



HOF: a regulator's perspective

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MSAC fatalities review

In 2014 the Mine Safety Advisory Council engaged Peter Wilkinson of The Noetic Group to undertake a fatalities review.

Recommendation 2: Drawing on the discipline of Human Factors, including human and organisational factors expertise, identify the reasons which make it more likely risk controls will be successfully and reliably implemented.

Incident prevention strategy

The Mine Safety Regulatory Reform Incident Prevention Strategy outlines a process of holistic reform to develop an outcomes-focused, risk-based approach to regulating mine safety.

The strategy identified three main project areas:

1. Risk-based intervention.
2. Human and organisational factors.
3. Quality data.

HOF info for industry

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Human and organisational factors

The Mine Safety Regulatory Reform Incident Prevention Strategy is implementing the recommendations from the Mine Safety Advisory Council (MSAC) *Fatalities Review*. This includes examining the role of human and organisational factors in incident prevention.

Human and organisational factors are the environmental, organisational and job factors, along with human and individual characteristics, that influence behaviour at work in a way that can affect health and safety. Read more on our factsheet 'Human and organisational factors in mining' (pdf, 125.35 kb).

Human and organisational factors can include:

- human failures, including errors and non-compliance
- over-reliance on procedures to manage the risk and lack of user-friendly processes
- competence, through a combination of skills, experience and knowledge
- staffing and workload
- manage

Human factors

This fact sheet describes a real life case study in the mining industry and has been prepared as an advisory tool for supervisors. Safety specialists and managers are to provide an understanding of the potential impacts of human and organisational factors in mining.

Human factors in mining

Human and organisational factors support critical controls within the safety management system. These factors can affect health and safety in the workplace in many ways. They include environmental, organisational and individual characteristics, which influence individual characteristics, which influence behaviour at work.

Case study: Fatal outburst

Two mine workers were trapped and killed when a pressure burst occurred in a conveyor tunnel at a coal mine. The major risk was that of a large scale outburst.

Both workers were experienced miners and at the time of the incident both were on the left side of the conveyor. The tunnel was a large section of the mine, which was supported by steel bolts and mesh to control a conveyor's mine roadway and meant to control a conveyor's mine roadway on top of health workers.

The mine was aware of the frequent need of 30 bars within the tunnel, which is common in the conveyor tunnel. However, workers at the mine in discussion they were quite concerned that most workers had become used to the vibration.

Human factors Case study 1

What happened?

A trainee plant operator suffered fatal injuries when the light vehicle the operator was driving collided with and was crushed by a haul dump truck.

The trainee plant operator worked as a contractor on site and had earlier parked a haul truck at a stockpile to collect a light vehicle. The light vehicle was being used to collect other workers and take them for a job break.

The light vehicle approached a T intersection and was required to give way to vehicles on the haul road, as per the procedure. The light vehicle turned right onto the haul road into the path of the haul truck. A collision occurred and the trainee plant operator died immediately from multiple injuries.

The incident occurred at 11.30pm on the trainee plant operator's second night shift. At the time of the incident the trainee plant operator had worked a total of 45 hours heading on to the sixth shift that week.

The intersection where the incident occurred was covered in ponding water. The windrow height on the ramp varied considerably and the windrows for the haul 10 metres were higher than both the mine standard and the practice. As such, the height of the windrows reduce the visibility of the light vehicle ahead.

The intersection was controlled by a give way sign, however location and size of the give way sign did not provide optimum warning to drivers. The haul vehicle was covered with dirt and mud and the location of its lights on a nearby workshop made it difficult to distinguish between the moving truck and the workshop.

What can we learn?

- Design roadways to separate light vehicles and heavy vehicles on haul roads if possible.
 - When heavy vehicles and light vehicles cannot be separated, design roadways to ensure appropriate grades, lines of site, windrow height and signs at intersections.
 - For night work, improve visibility of heavy vehicles. This includes cleanliness and visual lighting. Also consider the use of close proximity devices with an alarm management plan established by the mine.
 - Change how operators attend road works by eliminating the use of light vehicles to collect workers.
- Include advice in this document a design



What factors were involved?

- Unplanned sensory error - perception of approaching truck. An obstructed view from the light vehicle and lack of visual perception and lighting on the haul dump truck.
- Light and heavy vehicles using the same road way. Windrow heights, lines of sight and signs at intersection.
- The practice and urgency of collecting plant operators for meal breaks to meet production demands.

FACTSHEET

Human and organisational factors

Human and organisational factors are the environmental, organisational and job-related, and human characteristics that influence our behaviour at work. These factors can affect health and safety in the workplace.

