



CHAMBER OF MINES
of South Africa

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Glen Burn Lodge
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LEDGING AS A LEADING PRACTICE



Background to this Presentation



- Following a number of Fatalities in Ledging areas it was felt that the Safety Risk in Ledging Operations had increased
- Request from CEO Elimination of Fatalities(Zero harm Task Team) working group for MOSH FOG Leading Practice Adoption Team to include “Ledging” in their scope when identifying possible Leading Practices for Adoption by the Industry

This Presentation



We will look at primarily at:

- stoping vs. ledging fatality statistics,
- the methodology followed,
- influencing factors and
- Recommended Leading Practice

Process Followed



- MOSH FOG Industry Adoption Team Involvement
- Data gathering from (7) “Conventional Stoping” mines which engage in Ledging Activities
- Interviews with Mines
- Analysis of Data
- Outcomes as per presentation
- Recommended Leading Practice

Observations

- Ledging should be a safe process – if we do the right stuff correctly.
- Some pockets of excellence do exist
- Clear responsibilities and accountabilities before and during Ledging
- Good integrated planning processes
- There are companies who ledge safely
- The quality of the Ledge dictates the efficiency of the Stope

Discussions/Topics covered with participating mines



- Is Ledging a High Risk Operation (Stats compared to Stoping)
- Are there differing causational factors when comparing Ledging incidents to Stoping Incidents
- What does your Ledging Standard “Cover”
- What would you recommend we do to lower risks associated with Ledging

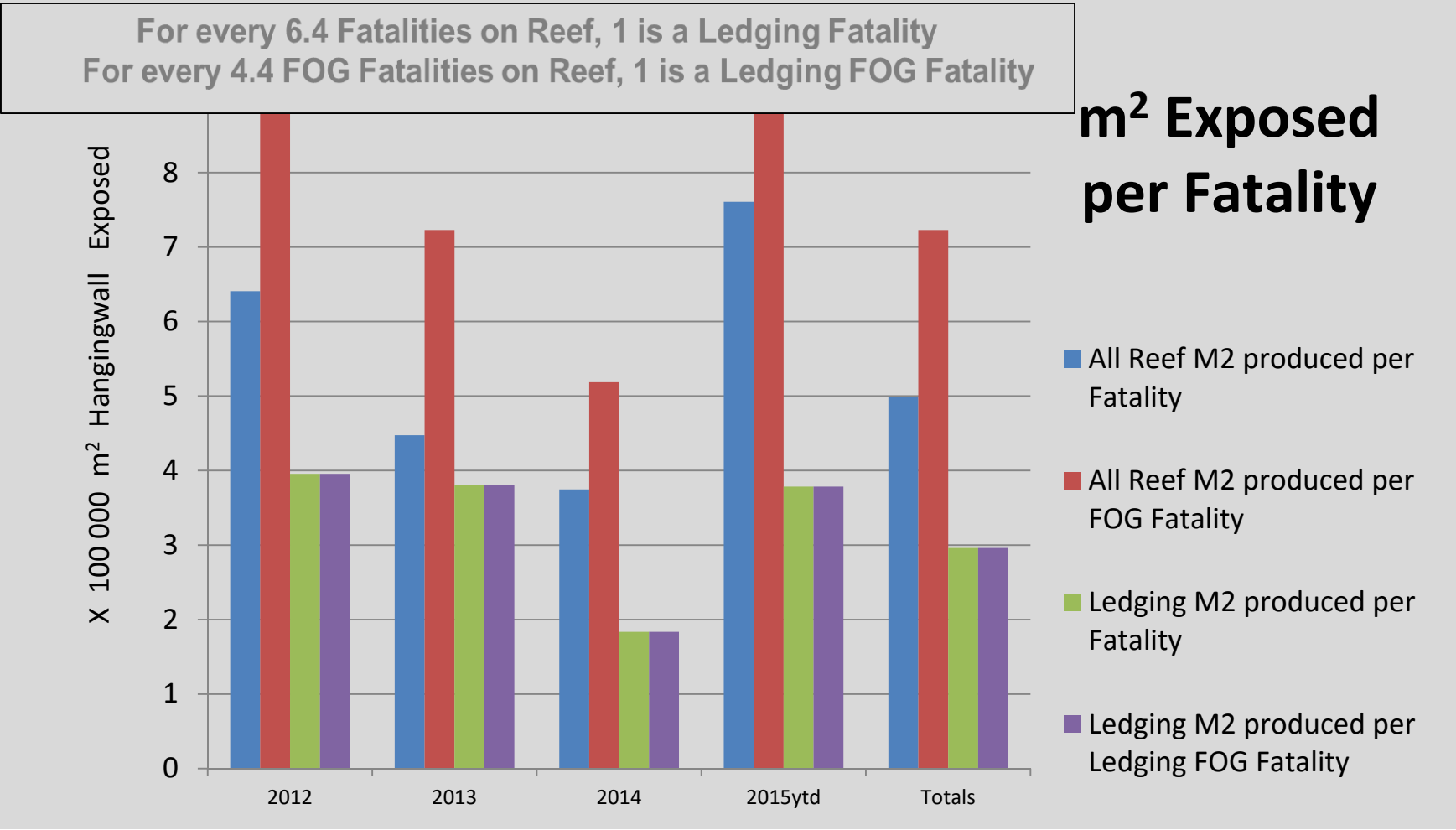
Ledging risks (7 mines)

