

# Personnel Proximity Detection for Longwall

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# **AGENDA**

- 1. Proximity detection as risk mitigation**
- 2. Basic parts of robust PPD system**
- 3. Why PPD for longwall?**
- 4. Specs and behavior**
- 5. PPD in action**

# How do we address hazards?

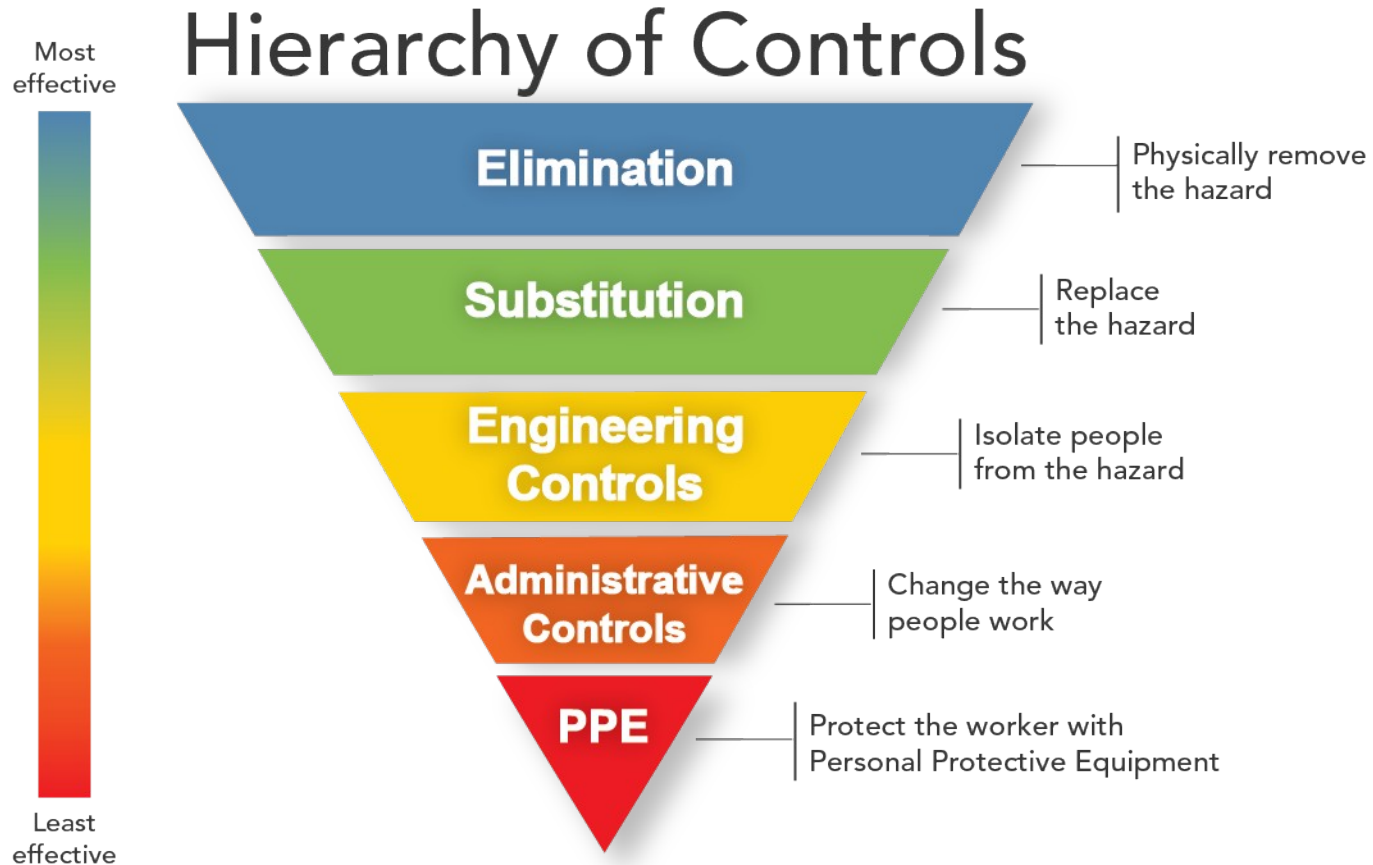


Image courtesy NIOSH

# What are some options for personnel detection?

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- Contact strips and pressure sensitive mats
  - Subject to wear. Users must deliberately use them and change behavior change. Not suitable for moving equipment.
- Motion sensors and Cameras
  - Sporadic performance. Too many heat and motion sources.
- Light barriers/curtains
  - Unsuitable for moving equipment. Subject false positives.

# Basic parts of robust PPD system



PPD Tags

- Mobile, compact
- Easy integration on various body locations
- No recharge necessary
- Maintenance-free application
- LED status feedback



PPD Reader/Marker

- Marker field generator and access station in one unit
- Easy mechanical integration
- Automatically or manually configure
- Remote and continuous change of set-up
- LED status feedback



Controller Network

- Marker directly connects to local controller for real-time response

# Why PPD for longwall?

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## **Safety is Everyone's Top Priority**

- Protecting mine site personnel working around moving equipment
- Know the location of all personnel on the longwall
- Mitigate risk from hazardous movement
- Improves training by identifying near-miss incidents and abuse of policies

## **Regulatory Compliance**

- MSHA (Room and Pillar) and global safety organizations mandate



# Why PPD for longwall?

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- A powerful computer system can automate heavy equipment but they can also integrate proximity systems.
  - We do not want automated movements to occur when an individual is working in the automated area



## Goals of a robust PPD system

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- Nuisance free operation without compromising safety.
- Seamless integration of multiple systems on the surface and underground. Be supported by administrative tools on one network.
- Monitor health of the system.
- Restricting equipment operation to only those trained for use.





