Underground Mining safety and radiation protection – Key considerations

IAEA - INT2019

Interregional Workshop on Case Study of Conventional Uranium Production: from Exploration to Closure

October 14 to 18th, 2019, Prague, Czech Republic

Agenda –Underground Safety and Radiation

- My Safety Journey
- PDCA for Safety & Radiation programs
- Practical examples on how to manage Safety & Radiation programs

My Safety Journey

Safety and Radiation Program Documents

- In Canada, Safety and Radiation are separate Licensing Documents (programs) but tie back into the Quality Management System for the Licensed Operation
- Regulations related to the Radiation Program include both Provincial and Federal requirements:

- CNSC Regulatory Guide G-129, Guidelines on How to Meet the Requirement to Keep All Exposures As Low As Reasonably Achievable (ALARA)
- Saskatchewan Mines Regulations
- Nuclear Substances and Radiation Devices Regulations
- Packaging and Transport of Nuclear Substances Regulations
- Radiation Protection Regulations
- S-106 (E), Technical and Quality Assurance Standards for Dosimetry Services in Canada
- Transportation of Dangerous Goods Regulations
- Uranium Mines and Mills Regulations

Radiation Protection Program

- Both the radiation and safety programs follow the Plan, Do, Check and Act (PDCA) model which is at the heart of most Management Systems.
- The PLAN can include the following elements:

1. Policy on Radiation Protection (ALARA)
2. Hazard Identification, Assessment and Control
3. Worker Classification NEW (Nuclear Energy Worker) or non-NEW
4. Dose Limits for Workers
5. Objectives, Targets and Plans for continual improvement

Radiation Protection Program PDCA

- DO can include the following elements:

1. Functions, Responsibilities and Authority
2. Training, Awareness and Competence
3. Basic Radiation Protection Training
4. Communication
5. Operational Control
6. ALARA and Exposure control (PPE, Radiation work permits etc.)
7. Radiation Code of Practice
8. Emergency Preparedness and Response

Radiation Protection Program PDCA

- CHECK can include the following elements:

1. Monitoring and Measurement
2. Establishing Key Performance Indicators*
3. Non-conformance and corrective actions
4. Audit
5. Radiation Monitoring equipment, urinary analysis and Dosimetry

* Key performance indicators to be discussed

Radiation Protection Program PDCA

- ACT can include the following elements:

1. Management review (lessons learned)
2. Use of Experience and Continual Improvement

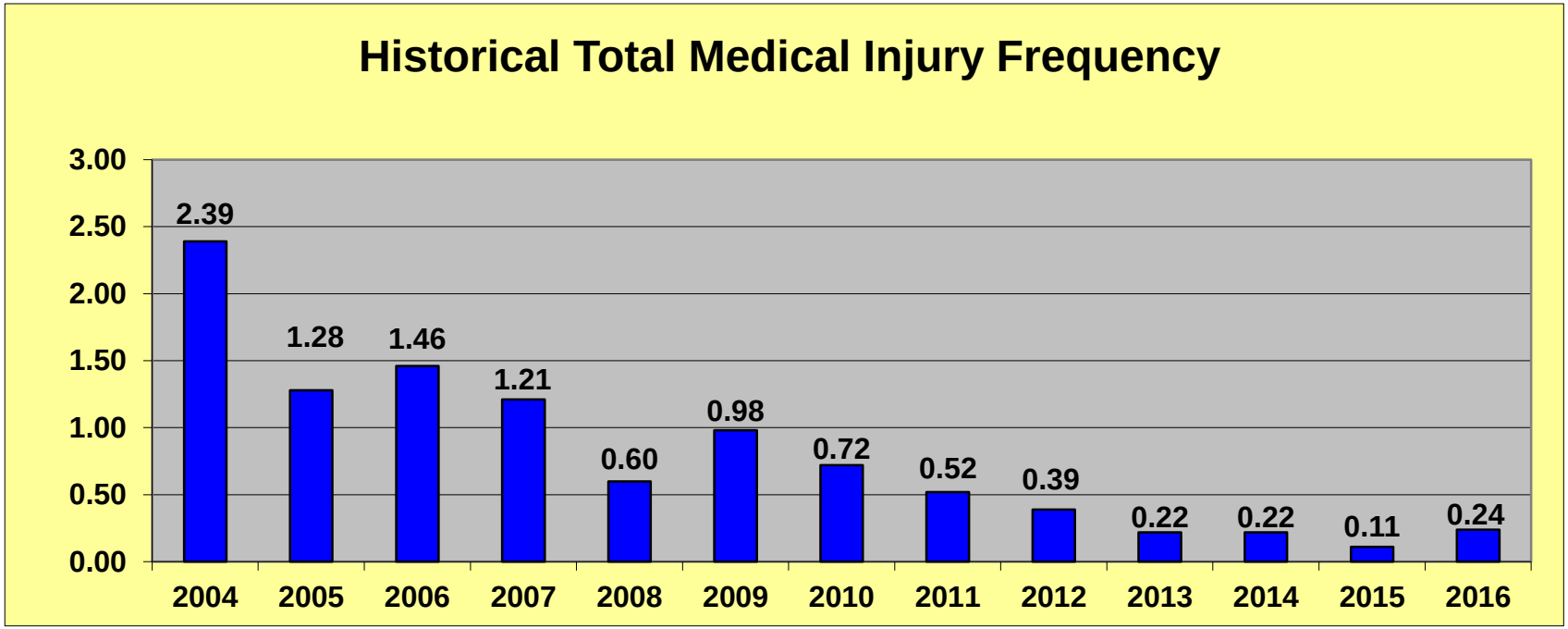
Safety Innovation at McArthur River

Cameco Safety

McArthur River

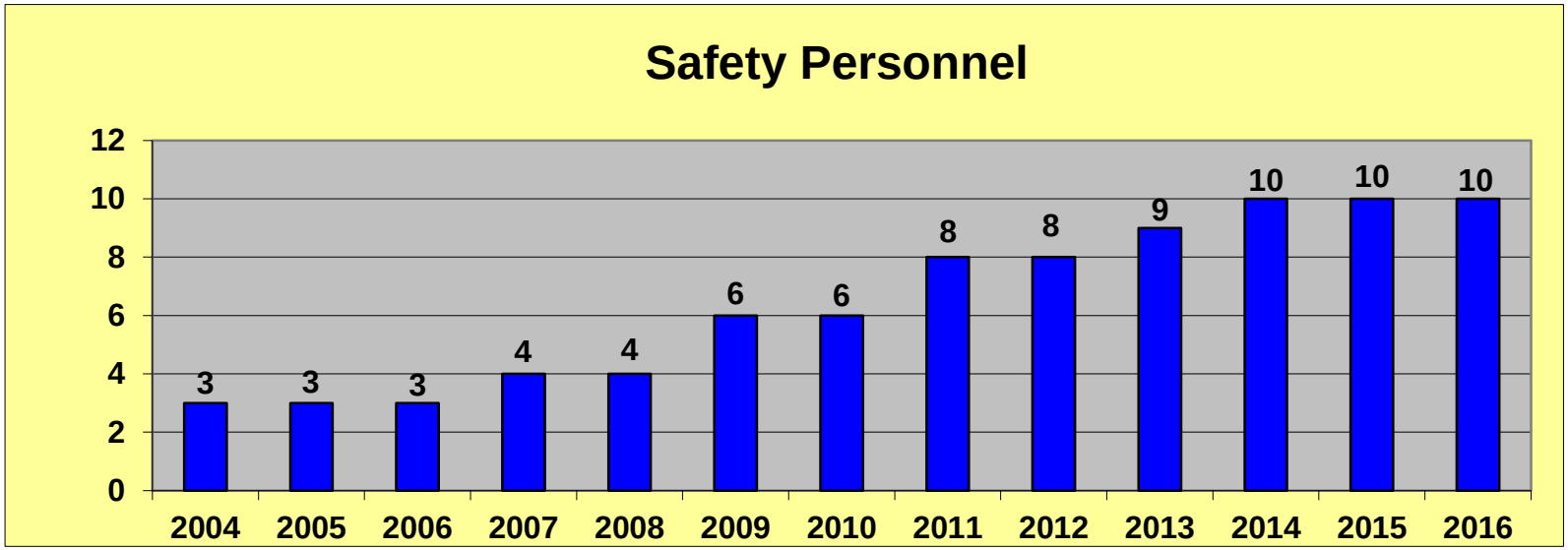
cameco.com

Historical Safety Performance



- Combination of lost time injuries + medical aid injuries
- Steady decline since 2007
- Won John T Ryan national award for best performance in a metal mine – 2009, 2013, 2014 & 2015 Regional Award 2010,2011

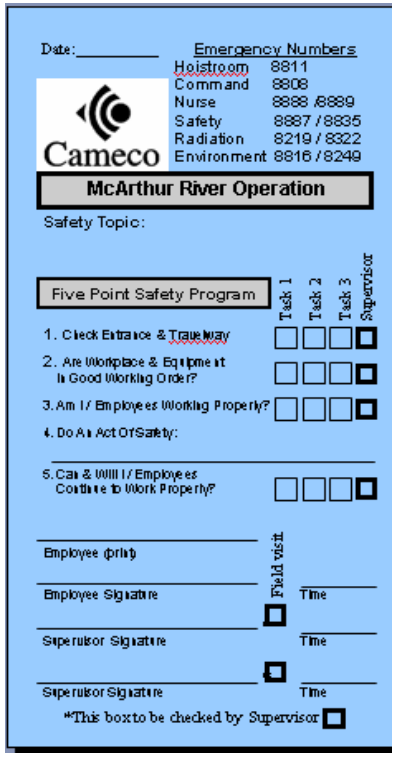
Safety Personnel

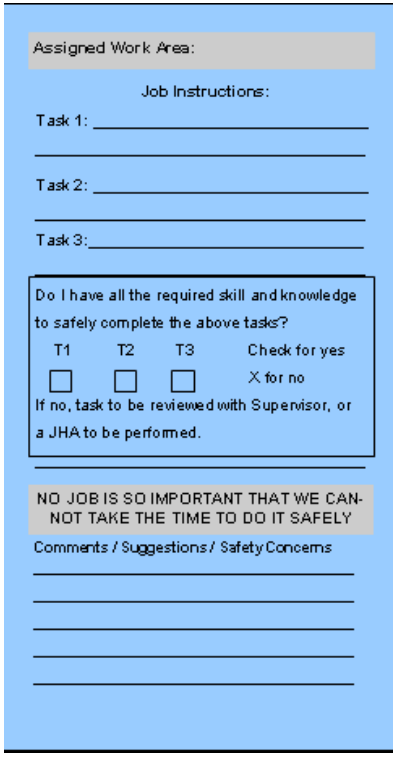


- As the mine began growing, safety personnel were slowly added
- Team consists of one coordinator, one industrial hygienist, 4 officers and 4 technicians spread over 2 shifts

Key Elements – 5-point safety system

- Each worker given a card at the start of each day
- Responsibilities for both the worker and supervisor to ensure safety is considered in every aspect of work
- Approx. 300 cards used each day
- All information tracked daily





Date: _____

Emergency Numbers

Hoistroom	8811
Command	8808
Nurse	8888 /8889
Safety	8887 / 8835
Radiation	8219 / 8322
Environment	8816 / 8249

Cameco

McArthur River Operation

Safety Topic:

Five Point Safety Program

	Task 1	Task 2	Task 3	Supervisor
1. Check Entrance & Travelway	☐	☐	☐	☐
2. Are Workplace & Equipment In Good Working Order?	☐	☐	☐	☐
3. Am I / Employees Working Properly?	☐	☐	☐	☐
4. Do An Act Of Safety: _____				
5. Can & Will I / Employees Continue to Work Properly?	☐	☐	☐	☐

