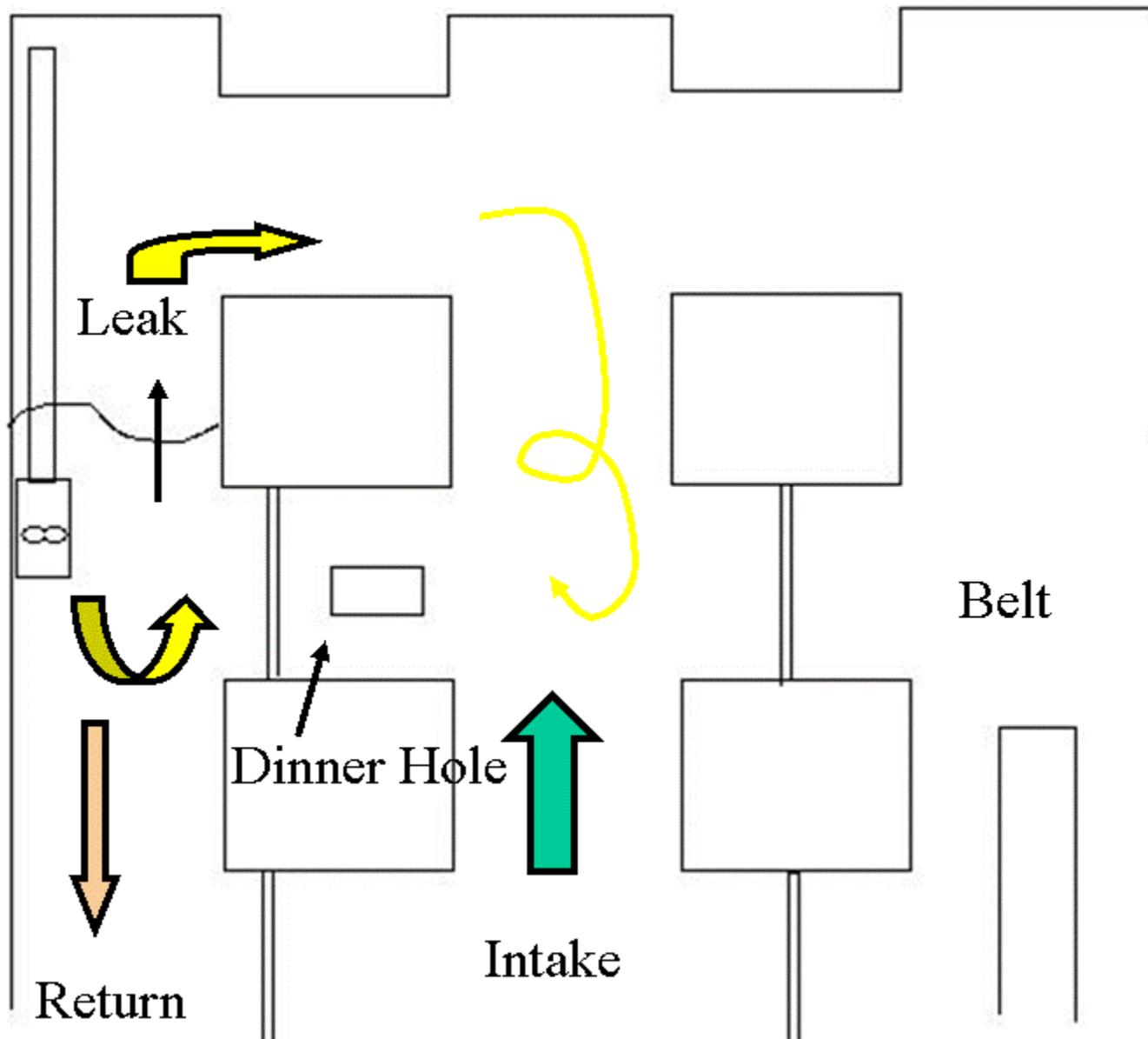
- Multiple participants strengthen development
- Workers involvement
 - Assess need
 - Development of solution
 - Consultation in design
 - Participation in testing
 - Protocol development
 - Testing
 - Feedback