# Specifications Overview

	PPD Tag	PPD Reader
<b>Power</b>	Battery life up to 1.5 years	220mA @ 12v I.S.
<b>Size</b>	75 x 55 x 30 mm	200 x 200 x 120 mm
<b>Communication</b>	<ul style="list-style-type: none"> <li>•2.4GHz Xbee Protocol</li> <li>•125kHz RFID</li> <li>•Intrinsically safe</li> <li>•Lightweight</li> </ul>	<ul style="list-style-type: none"> <li>•2.4GHz Xbee Protocol</li> <li>•125kHz RFID</li> <li>•PMC-R Serial</li> <li>•Serial debugging</li> </ul>



# CAT PPD system - Tag options

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**Helmet**



**Belt**

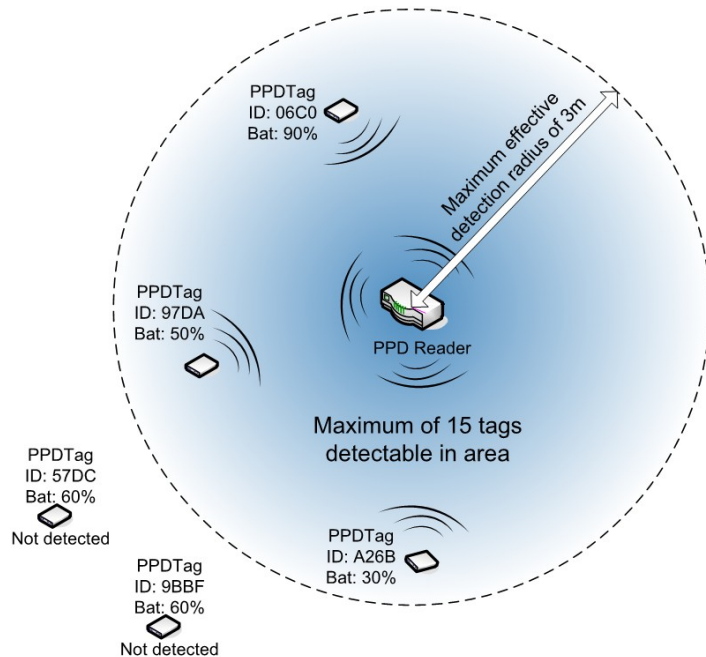


**Loop or Bolt**



**Visitor's tag**

# Tag capabilities



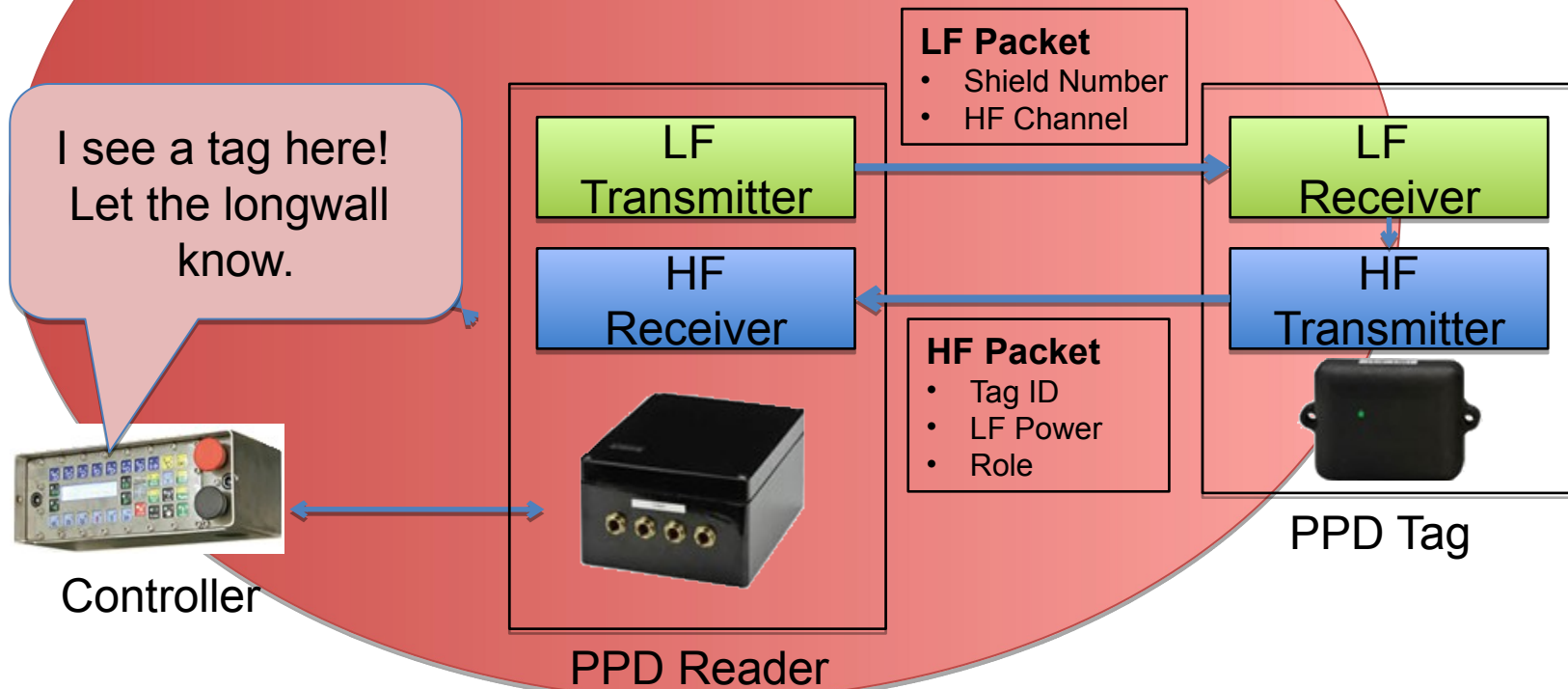
## Identify presence or absence of tagged personnel on longwall