_____ Employee (print)

_____ Employee Signature — Field visit ☐ — _____ Time

_____ Supervisor Signature — _____ Time

_____ Supervisor Signature — ☐ — _____ Time

*This box to be checked by Supervisor ☐

Radiation Protection

ALARA—As Low As Reasonably Achievable

Reduce your radiation exposure by:

1. Minimizing Time
2. Maximizing Distance
3. Maximizing Shielding
4. Proper Ventilation
5. Use all PPE

DRD's

Daily	50 µSv/day report to your supervisor to minimize dosage
	200 µSv/day maximum allowable dosage
Weekly	400 µSv/wk 7 day maximum
Dose Limits	1 year average 20 mSv (20,000 µSv)
	1year maximum 50 mSv (50,000 µSv)
	5 year maximum 100 mSv (100,000 µSv)

Environmental Management System

Help Prevent Pollution through Compliance and Continual Improvement

How could my tasks potentially impact the environment?

_____

How can I do this task to minimize or eliminate the impact on the environment

Pre– Shift Equipment Safety Checks

Date: _____

Shift Day ☐ Night ☐

Employee: _____

Supervisor: _____

Walk Around	Equip. #			
Engine Oil Level:	☐	☐	☐	☐
Hydraulic Oil Level:	☐	☐	☐	☐
Engine Coolant Level:	☐	☐	☐	☐
Fire Extinguisher:	☐	☐	☐	☐
Fire Suppression:	☐	☐	☐	☐
Oil Leaks:	☐	☐	☐	☐
Belts & Guards:	☐	☐	☐	☐
Steps, hand rails, & Cab:	☐	☐	☐	☐
Tires, Rims, Lug Nuts:	☐	☐	☐	☐
Attachments (bucket, forks)	☐	☐	☐	☐
Startup Alarm:	☐	☐	☐	☐
Wheel Chocks:	☐	☐	☐	☐
After Start Up				
Transmission Oil:	☐	☐	☐	☐
Lights, Gauges, Access.:	☐	☐	☐	☐
Brake test:	☐	☐	☐	☐
Brake operation:	☐	☐	☐	☐
Backup Alarm:	☐	☐	☐	☐
Grease all required fittings:	☐	☐	☐	☐
LOS: If applicable:	☐	☐	☐	☐
Equipment Fueled:	☐	☐	☐	☐

