

Assessing the Safety Culture of Underground Coal Mining: A Progress Update

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Project Background

- NIOSH study to evaluate 6 underground coal mines' safety culture
- 5 mines completed
- Assessment methods and instruments demonstrated and validated by Human Performance Analysis Corp.
- Project outputs:
 - 6 individual mine safety culture assessment reports
 - A master report presenting overall findings and recommendations
 - A mine safety culture assessment “tool kit”



What is Safety Culture?

“Characteristics of the work environment, such as the values, rules, and common understandings, that influence employees’ *perceptions* and *attitudes* about the importance that the organization places on safety”

(Haber & Barriere, 1998)



Safety Culture Characteristics

- Safety is a clearly recognized value
- Accountability for safety is clear
- Safety is integrated into all activities
- A safety leadership process exists
- Safety culture is learning-driven
- A process exists for establishing a strong and effective Safety Conscious Work Environment (SCWE)



Organizational Behaviors Impacting Safety Culture

- **Attention to Safety**
- **Coordination of Work**
- **Decision-making**
- **Formalization**
- **Goal Setting/Prioritization**
- **Communications
(Intradepartmental,
Interdepartmental, External)**
- **Organizational Culture**
- **Organizational Learning**
- **Organizational Knowledge**
- **Performance Evaluation**
- **Performance Quality**
- **Personnel Selection**
- **Problem Identification**
- **Resource Allocation**
- **Roles & Responsibilities**
- **Time Urgency**
- **Training**



How Organizational Behaviors Relate to Safety Culture Characteristics

Organizational Behaviors	Safety Culture Characteristics
<ul style="list-style-type: none">• Attention to Safety• Decision-making• Goal Setting/Prioritization• Resource Allocation• Time Urgency	Safety is a clearly recognized value
<ul style="list-style-type: none">• Roles and Responsibilities• Performance Quality• Communication	Accountability for safety is clear
<ul style="list-style-type: none">• Coordination of Work• Formalization• Training• Organizational Knowledge	Safety is integrated into all activities
<ul style="list-style-type: none">• Organizational Culture• Communication	A safety leadership process exists
<ul style="list-style-type: none">• Organizational Learning• Problem Identification & Resolution• Performance Evaluation• Personnel Selection	Safety culture is learning-driven



Why Assess Safety Culture?

- It demonstrates management's commitment to safety and that they are interested in understanding and improving safety culture
- Management may have misperceptions of the strength or weakness of their mine's safety culture
- Assessment results highlight specific areas on which to focus in order to improve safety culture
- To detect improvements or deterioration over time



Assessment Methods

1. Functional Analysis
2. Interviews
3. Behavioral Anchored Rating Scales (BARS)
4. Behavioral Observations
5. Organizational and Safety Culture Questionnaire

We look for consistency in the findings generated by different assessment methods



Method 1: Functional Analysis

- Review documentation available from the mine and MSHA
- Conducted 2-4 weeks prior to on-site data collection
- Purposes:
 - Clearly identify the organizational units at the mine
 - Identify the key supervisory and managerial positions of each organizational unit
 - Gain an understanding of each organizational unit's functions and interfaces
 - Examine how information flows among and within units
 - Guides selection of key Organizational Behaviors for on-site assessment



Documentation examples

- Organizational charts
- Safety policies & practices
- Strategic plan, mission and vision statements
- Significant events (1 yr)
- Safety performance indicators (1 yr)
- Description of safety culture related activities
- Results from prior internal or external assessments



Method 2: Interviews

- Sample size: 10-20% of employees
- Participants:
 - Hourly: cross section from each job type and shift
 - Salaried: shift foreman, fire boss, and at least one section foreman from each shift
 - Managers: mine, safety, underground operations, above ground operations, corporate safety
- Focus on 4 organizational behaviors per interview



Sample Interview Questions

Standard Opening:

1. Tell me about how you got to the job you have today.
2. What are your roles and responsibilities as (a continuous miner operator)?