- Accurate, reliable, consistent
- Tags are lightweight with a battery life of up to 1.5 years
- Tags programmed specifically for each individual ID and job role

## PPD must be tailored to longwall

- Broadcast speed is increased
- RF zone is shrunk for greater location precision
- Battery life and health of the tag is monitored regularly and a schedule is enforced for diagnostic testing

# How does this system work?

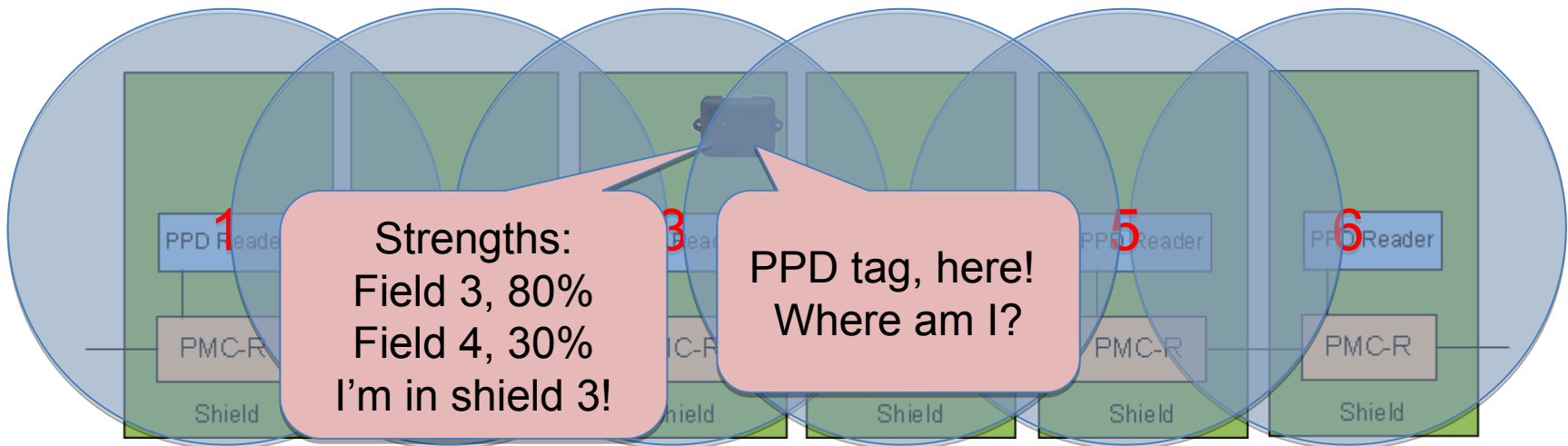


125kHz RFID Field



# Physical Implementation

- With a PPD reader on each shield the LF detection fields must be fired rapidly in an alternating fashion to prevent radio interference
- The location of a tag can be determined by the relative strengths it reports from each LF detection field





# PPD IN ACTION

Over the next few minutes I will be a mine employee and your guide at a longwall operation running PPD for longwall. You will be my visitor.

# A miner starts his shift with a new PPD tag

PPD User-Management

Datei Bearbeiten Meldungen Sprache Hilfe

## Benutzer

Name	PID	Login	Tag ID	Batterie	Nächstes Training	VUser-Rolle	Tag-Rc
Chrusher, Chris	778855	Chrush	2948	75%	02.04.2014	None	Miner
Coal, Tom	966544	TomC	0000	0%	18.03.2014	Administrator	Visitor
Conveyor, Mark	2255417	MarkCo	0000	0%	18.03.2014	Mechanic	Miner
Drive, Hans	2212889	DriveH	8FBB	30%	10.06.2014	None	Miner
Hardrock, Udo	77088	root	2947	86%	27.05.2014	Administrator	CAT_Adr
Plow, Paul	1258756	PlowP	0F62	66%	10.10.2014	Plowdriver	Miner
Pumpe, Peter	669354	Pumpe4	0F61	45%	10.01.2015	Mechanic	Miner
Reader, Mike	1123564	MikeR	0000	0%	18.03.2014	Electrician	Miner
Shearer, Stefan	996654	StefanS	8FBA	88%	12.12.2014	Administrator	CAT_Ser

## All users

Hinzufügen Bearbeiten Löschen

## PPD-Maintenance User-Management

### Verfügbare Tags

☒ Nur nicht zugewiesene Tags anzeigen

Tag ID	Batterie	Benutzer	Letzter Zugriff	Initialisierung
2946	86%	-	17.03.2014	17.03.2014
8FB9	88%	-	17.03.2014	17.03.2014
0F60	82%	-	17.03.2014	17.03.2014