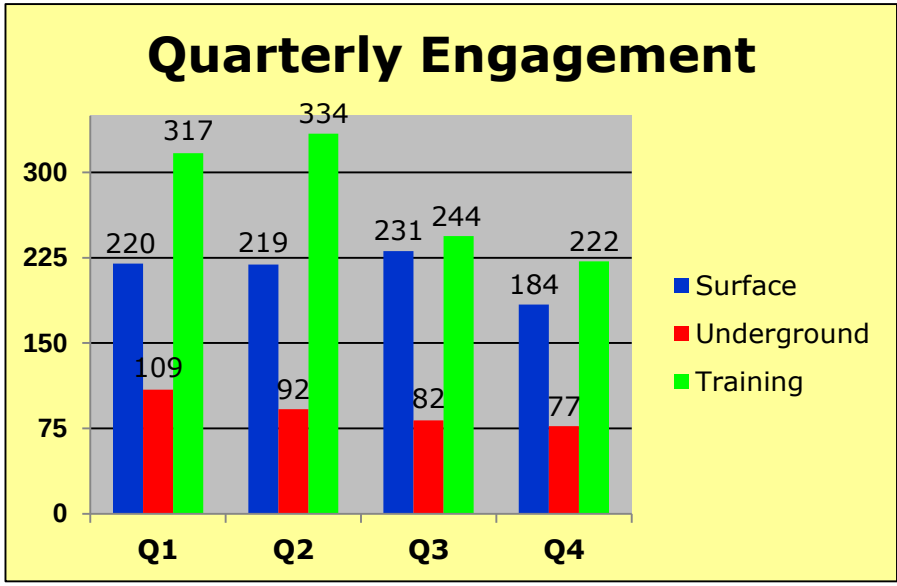
Key Elements – High Hazard Activities

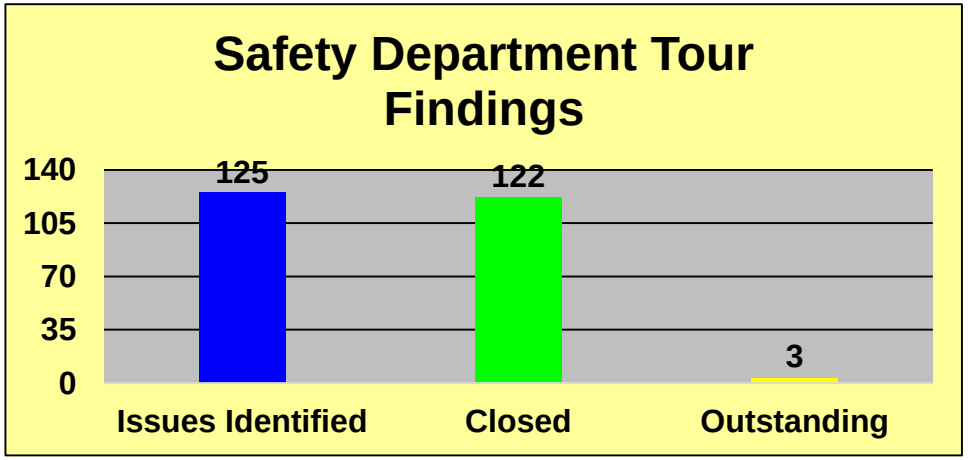
- All workers participated in developing a “Top 12” list of most high potential work
- Safety Department creates monthly safety package focusing on these topics
- Daily toolbox topics each weekend (8 per month) break down finer safety points related to these high-hazard activities

Major Hazard
Control of Hazardous Energy (LOTO)
Fall protection
Chemical safety
Confined space
Pressure hazards
Ground support/blasting issues
Guarding/barricades
Fire prevention
Mobile Equipment / Visibility Issues
Respiratory protection
Industrial Hygiene
Rigging/hoisting

Key Elements – Safety Department Engagement

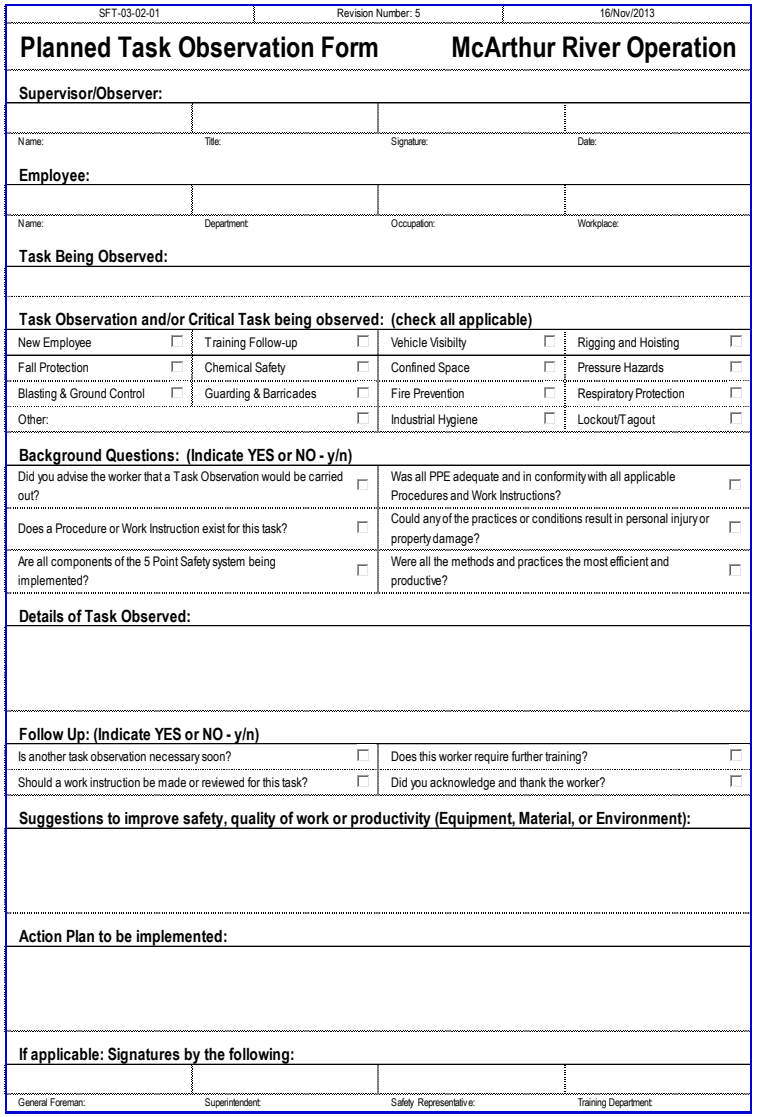
- Safety staff track engagement during Underground tours, surface tours and training opportunities
- Weekly targets are set for each shift (6 surface, 6 u/g engagements)
- All identified issues are tracked