Sample Questions to Investigate Communication Behavior:

1. How well informed are you about what is going on at the mine site?
 - How do you obtain most of your knowledge about mine site activities?
2. Describe how you receive information from upper levels of management.
 - What could be done to improve this?
3. Tell me how you go about transmitting information to upper management.
 - What could be done to make this process more effective?
4. Tell me about the last time you got together with other workers and supervisors to discuss problems that were going on in your work group.

[Continue with questions about other 3 organizational behaviors]



Method 3: Behavioral Anchored Rating Scales (BARS)

- Participants: All interviewees
- Behavioral examples anchor various levels of each behavior and facilitate interpretation
- Interviewees complete 4 BARS corresponding to 4 organizational behaviors
- BARS provide a more quantifiable means of assessing opinions on these topics



BARS Sample

Attention to Safety refers to the characteristics of the work environment, such as the norms, rules, and common understandings that influence employees' perceptions of the importance that the organization places on safety. It includes the degree to which a critical, questioning attitude exists that is directed toward site improvement.

- Individuals at the site believe safety is the number one priority and that perspective is reinforced by senior (high-level) management and clearly disseminated to all individuals at the site.
- Personnel make an effort to correct problems in a timely and effective manner to ensure that safety levels are not compromised at the site. Individuals have a clear understanding that safety is a top priority.
- Site management reflects a delicate balance of emphasizing safety, while at the same time, making it clear that there is a need to keep the mine operating.
- At times, the interests of the stakeholders seem to take priority over concerns regarding the safe operation of the mine and the lack of organization wide support for safe site operations is clearly evident.
- Questions regarding safe operations are not welcome or addressed. Management's attitude keep running coal regardless of evident safety issues.



Method 4: Behavioral Observations

- Non-intrusively observe work activities on the surface and underground
- Meetings
 - Start of shift meetings
 - Management meetings
 - Safety meetings
 - Training classes
 - Etc.
- Observer records examples of selected organizational behaviors



Method 5: Organizational and Safety Culture Questionnaire

- Participants: All mine site employees
 - Minimum 70% response rate
 - Lets employees know their views are important
- 61 multiple choice rating scale questions
- Provides baseline data to track future performance



Questionnaire Scales

- Commitment
- Cohesion
- Coordination
- Job Satisfaction
- Hazard
- Safety
- Communication Trust
- Communication Accuracy
- Communication Interaction
- Communication Satisfaction
- Safety Conscious Work Environment (SCWE)



Sample Questionnaire Items

Please mark the number below each statement or question that best describes your opinion:

- 1) I talk up this organization to my friends as a great organization to work for.

strongly disagree

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
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strongly agree

- 2) I find that my values and the organization's values are very similar.

strongly disagree

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
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strongly agree

- 3) I am proud to tell others that I am part of this organization.

strongly disagree

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
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strongly agree