What people are being asked to do, the task and its characteristics, who is doing it (the individual and their organisational and its attributes) all have an influence on the safety of the workplace.

The factsheet outlines how human and organisational factors that, if ignored, reduce the likelihood of all types of human failure.

Figure 1. Collaborations for human and organisational factors.

Individual, Job, Organisation

Ten human and organisational factors to consider

1. Human failures

Human failures are not random. They can be attributed to two main types of human failure: errors and violations.

Errors

Slips or lapses are actions that are not planned or intended. These types of errors are commonly made by highly trained people carrying out procedures where familiarity means the person does not need to concentrate on what they are doing. Slips and lapses cannot be eliminated by training, but improving design can reduce the likelihood and create a more error-tolerant system.

Errors of judgement or decision-making are where the intended actions are wrong. These also occur when a person does not know the precise method of carrying out a task, either because it is new and/or unpractised, or because they have not been properly trained. Often in such circumstances people fall back on rules remembered from similar situations, and these may not be correct or inappropriate.

Human and organisational factor analysis

The Resources Regulator engaged the Keil Centre to help develop a bespoke human factor analysis tool for investigators and inspectors.

The aim was:

- to build a web-based tool
- develop a human failure taxonomy for unintentional and intentional behaviour
- develop a taxonomy for performance shaping factors specific to the mining industry
- map the path of decision making for HOF
- design and deliver training on HOF to inspectors and investigators.

Case study

What happened?

An incident occurred in an underground coal whereby a multi-skilled mine worker was moving a bull hose when he uncoupled two hoses without isolating the main air supply.

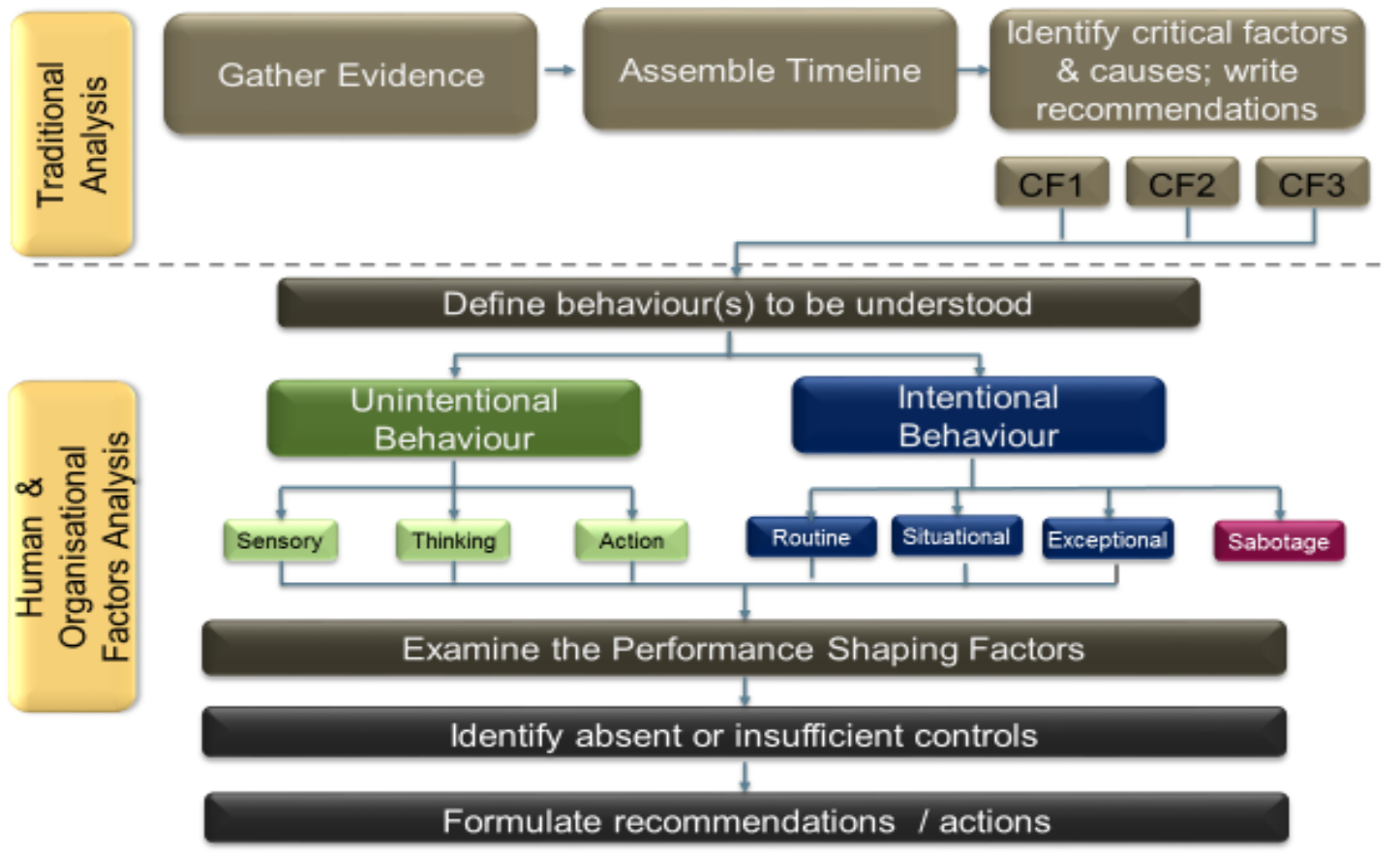
What was the result?