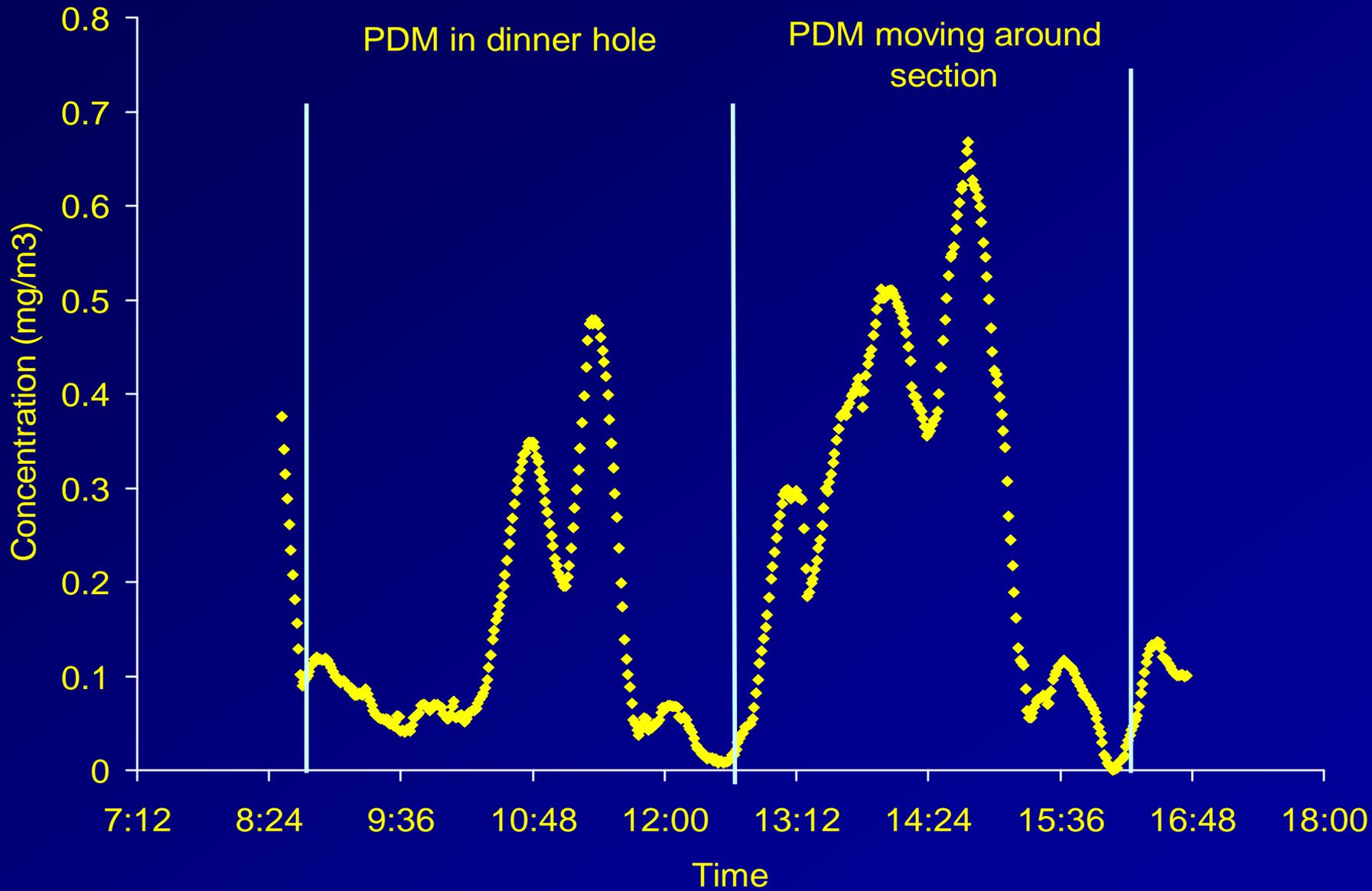
Example of timely information

“Discovery of a Leaking Curtain”

- Benefit of immediate feedback
 - Education
 - Action – result
 - Understanding the connection between cause and effect.
 - Avoid over exposure
- PDM worn by a miner while on break in the dinner hole
- Observed an increase in the dust levels in the intake.
- Located source







4. Verify exposure

- Periodic sampling – time delay
 - Allows time for conditions to change
 - Recollection of events that resulted in the exposure are forgotten
- DRM's provide timely, on-the-spot, data
 - Worker, manager, and inspector see same information at same time
 - Unambiguous arbitrator of need

5. Novel

- Psychological
 - Noise example
 - PDM example
- Empowerment
 - Employee
 - Management

Novel – Psychology Model

- Israel noise study
 - Controlled group study
 - One group saw real-time noise exposure data
 - One group did not
 - Group with information lowered exposure
- NIOSH PDM (Peters, et al. J. Int. Soc. Resp Prot. 4:2007. & NIOSH IC 9501, 2008)
 - Miners with knowledge of exposure data reduced exposure

Model of How Miners' Use Personal Dust Monitor Feedback

1. Diagnosis
2. Action Planning & Intervention
3. Evaluation
4. Institutionalization

Feedback



Behavior
Change

Interview findings generally support the model

- Most miners paid attention to PDM feedback
- Most miners tried to reduce exposure
- One crew reduced their average dust exposure 60% in 4 weeks



DRM's Empower

- Worker
 - Combine job experience with timely data
 - Understand connection
 - Act to improve situation
 - Individually
 - Through management
- Management
 - Timely data allow risk to be managed
 - Demonstrate their duty to provide a healthy workplace

Challenges -- How can we improve workers health with DRM's?

Issues for discussion

1. Continuous monitoring
2. Frequency of sampling
3. Worker participation and training
4. Verify exposures
5. Innovative approaches