Key Elements – Job Task Observations

- Supervisors required to conduct 5 observations each month
- Supervisors required to cover all elements of the “Top 12” list as well as other high-level tasks
- All observations tracked and scored for quality purposes
- Measured element of our Key Performance Indicators (KPI) program



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Planned Task Observation Form — **McArthur River Operation**

Supervisor/Observer:

Name:	Title:	Signature:	Date:

Employee:

Name:	Department:	Occupation:	Workplace:

Task Being Observed:

Task Observation and/or Critical Task being observed: (check all applicable)

New Employee ☐	Training Follow-up ☐	Vehicle Visibilty ☐	Rigging and Hoisting ☐
Fall Protection ☐	Chemical Safety ☐	Confined Space ☐	Pressure Hazards ☐
Blasting & Ground Control ☐	Guarding & Barricades ☐	Fire Prevention ☐	Respiratory Protection ☐
Other: ☐		Industrial Hygiene ☐	Lockout/Tagout ☐

Background Questions: (Indicate YES or NO - y/n)

Did you advise the worker that a Task Observation would be carried out? ☐	Was all PPE adequate and in conformity with all applicable Procedures and Work Instructions? ☐
Does a Procedure or Work Instruction exist for this task? ☐	Could any of the practices or conditions result in personal injury or property damage? ☐
Are all components of the 5 Point Safety system being implemented? ☐	Were all the methods and practices the most efficient and productive? ☐

Details of Task Observed:

Follow Up: (Indicate YES or NO - y/n)

Is another task observation necessary soon? ☐	Does this worker require further training? ☐
Should a work instruction be made or reviewed for this task? ☐	Did you acknowledge and thank the worker? ☐