## All scanned tags

Scan 3 nicht zugewiesene Tags gefunden Tag zuweisen Edit tag

### Zugewiesene Tags

Tag ID	Benutzer	Tagzuweisung	Batterie	Letzter Zugriff	Initialisierung	Tagdiagnose
0F61	Pumpe, Peter	17.03.2014	45%	17.03.2014	17.03.2014	17.03.2014
2948	Chrusher, Chri	17.03.2014	75%	17.03.2014	01.01.0001	17.03.2014
8FBB	Drive, Hans	17.03.2014	30%	17.03.2014	17.03.2014	17.03.2014
8FBA	Shearer, Stefa	17.03.2014	88%	17.03.2014	17.03.2014	17.03.2014
2947	Hardrock, Udo	17.03.2014	86%	17.03.2014	17.03.2014	17.03.2014
0F62	Plow, Paul	17.03.2014	66%	17.03.2014	17.03.2014	17.03.2014

## Already assigned tags

Tag zuweisen Tagdetails anzeigen Tag disable

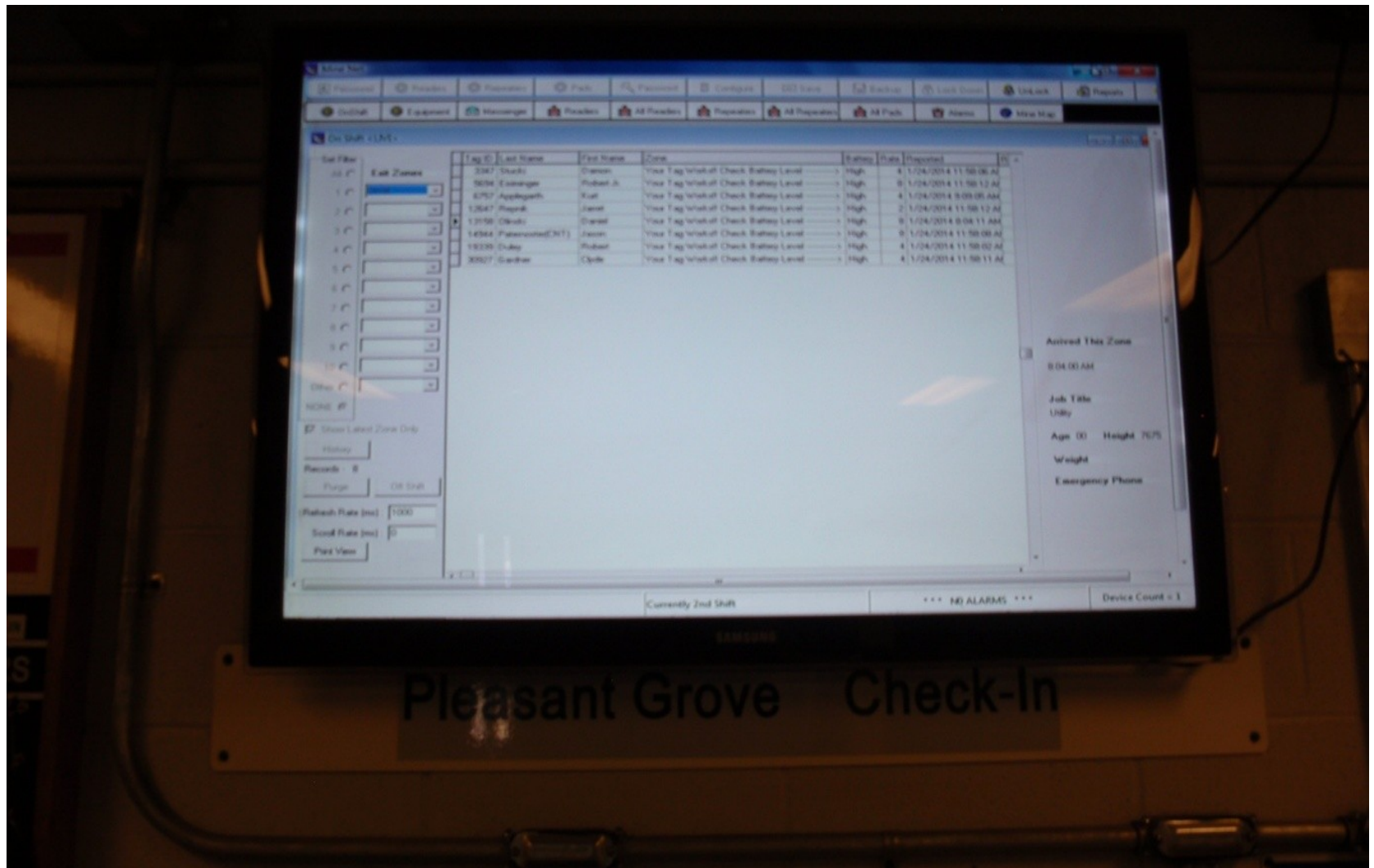
# At the elevator



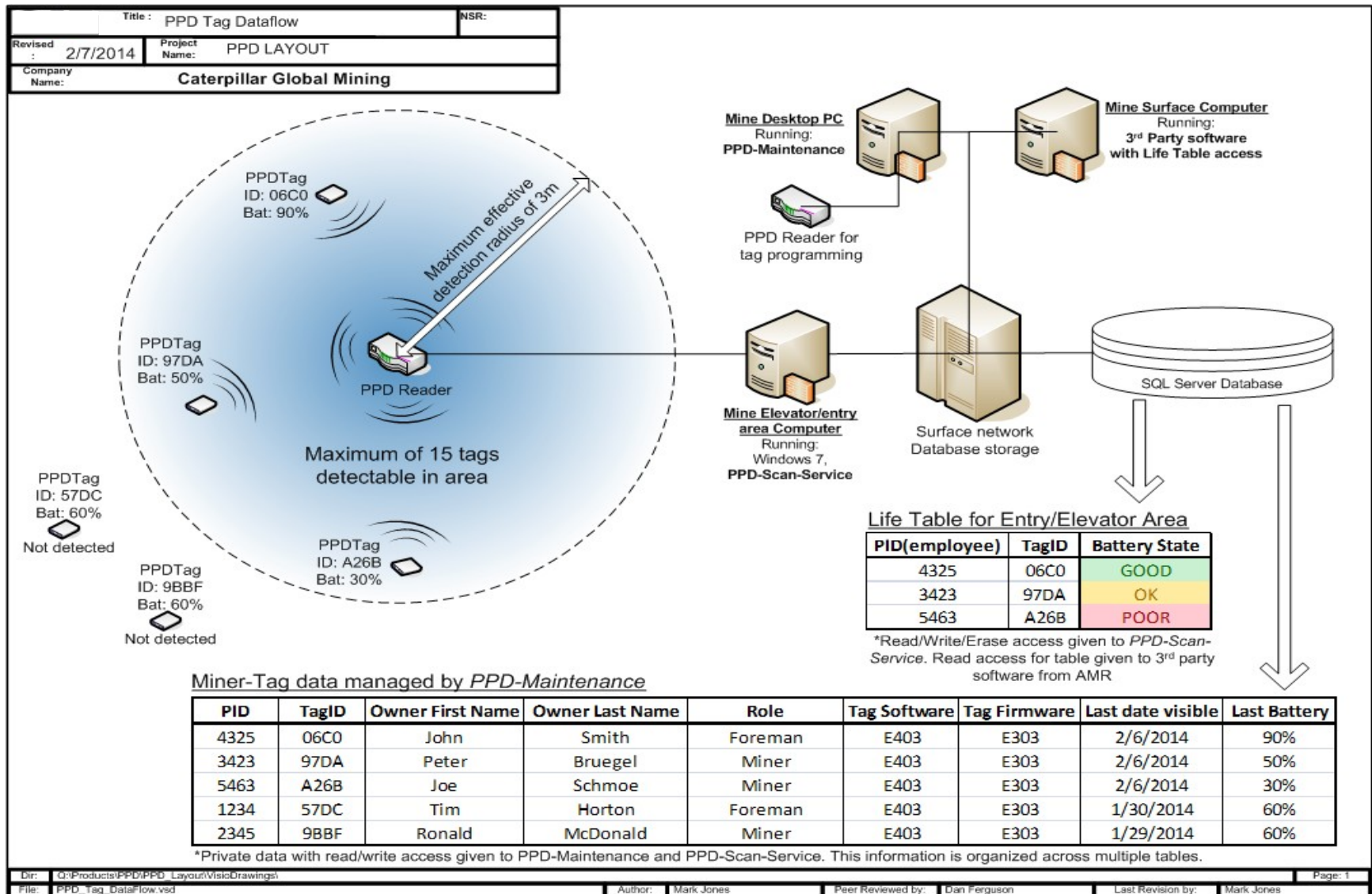


[illegible]