This action resulted in whipping of the pressurised hose until the hose was isolated. A deputy and another multi-skilled mine worker were standing near the area when the incident occurred.

Aim of the review

- trial the SHOF tool
- identify the PSFs which may have deteriorated and contributed to the condition.

Typical Incident Analysis Process



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	Failure type	Definition	Characteristics	Examples
Unintentional Action (Error)	Sensory Error	Where information input via sensory channels is degraded.	<ul style="list-style-type: none"> Associated with expectancy and attentional focus 	<ul style="list-style-type: none"> Mishearing an instruction from a colleague Not seeing an oncoming vehicle Not detecting smell of chemical/product Reading the wrong pressure gauge Misreading a speed indicator
	Action Error: Slips and Lapses	Where a simple, frequently performed physical action goes wrong.	<ul style="list-style-type: none"> Associated with familiar tasks requiring little conscious attention: Slip: where the right action is intended but the wrong action is performed Lapse: where the required action was omitted due to a momentary memory lapse The individual often finds it difficult to explain why they acted as they did. 	<ul style="list-style-type: none"> Opening wrong valve Moving a switch in the wrong direction Forgetting a crucial step in a procedure Driving vehicle away with fuel hose still attached
	Thinking Error: Mistakes	Action is carried out as planned, but wrong course of action is taken. Decision making errors, errors of diagnosis or judgement involving conscious mental processes.	<ul style="list-style-type: none"> Misapply a good rule, or apply an inappropriate rule Misdiagnose an indication and apply inappropriate corrective action 	<ul style="list-style-type: none"> Ignoring alarms in a real emergency based on a history of false alarms Misjudging vehicle capability due to experience in a different vehicle Applying outdated procedure which doesn't fit the current conditions
Intentional Action (Non-compliance)	Routine	Deviation from rules and procedures as the normal way of operating in order to get the job done.	<ul style="list-style-type: none"> Non-compliance has become the norm Consensus within team or organisation that it is not necessary to follow the rule/procedure 'to the letter' Organisation/team 'turns a blind eye' 	<ul style="list-style-type: none"> Driving at a speed outside the speed limit, because everybody does it Omitting pre-start inspections because supervisor never checks them
	Situational	Non-compliance with rules or procedures, due to situation-specific factors, such that non-compliance is perceived as the best way to get the job done.	Taking shortcuts or not following procedures in order to overcome an obstacle, such as time/production pressure, broken down equipment or impending weather conditions	<ul style="list-style-type: none"> Changing sequence on a procedure to save time and get the job done Omitting an independent inspection when a supervisor can't be located
	Exceptional	The non-compliance is intended to solve a novel problem in highly unusual circumstances, such that compliance is perceived as the only way to resolve the problem, and get the job done.	Takes a calculated risk in deviating from the rules due to highly unusual circumstances. The rules are seen as no longer applying.	<ul style="list-style-type: none"> Speeding on the way to maternity unit Skipping communication steps in procedure during emergency in order to return plant to safe operations and avoid catastrophic failure
	Sabotage	An egregious act, where non-compliance is intended to cause harm or damage.	Unlike other non-compliance which seeks to get the job done, sabotage is characterised by malicious intent to cause harm.	<ul style="list-style-type: none"> Acts of arson Deliberately putting plant into unsafe state

