

# Safety Considerations for Underground Mine Communications and Tracking Systems Battery Safety

Office of  
Mine Safety and  
Health Research

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# The MINER Act and Battery Safety

- The MINER Act will increase the number of batteries used in underground coal mines (communications, tracking, and AMS equipment)
- There are questions and concerns about battery safety in underground mines
- Development, approval, and promotion of communications and tracking technology continues to move forward

# **NIOSH Contract with QinetiQ North America to Study Battery and Charger Safety**

- NIOSH commissioned an objective, detailed study of battery safety issues. This study is not yet complete but the final report is due on 8-4-09.
- Numerous communications and tracking (CT) systems have been approved, and a wide range of battery types/sizes are used.
- The NIOSH studies will stimulate consideration of what is required to safely operate equipment post accident.

# The MINER Act and Battery Safety

- The NIOSH sponsored study suggests areas where battery safety can be improved.
- The following are considerations for the selection and implementation of battery technology to improve the safety of CT systems.

# Battery Safety Considerations

## Portable Equipment

- Monitor and document the condition and cycle history of batteries (battery packs)
- Design CT systems and devices to support easy, safe, underground battery replacement — under extreme conditions

# Battery Safety Considerations

## Portable Equipment

- Establish procedures to ensure that battery powered portable equipment or batteries are not lost or discarded underground
- Consider alternatives to Li batteries (Li Primary, Li-ion, Li-polymer) when other types of batteries (such as lead-acid) are practical
  - Li batteries are of particular concern and are the subject of on-going research

# Lithium Battery Safety Concerns

- In rare events, damaged cells and other factors may result in thermal runaway
  - May explode, vent flames, or hot gases
- A number of recalls in recent years
- Lithium battery pack restrictions on commercial flights
- Fire at NIOSH Pittsburgh Research Lab linked to Li ion powered equipment being charged

# Caplump Fire at NIOSH PRL



# Lithium Battery Safety Considerations

## Portable Equipment

- Use administrative procedures to reduce the risk of batteries being lost, discarded, or mishandled underground
- Take visibly damaged equipment out of service immediately
- Provide training to the equipment users to prevent abuse or mishandling of the batteries
- Avoid underground charging of Li batteries used for portable devices (e.g. handheld radios)

# Battery Safety Considerations Stationary Equipment

- Stationary equipment will be on charge and unattended for long periods of time
- Use the fewest separate underground battery locations for CT systems as practical
  - Compare benefits and disadvantages (of fewer locations) for the type of CT system in question
- Avoid placing stationary components containing batteries in return air where possible

# Battery Safety Considerations

## Stationary Equipment

- Design battery powered stationary underground C/T components to address the following issues:
  - Permissibility: XP, IS, 30 CFR Part 7
  - Safe/effective charging: proper rates and levels, over-temperature detection, cell-level monitoring
  - Protection from damage e.g. supplemental roof supports
  - Hazardous gas generation (hydrogen) - detection, venting, automatic shutdown

# Battery Safety Considerations

## Stationary Equipment

- Design battery-powered stationary underground CT components to address the following issues (continued):
  - Remote monitoring and control, and local status indication (status lights)
  - Inspection, testing, and maintenance of both batteries and enclosures
- The use of Li batteries (Li Primary, Li-ion, Li-polymer) present greater risks than other chemistries because Li batteries have been known to be involved with thermal runaway incidents.

# Summary

- Communications and tracking systems will greatly improve the safety of miners, but more batteries will be required underground.
- The potential hazards associated with batteries can be mitigated through battery choice, design, training, maintenance, and installation practices.
- NIOSH continues to research the use of batteries and post-accident power management for underground mines.