# ...at the elevator



# ...at the elevator

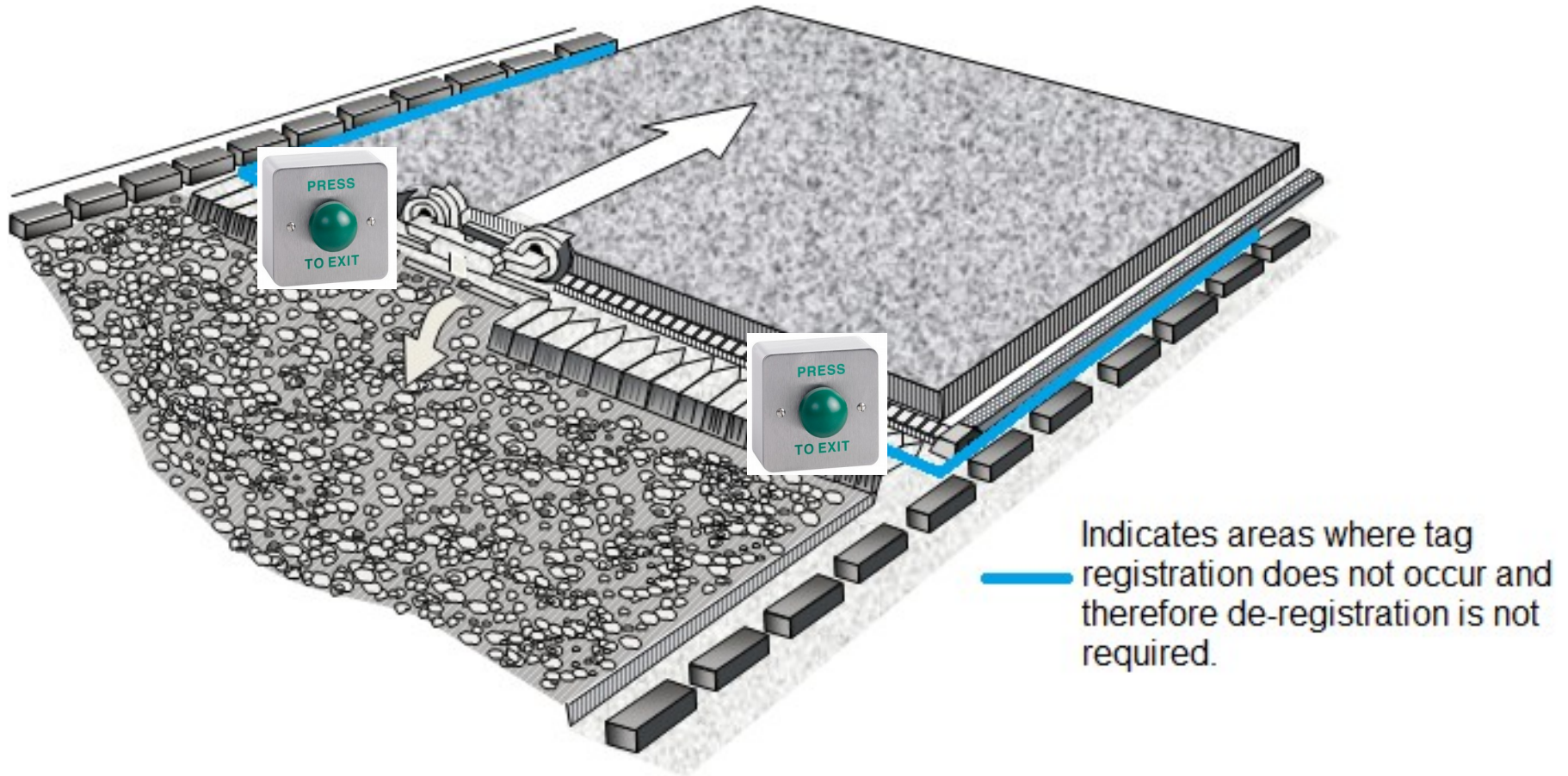




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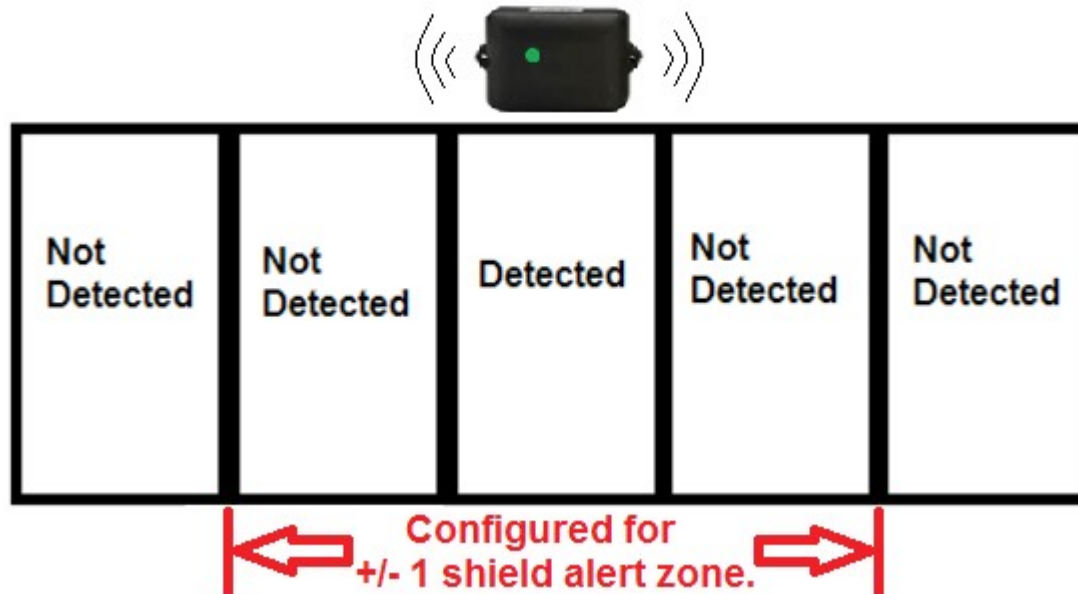
## ...walking onto the longwall



# PPD in action

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- When a tag is detected in a shield its protection zone extends to an additional shield in each direction
- Any automated sequence that is initiated by the system or another worker will queue for 10 seconds for the tag's alert zone to leave the area before giving up the action