Characteristics of our sample

Sizes

1 Small (0-50)

2 Medium (51-499)

2 Large (500+)

Regions

2 Northern Appalachia

1 Central Appalachia

1 Southern Appalachia

1 Western

Labor Affiliation

1 Union

4 Non-Union



Total Number of Responses

Interviews	BARS	Questionnaires
274	1,096	1,356



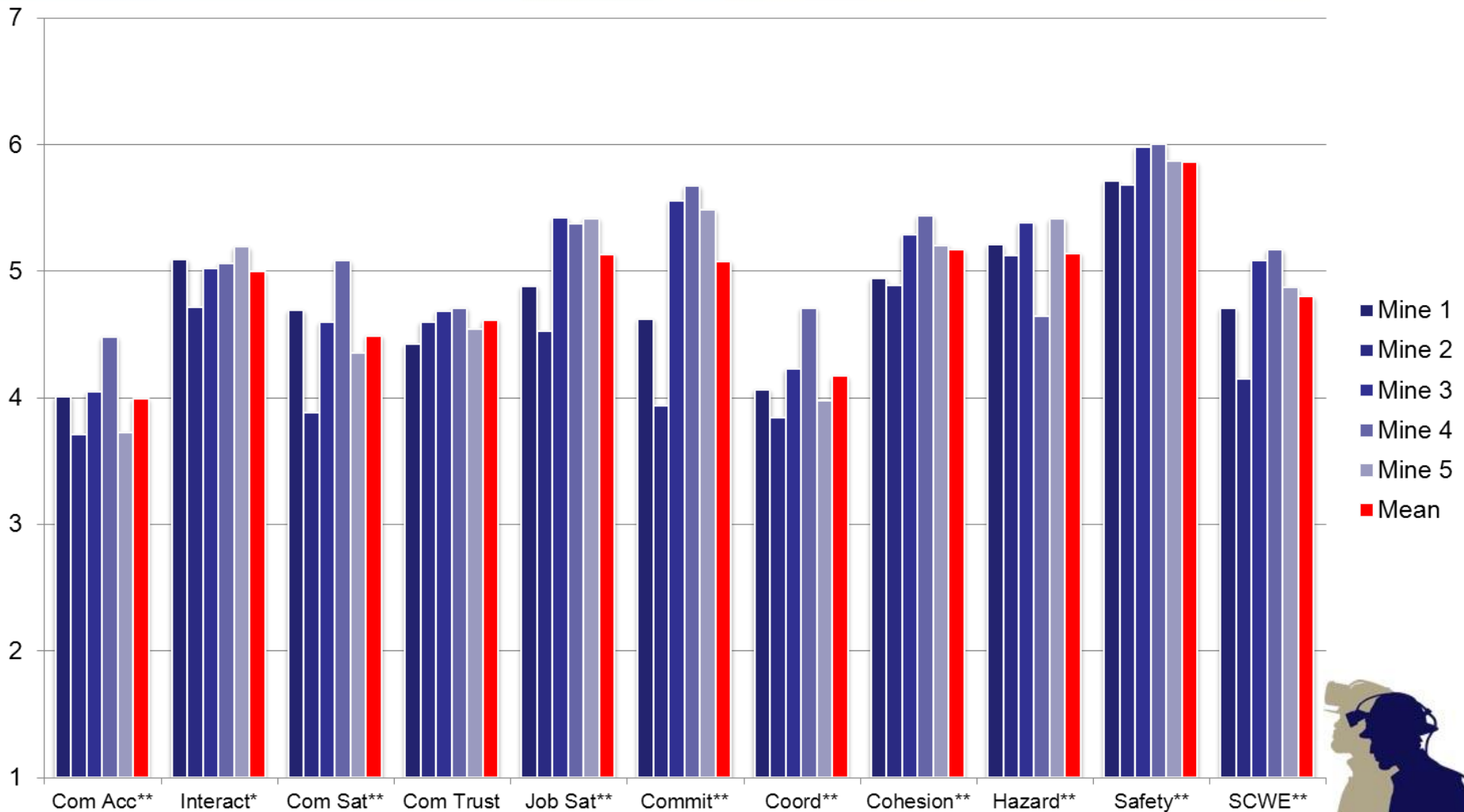
Preliminary Results

1. Questionnaire

2. Behavioral Anchored Rating Scales



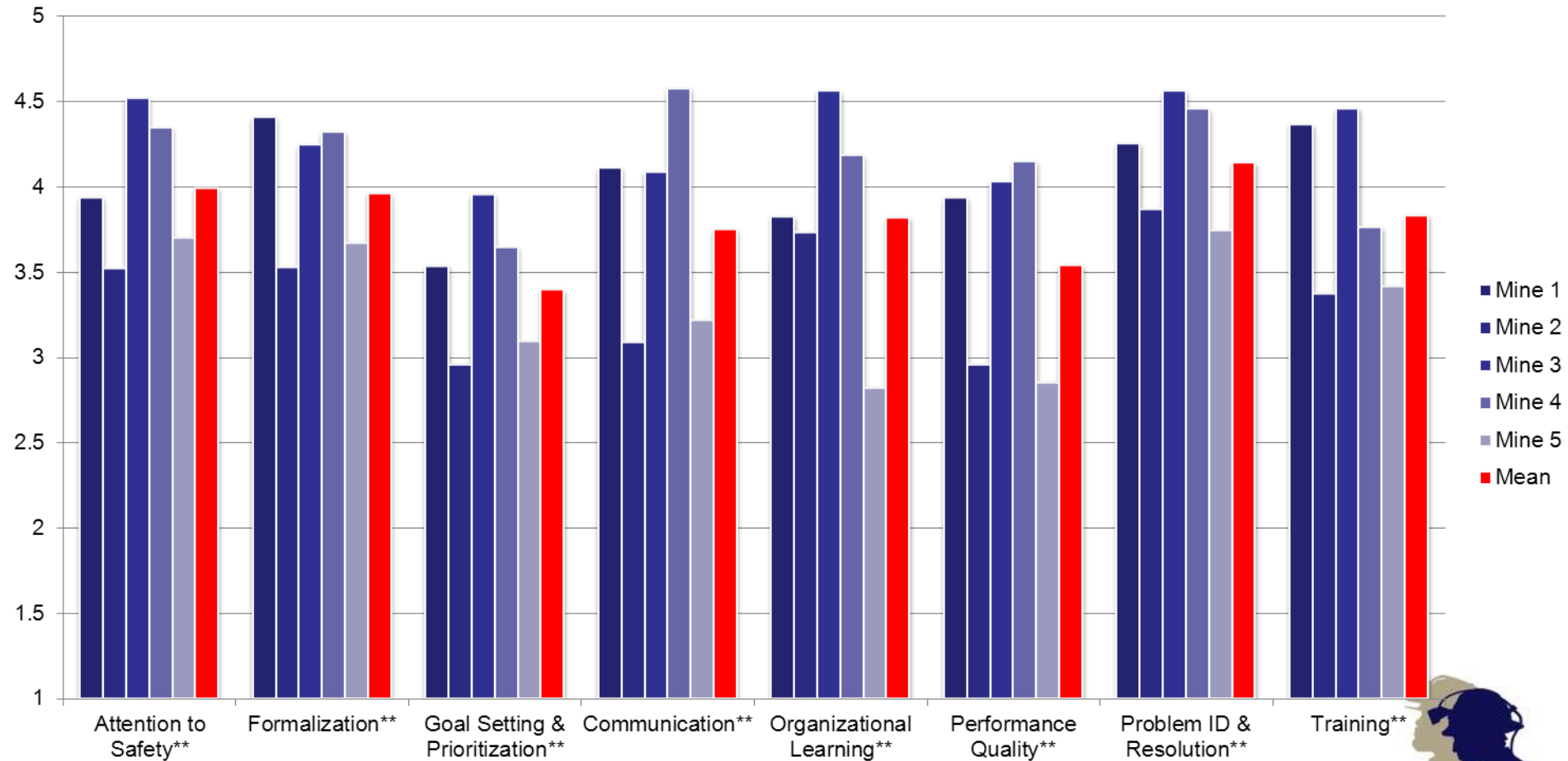
1. Questionnaire Results



* $p < .05$, ** $p < .01$



2. BARS Results



** $p < .01$



Comments on Interpretation

- Participating mines can see how their scores compare to other mines
- We have no clear-cut standards for judging the extent to which an individual mine's overall safety culture is positive or negative



Markers of Greater Emphasis on Safety

- Safety goals are concrete, clearly articulated, and retained
 - Simple, straightforward safety goal(s)
 - All levels of management review safety goal(s) with employees
 - 100% of interviewees could recite the safety goal(s)
- Consistency exists between management's espoused values and actions
 - Safety is communicated as #1 value and #1 goal
 - Little emphasis placed on production when communicating with miners
 - Employees are empowered to shut down if there is a safety concern
- Implementation of additional safety measures
 - Roof and rib mesh, extra bolts, and safety training beyond MSHA's requirements



Markers of Lesser Emphasis on Safety

- Frequent changes and informal change management
 - Changes enacted frequently (e.g., leadership, scheduling, policy, bonus distribution, etc.)
 - Formal channels are not used to announce and implement change (e.g., miners know about changes before bosses, new policies are enacted before being thoroughly explained)
- Lack of a Safety Conscious Work Environment
 - Employees do not feel that management wants safety concerns raised
 - Employees fear retaliation for reporting problems
- Inconsistency between espoused values and behaviors
 - e.g., stating that safety is the #1 priority but taking actions that contradict those statements such as having lofty production bonuses, unrealistic timelines, frequent mandatory overtime work



Discussion?



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