2012 to 2015 (end Feb)	
Reef Horizon Fatalities	58
Reef Horizon FOG Fatalities	40
Ledging Fatalities	9
Ledging FOG Fatalities(23%)	9
Reef Horizon Serious Injuries*	741
Reef Horizon Serious FOG Injuries*	430
Ledging Serious Injuries*	39
Ledging Serious FOG Injuries*(3.5%)	15

Ledging Risks

For every 6.4 Fatalities on Reef, 1 is a Ledging Fatality
 For every 4.4 FOG Fatalities on Reef, 1 is a Ledging FOG Fatality

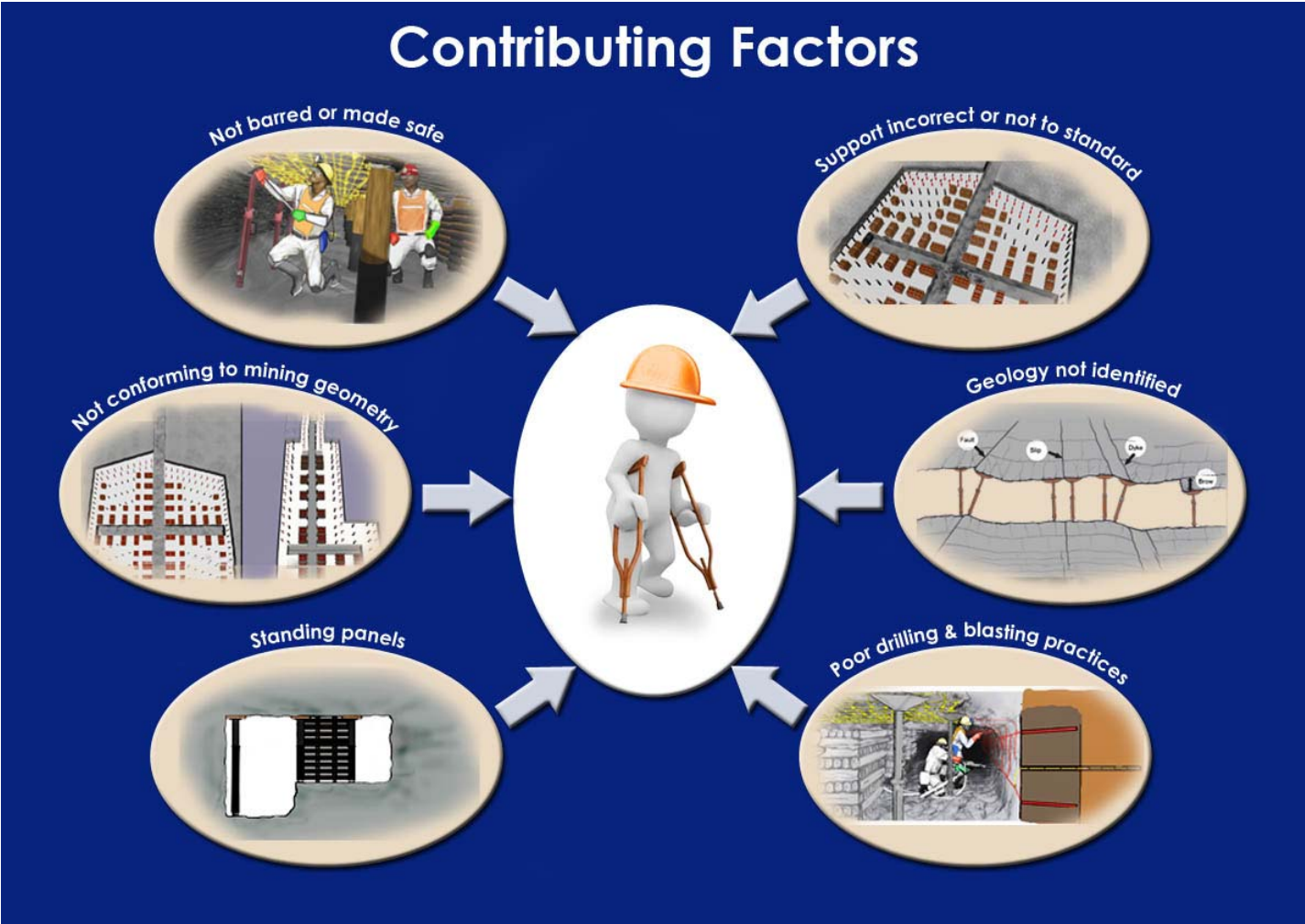
m² Exposed per Fatality



Indications

- Statistics indicate a higher risk of Fatality per Ledging m2
- Statistics indicate that over the period in question, all Ledging Fatalities were Falls of Ground related
- At least two mining companies had no ledging fatalities during the period in question (Its possible)

Contributing factors



Contributing Factors mine A

Disregard for Standards and Rules	85%
Not barred or made safe	46%
Support incorrect or not to Standard	38%
Not conforming to Mining Geometry	23%
Standing Panels	23%
Geology not Identified	15%
Poor Drilling and Blasting Practices	15%

Contributing Factors Mine B



“Condoning” deviations from Standards and Rules	85%
Not barred or made safe	46%
Support incorrect or not to Standard	38%
Not conforming to Mining Geometry	23%
Standing Panels	23%
Geology not Identified	15%
Poor Drilling and Blasting Practices	15%

The Aim of the Leading Practice



- Maintain Hanging wall Integrity throughout
- Maintain a sound Ledge for effective Support
- Keep the Stopping Aorta alive and well for the life of the Stope
- Do the above Safely

Influences/Causes

- Causes of Ledging Accidents not really differ to those of Stoping Accidents, however some factors relate:
- Poor development of raises (especially damage to hanging wall)
- Disorganization of Services during Ledging
- Dynamic changing environment – stoping has a rhythm
- Ledging is a specialised operation requiring specialist operators
- Resting faces increase the FOG risk, especially at depth
- Differing Bonus payments have differing outcomes etc.

Influences unique to Ledging

- Lack of proper cleaning facilities often lead to “maak n plan” resulting in support removal or damage etc.
- Accumulations of Stof cause difficulties for installation of support
- Installation and re-installation of especially pack support for gullies
- Non adherence to “Ledging Limits” and mining blue-print requirements
- Lack of preparation for ledging operations, Development, time coordination, ore transport, ventilation, services etc.
- Lack of complete standards

