MARTIN MARIETTA MATERIALS, INC.
SYNYDER MINE
DUNCAN, OK

OCTOBER 10, 2010
ELECTRICAL FATALITY

• A 42 year old contract electrician with 4 years of experience was seriously injured at a granite operation.

• The victim and two co-workers were installing ground fault indicator lights in a circuit breaker enclosure when an arc flash occurred.

• The circuit breaker enclosure contained a bottom feed circuit breaker.

• The circuit breaker was in the “OFF” position, but remained energized on the input side.

• All three workers were hospitalized and the victim died on October 12, 2010.
ACCIDENT SCENE

INSIDE MCC TRAILER
ACCIDENT SCENE

CIRCUIT BREAKER ENCLOSURE
OVERVIEW

- Four electricians were replacing a junction box and installing new cables for six electric motors.
- The job was started on October 8, 2010 and they were returning to complete the job.
- Following completion of the original job, the plant operator started the plant so the electricians could check the new installations.
- All installations were functional upon this check.
The contract employees were often used to install ground fault indicator lights at all plants when it was convenient to do so.

The victim and two other employees entered the MCC trailer at 12:45 pm to install the indicator lights.

The main circuit breaker was turned to the “OFF” position prior to working on the indicator lights.

The fuses at the nearby transformer station were not removed to de-energize the circuit breaker.

The input side of the main circuit breaker remained energized.
OVERVIEW, CONT’D.

• The victim was kneeling in front of the main circuit breaker.

• The indicator lights had been mounted on the inside door of the cabinet which enclosed the main circuit breaker.

• One end of the ground wire for the indicator lights had been connected and the bottom section of the cover for the main circuit breaker had been removed when the accident occurred.
OVERVIEW, CONT’D.

• A fault condition was created while the electricians were working on the energized side of the main circuit breaker.

• The 480-volt lead wires dropped from the bottom side of the main circuit breaker and one of the phases contacted the cabinet which enclosed the circuit breaker and an arc flash occurred.
The main circuit breaker was a “bottom feed” breaker located in a Type 4 cabinet in the MCC trailer.

The power conductors from the transformers entered the bottom side rather from the top side as is typical with most electrical circuit breakers.

This arrangement made it necessary to route the incoming power cables from the top of the MCC trailer down to the inside floor then bend them back up 180 degrees into the lugs of the main circuit breaker.
A bottom load breaker would have leads entering the bottom of the box and extending upward to attach where the black and white wires normally attach.
ROOT CAUSE ANALYSIS

WHAT WAS THE ROOT CAUSE OF THIS FATALITY?
MSHA ROOT CAUSE

- CONTRACTOR MANAGEMENT PROCEDURES FAILED TO ENSURE THAT THE ELECTRICAL CIRCUIT BREAKER WAS DE-ENERGIZED PRIOR TO PERFORMING WORK ON IT.
BEST PRACTICES

WHAT BEST PRACTICES WOULD YOU RECOMMEND TO PREVENT THIS TYPE OF ACCIDENT FROM RECURRING?
MSHA BEST PRACTICES

• Workers should be trained on all the electrical tests and safety equipment necessary to safely test and ground the circuit being worked on.

• Use properly rated Personal Protective Equipment (PPE) including Arc Flash Protection such as a hood, gloves, shirt, and pants.

• De-energize power and ensure that the circuit is visibly open.

• Place YOUR lock and tag on the disconnecting device.
MSHA BEST PRACTICES

- Verify the circuit is de-energized by testing for voltage using properly rated test equipment.
- Ensure ALL electrical components in the enclosure are de-energized.
- Ground ALL phase conductors to the equipment grounding medium with grounding equipment that is properly rated.
- Install warning labels on the terminal covers of bottom feed circuit breakers stating the "Bottom terminal lugs remain energized when the circuit beaker is open".
ARC FLASH AWARENESS
Arc Flash Event

• A dangerous release of energy created by an electrical fault

• Release will contain:
  o Thermal energy
  o Acoustical energy
  o Pressure wave
  o Debris
Arc Flash Events

• Can reach 35,000° F
• Fatal burns >10 feet
• Majority of hospital admissions are arc flash burns, not shock
• 30,000 arcs, 7000 burn injuries per year
• Over 2000 people admitted to burn centers yearly with severe arc flash burns
Why is Flame Resistant Clothing (FRC) Needed?

• Most severe burn energies and fatalities are caused by FRC igniting and continuing to burn
• FRC will self-extinguish, thus limiting the injury
• Body area under non-FRC is often burned more severely than exposed skin
Proper Use

• Proper Use
• FRC should be appropriate to hazard
• Always the outermost layer
• Worn correctly; zipped, buttoned, etc
• All natural, non-melting undergarments
• Clean, no flammable contaminants
• Repaired correctly and removed from service when needed
BURN CAUSED BY IMPROPER USE
Survival Factors

• Odds of survival fall with total % burn
  o Burn percentage, more than severity, predicts survival because skin is infection barrier
  o 2\textsuperscript{nd} and 3\textsuperscript{rd} degree burns break skin, providing an infection pathway

• Odds of survival fall precipitously above 50% burn
  o Most hospital deaths that occur 2 to 4 weeks post-exposure are caused by infection

• Odds of survival fall as age increases
DONNIE’S ACCIDENT
Donnie’s Comments

• “During my safety presentations I always repeat that all of this could have been avoided had I been wearing my PPE.”

• “If anything good could come out of this, I love that it is helping other people remember to follow their safety procedures and what could happen if they do not!”