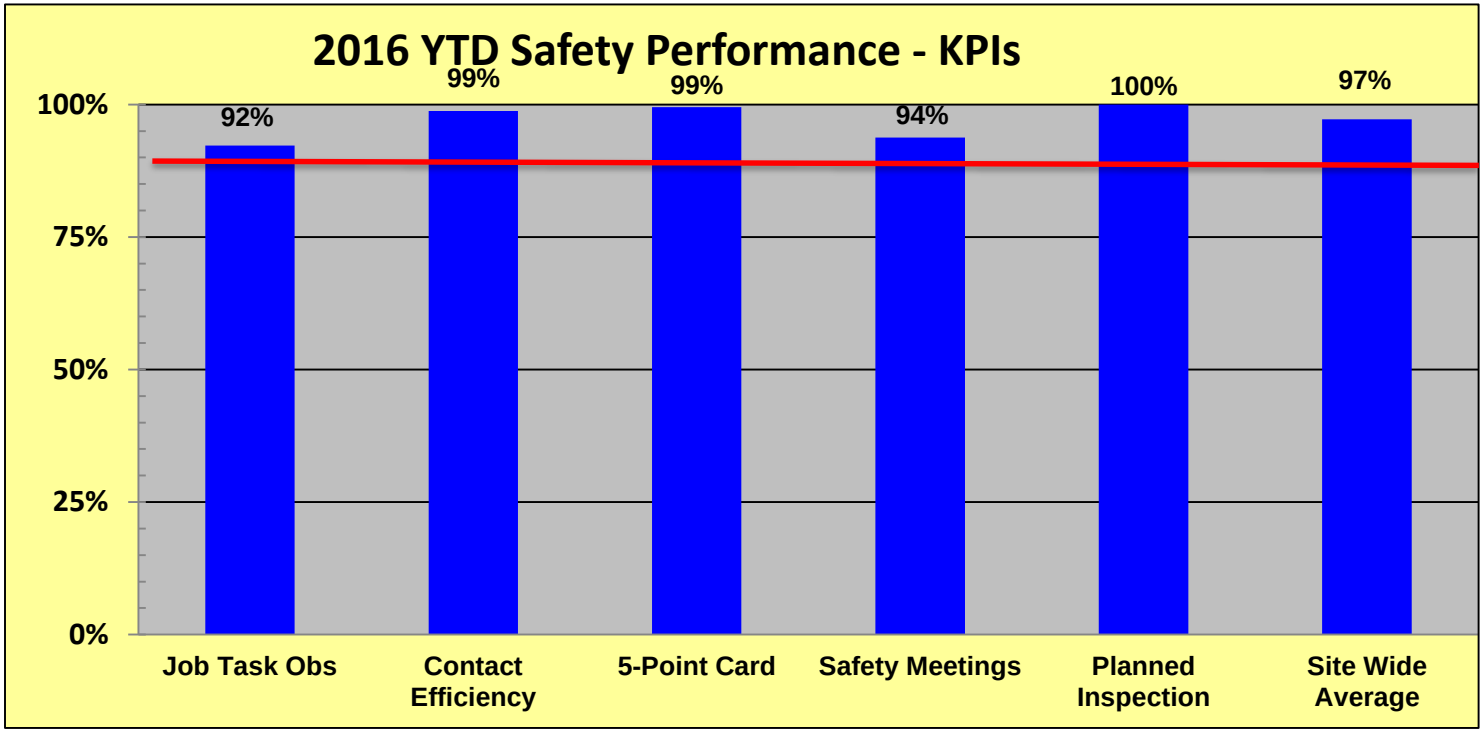
Suggestions to improve safety, quality of work or productivity (Equipment, Material, or Environment):

Action Plan to be implemented:

If applicable: Signatures by the following:

General Foreman:	Superintendent:	Safety Representative:	Training Department:

Key Elements – 5 KPIs



- Job task observations
- Safety meetings, supervisor contacts, 5-point card usage and planned inspection program make up other 4 elements
- Each element has a target of 90% compliance

Key Elements – Supervisor Training

- McArthur River has developed specific training to help supervisors complete their roles in regards to safety:
  - How to conduct and prepare for safety meetings
  - Job task observations
  - Supervisor duties in an emergency
  - How to handle work refusals
  - Gas testing for confined spaces
  - Key Performance Indicators – supervisor responsibilities

Adjusting to site conditions

- As with any industrial site, the ability to “read” site trends and shortfalls is a key element
- Site typically has 2-3 site wide safety stand downs when it appears that safety may be sliding, complacency sets in or a complete miss has been identified
- Safety department creates in-depth review packages with key messages to combat site poor performance
- Cannot emphasize enough the role of “walking the walk” – safety, supervisors and management need to be on the floor as much as possible a push safety until it becomes second nature

Summary

- In underground operations workers are alone for the majority of their shift and therefore need to develop a good safety culture.
- A good safety culture starts with people inspecting their workplace and correcting non-standard conditions.
- Supervisors must ensure that workers are trained in the tasks they perform and they perform those duties with the right mindset to work safe.
- Tools or systems to constantly remind workers of hazards will result in improved safety performance
- When a negative safety trend is perceived, stop activities across the operation and remind people that safety in the workplace is their most important function.