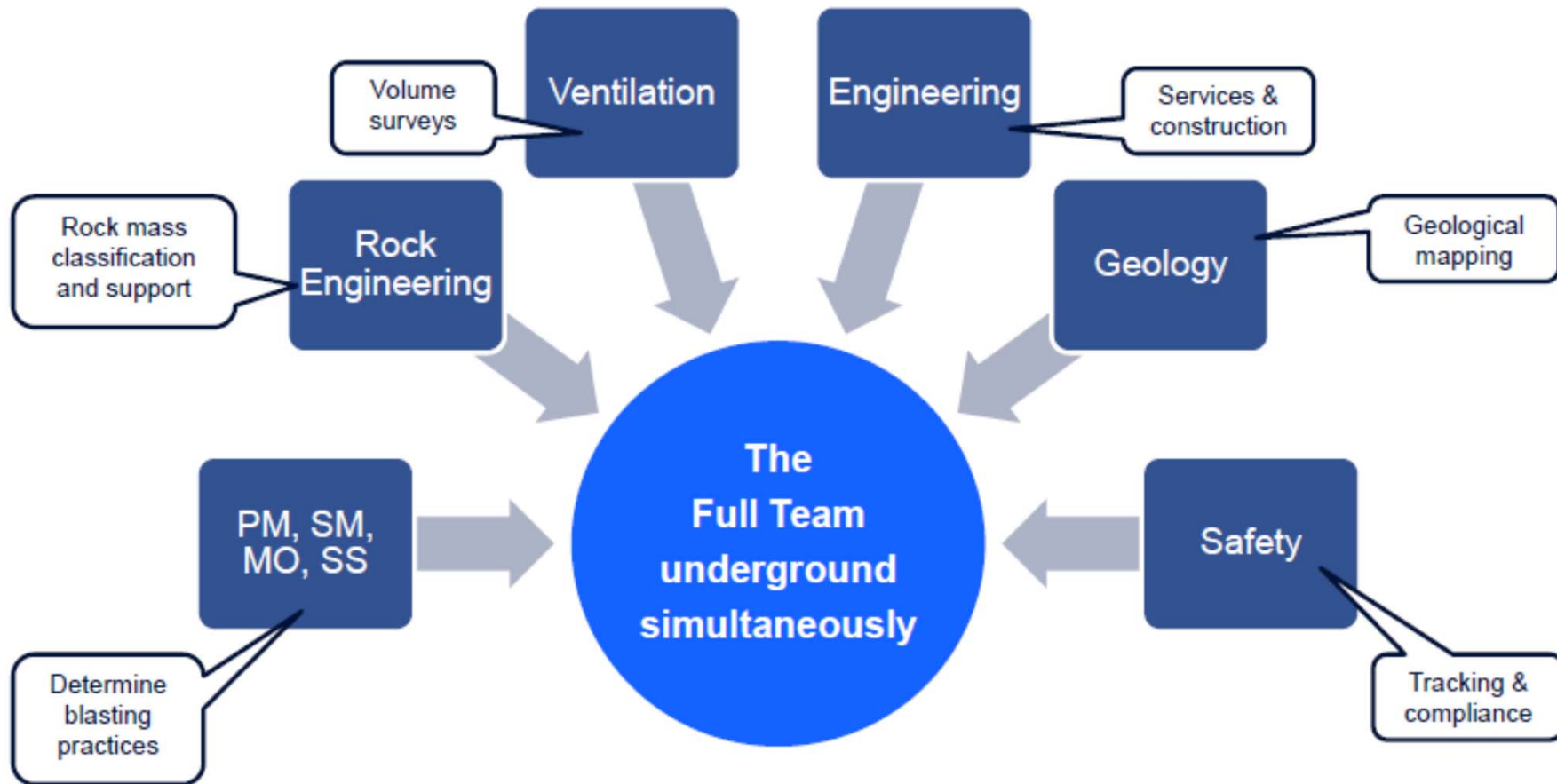
Attributes of a Good Ledging Practice



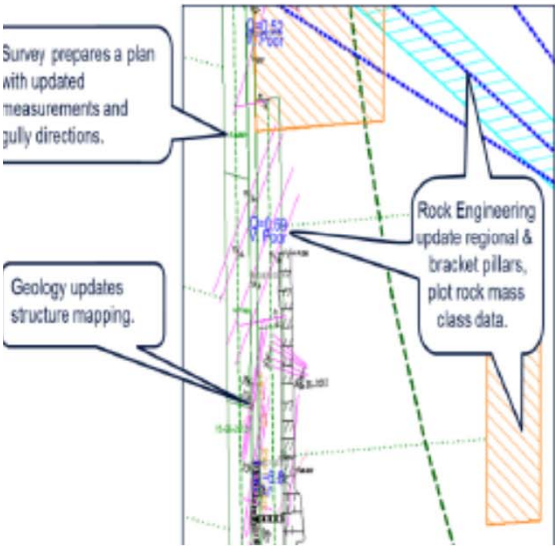
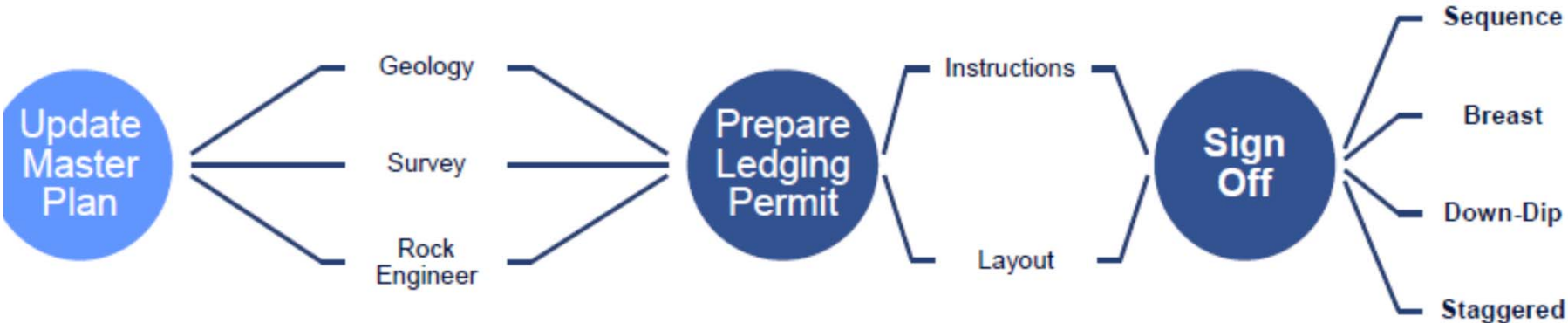
- Good Planning processes,
- **Pre-Ledging, Ledging, Post Ledging and Assessments of good control systems**
- Enhanced controls to ensure good mining discipline and coordination of mining sequences
- Set up “**Professional Ledgers**” and **crews**
- Ledging is a “Set-up” phase and not an Easy Production Phase.

Pre- Ledging

No ledging unless...



Planning Process(Surface)