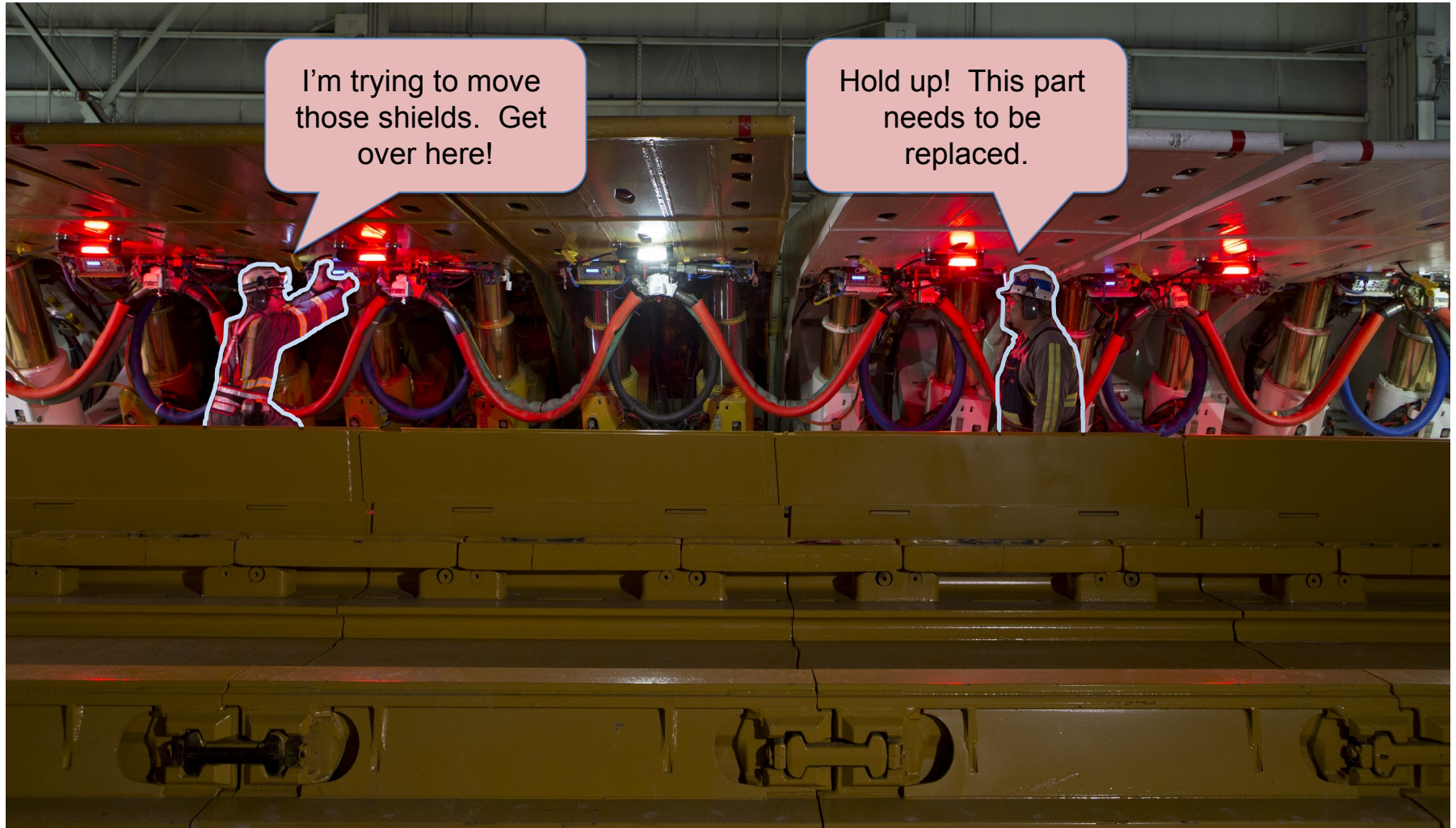
## ...walking onto the longwall





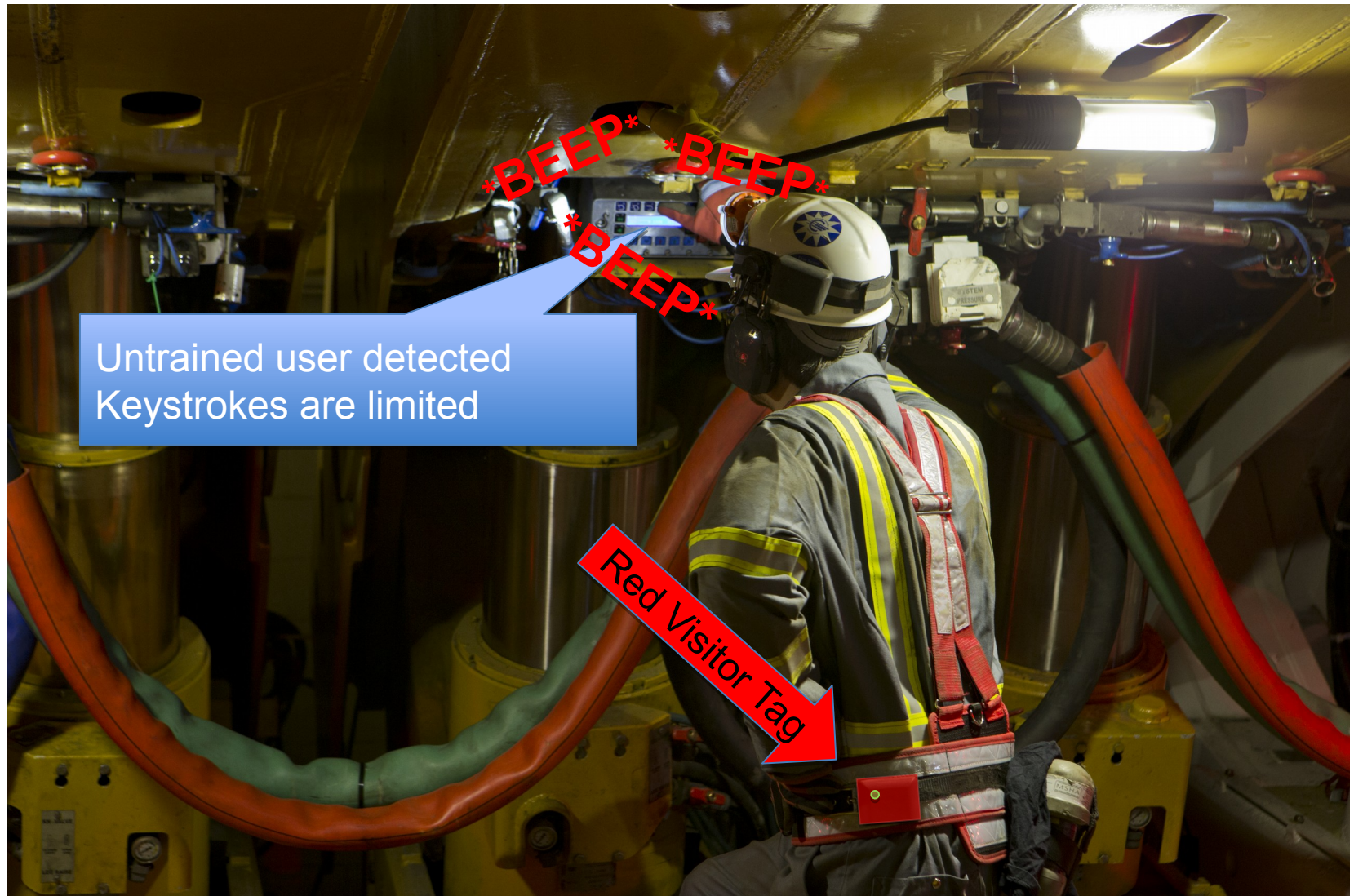
# PPD in action...what if?