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Behaviours that contributed to this incident	
Person performing behaviour	Multi-skilled mine worker
The task they were engaged on at the time	Breaking the join in the air hose
What they did (or did not do)?	Did not check for isolation or test for dead at the manifold valve
What was the result?	Hoses whipping around
Was the behaviour intentional?	Yes
Based on the evidence, the intentional behaviour that best describes this behaviour is?	Situational (please refer to appendix A for definition of behaviours)
Reason for selecting this behaviour type:	<ul style="list-style-type: none"> wanted to save time perceived it was not necessary as from a distance he thought the bull hose (spinning valve) was open did not check for isolation

Performance shaping factors taxonomy

Personal factors	Job factors	Work Environment	Team factors	Organisational factors
Individual technical competence	Task demands	Environmental Conditions	Team dynamics	Planning & Resourcing & Planning
Familiarity with task	Physical demands of task	Weather	Team relations & trust	Planning & co-ordination of resources
Level of experience	Mental demands of task	Temperature / Humidity / Light	Team member example behaviour	Availability of appropriate resources
Learning/knowledge of task	Time pressures	Air quality/Noise/Vibration	Team member expectations	Mine planning
Training sufficiency	Task design	Time of Day	Supervisor / Leader example behaviour	
Training recency	Workload	Roadway conditions	Supervisor / Leader expectations	Training & competence systems
	Non-standard activity		Supervisor communications quality	Availability of training
			Supervisor planned inappropriate operations	Frequency of training
Individual non-technical factors			Team communication quality	Training quality
Situation assessment	Communications factors		Supervisor support / assistance	Suitability of training
Perception & understanding	Information content		Team peer support/assistance	Competence management system
Confidence/motivation/attitude	Communication method		Groupthink	
Job satisfaction/morale	Communication quality		Bullying	Safety Management
Attention/alertness/vigilance	Comms equipment quality/reliability			Risk management arrangements (Identification, Analysis, and Control selection)
Distraction			Work practices	Worker participation & involvement (consultation)
Boredom	Procedures		Team risk management practices	Implementation of risk management arrangements
	Procedure availability / access / location		Permit to work practices	Arrangements covering high risk work
Individual Wellbeing	Procedure accuracy or completeness		Fitness for work management practices	Change management
Stress	Procedure clarity or complexity		Mentoring and supervision practices	Checking inspection & monitoring
Fitness/physical health issues	Procedure format (physical)		Allocation & communication of responsibility	Investigation & audit findings
Sleep problems	Procedure validity / feasibility / suitability		Accountability	Safety trend analysis & review practices
Fatigue	Compatibility with other procedures		Task / shift handover/takeover practices	Fatigue risk management
Mental health issues				Fitness for work management
Substance use	Ergonomics		Planning & Co-ordination Practices	Contractor management
	Control panel layout/design		Shift organisation & rostering	
	Alarms and warning devices quality		Team staffing levels	Organisational arrangements
	Visual display quality		Team composition (skill set/experience)	Maintenance, inspection & testing plant/equipment)
	Workplace layout		Role clarity	Procurement & commissioning
	Fit for purpose equipment & tools		Co-ordination between teams	priority of production bonus and safety incentives
			Co-ordination between workgroups	Interdepartmental comms & co-ordination
	Tool use/equipment use			Industrial relations
	Tools / equipment availability			
	Tools / equipment reliability			Organisational culture
	Trust in tools or equipment			Organisational learning
				Trust within the organisation
				Reporting and/or investigation culture
				Consistency of safety message
				Production culture
				Social norms & pressures (Org level)
				Normalisation of risk
				Discipline, rewards & benefits

Performance shaping factors identified

Performance shaping factors				
Personal factors	Job factors	Environmental conditions	Team factors	Organisational factors
Situational assessment	Task design	Light	Team communication quality	Safety trend analysis and review practices
Perception and understanding	Communication method		Team risk management practices	
Confidence, motivation and attitude	Communication quality		Mentoring and supervision practices	
distraction	Procedure availability, access, location			
Sleep problems				

PSF findings

- communication, including communication within the team and to the team
- team supervision
- risk management effectiveness, including quality and feedback

Recommendations

- SLAMS need to be completed at the time and location of the task in consultation with all people involved. This will ensure that the team communicates and coordinate roles and responsibilities
- SLAMS need to be reviewed to consider the effectiveness of controls, with feedback to workers to enable continuous improvements
- if isolation is required, the supervisor should communicate this to the workers undertaking the task.

Where to from here?

- ongoing program of training for investigators and inspectors
- mentoring and coaching program to follow training
- tool will be integrated into work processes
- investigation reports will include HOF
- integrate HOF into proactive targeted assessment program
- greater focus on informing industry about HOF and importance of reviewing controls in respect to SMS and their sociotechnical systems

Questions?



More information

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