TUMELA MINE
PERMIT TO CONDUCT LEDGING OF A PROPOSED NEW BRIDGE

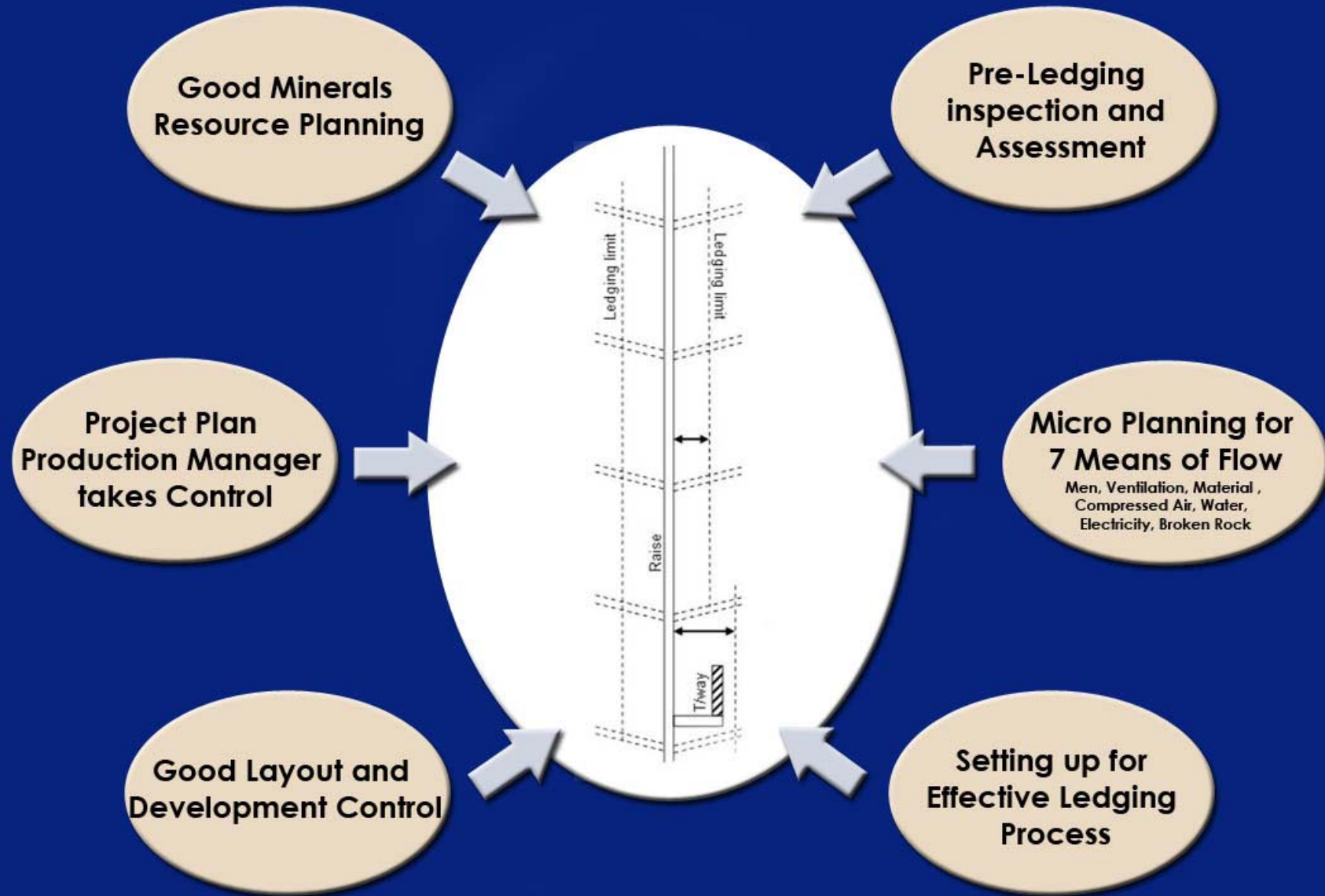