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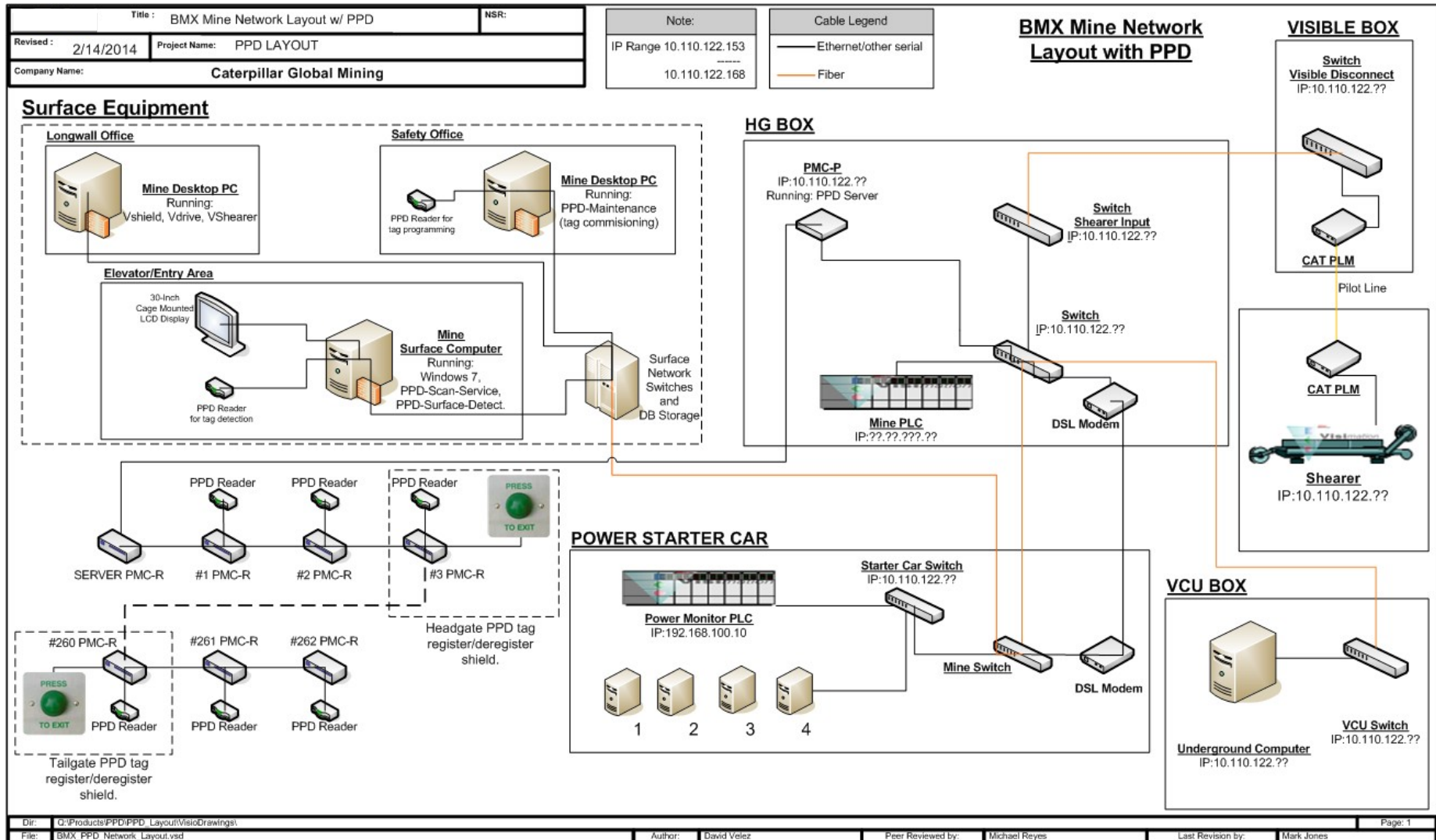




# PPD in action



# System Review in conclusion



**Thank You**

**...Any questions?**