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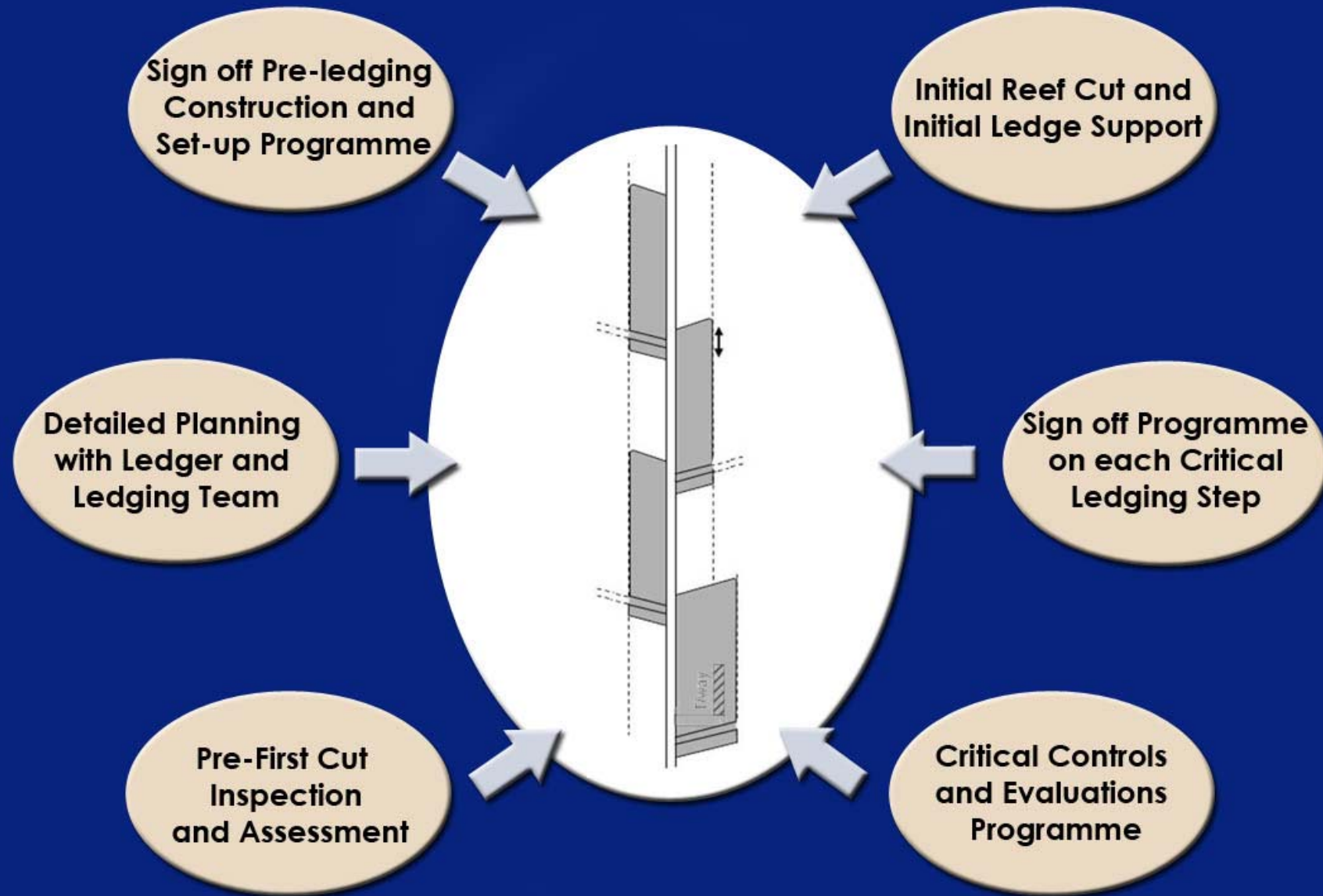
Example of Ledging Permit

PERMIT TO COMMENCE LEDGING OF A RAISE/WINZE/REEF DRIVE			
Department	Yes	No	Comments
GEOLOGY			
Is the whole raise line mapped?			
Has all mapping been transferred from the development sheet to the stope sheet?			
All known geological features indicated on the plan?			
Has harzburgite been exposed?			
Are there any borehole intersections expected in the excavations ahead and demarcated on the plan?			
ROCK ENGINEERING			
Rock engineering risk rating / RMC on plan?			
Primary support in place and to standard?			
Geological features and brows demarcated?			
Geological features and brows supported?			
Has harzburgite been exposed?			
Additional support required?			
Change in mine layout required?			
Mine sequence given?			
UG2 & Merensky Pillars and remnants indicated on plan?			
SURVEY			
Breakaway note of strike gullies approved and signed off by Section Manager?			
Strike gully positions indicated on plan?			
Abutments indicated on plan?			
Pillars on plan (approved by Rock Engineering)?			
VENTILATION			
Is the available quantity of air sufficient for mining the raise?			
Are there any restrictions in the raise?			
MINING			
Have the strike gullies been broken away?			
Is the X/cut pumped?			
Is all the primary development completed?			
Is there a minimum of two winches installed?			
Is all construction completed?			

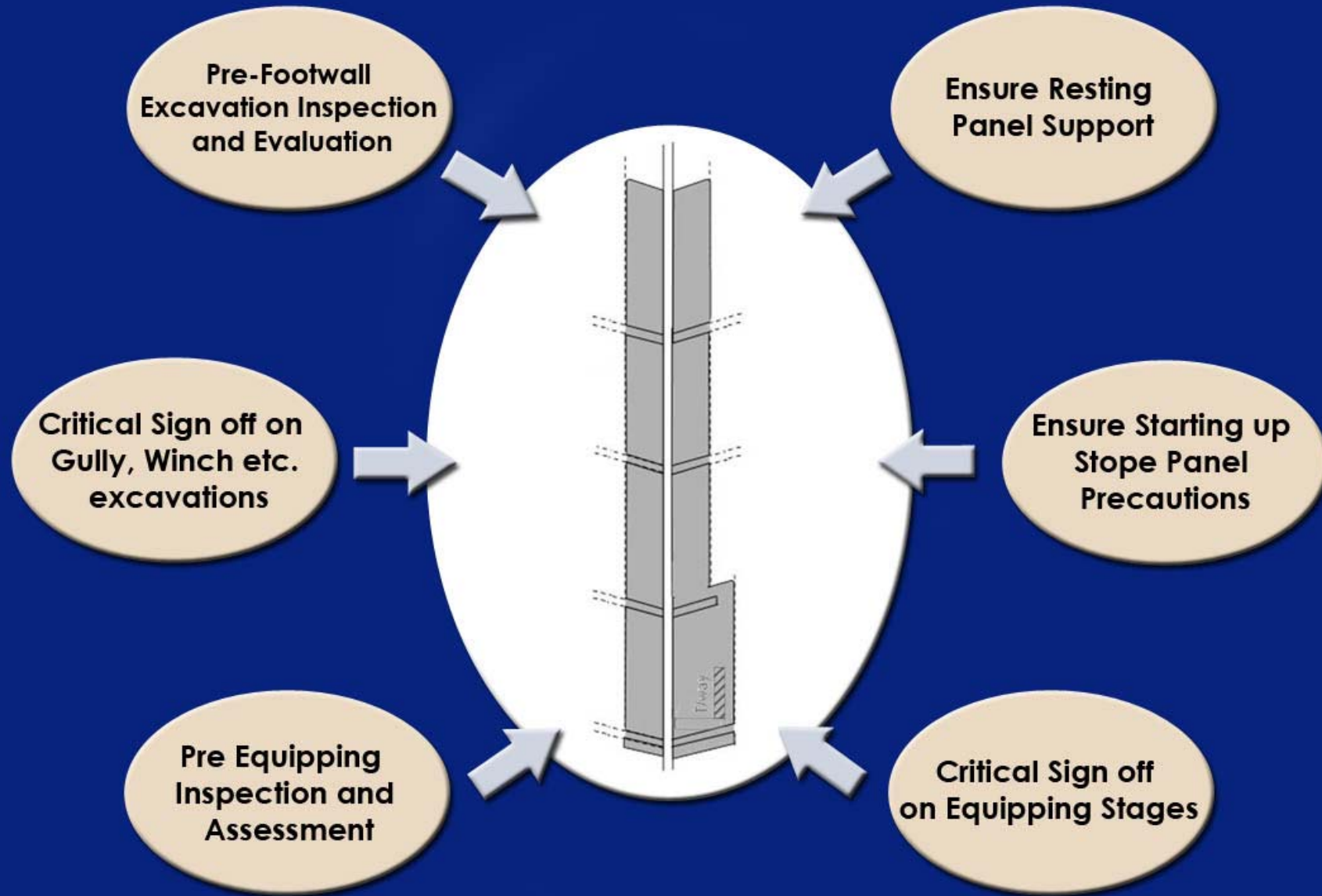
Pre Ledge Process



Ledging Process



Post Ledge Process



KEY CONSIDERATIONS



- Good Leadership Practices for ensuring compliance Eg accountability (Sign offs)
- No substitute for good Geological Information up front!
- Fixed responsibilities, accountabilities and “consequences” for especially control failures.



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