

## INTRODUCTION

This report details my 200-hour internship at Kerr McGee Coal's Galatia Mine. Kerr McGee Coal is the largest production underground mine in the state of Illinois. I have been employed by Kerr McGee for the past 14 years. For the last five years I have worked as an Electrician, this has given me the opportunity to use my day to day experience to complete my internship. Working full time and attending school has given me the opportunity to apply skills learned in the classroom and to strengthen job performance. It has also given me a chance to share some of my experience with my classmates.

In the early days of coal mining the power source was man himself. Later man employed steam and compressed air to reduce his muscle power requirements needed in the extraction of coal. By the turn of the 20th century, electricity had become the most common source of power for the coal industry.

Electrical laws and regulations are quite extensive and somewhat complex for underground coal mining. Man-made laws, rules and regulations for the care and handling of electricity in mining are designed for man's safety and are rigidly enforced by Mine Safety and Health Administration (MSHA) as well as the various state departments of mines.

Electrical equipment has to be frequently examined, tested and maintained by laws. Only a qualified person is permitted to perform this work. A qualified person is one that has worked at least a year along side an experienced miner. A log is kept of all work performed. Also, 120 hours of electrical training and first aid is received. This is then submitted to the state mining board and they will determine if work experience is sufficient to issue underground and surface high, medium, and low voltage electrical certification.

As coal miners, our main objective is to mine as much coal as safely possible. In a coal mine there are many safety hazards, so one has to be able to work safely without harming yourself or your fellow workers. When I first got into the maintenance department, I found it very rewarding, but with a lot of responsibility placed upon me. So I made a personal commitment not to let the pressures of a down piece of equipment sway good judgement.

I found this has helped me develop a professional attitude. I have worked underground for 18 years and feel that modern mining has exposed me to a wide variety of equipment and the latest technology. My day to day duties usually starts with an update from the previous shift of any problems that they encountered. Communicating between shifts is very important and saves time and loss of production.

My daily duties include maintaining communication underground and to the surface, high voltage power distribution, installation and calibration of environmental monitors, installing and maintaining conveyor belt systems and longwall pump station, and weekly and monthly permissibility.

Communication is a very important part of coal mining and coal mining safety and must be maintained in good working condition. We have three forms of communication: 12 volt mine page, PBX phone system, and a two-way radio system. If any one of these systems is not working properly, it is a top priority to get it working as quickly as possible. Communications lines emanate from the surface and enter the mine through a series of communication bore holes. The biggest problem with maintaining communication line hung from the roof of the mine is falling rocks and coal ribs, causing loose connections and damaged cables.

Coal mines use large machinery to extract coal from the mine and a large power source is needed. Kerr McGee has a main incoming power source to the underground of 12,470 volts. This enters the mine in a central location. Power is then run to different parts of the mine on cables rated for high voltage. When lower power sources are needed, transformers are used to reduce the voltage. Most common equipment voltages are 995v, 480v, and 120v. Portable vacuum breakers are used as safe disconnects when switching is needed. We are never permitted to work on any energized 12,470 circuits. Most common problems occur in

the 120v control circuits.

Environmental monitors are used to monitor methane and carbon monoxide levels in the mine's atmosphere. Once a month and weekly where men are working, monitors have to be calibrated and tested. This insures the safety of workers in that area. Each monitor is addressed and levels are monitored by computer.

Our conveyor belt systems are PLC controlled, using Texas Instrument controller. They have been very reliable. I have learned more about PLC's and ladder logic from installing and troubleshooting conveyor belts. Within the past year we installed our first (VFD) variable frequency drive, state of the art. I was very impressed how well it has performed being able to ramp up to speed for a softer start. It has saved a lot of wear and tear on the conveyor belt. The system is very expensive and very complicated to work on. I question its use in a coal mine where the environment is so harsh on equipment. Most miners find it too complicated and we receive more calls for help, job security I guess.

Recent years have seen a steady decline in the number of coal mines with tougher emission laws and the clean air act. The remaining mines are adapting for longwall mining. Longwall mining uses an advancing 1,000 foot face with shield-type supports of the roof. As the coal face advances, each massive hydraulic shield walks into place and sets against the roof supporting it. There are anywhere from 100 to 160 shields on a longwall face. Massive hydraulic cylinders on the shield use an oil water mix called emulsion oil. A working pressure of 4,500 to 4,800 PSI is needed on the face. A portable pump station is needed to supply the face with the needed pressures. Three 200 hp piston pumps run continuous to supply the face. The pumps are PLC controlled and load and unload on demand. Pressure and flow transducers are used throughout the system. Emulsion oil is mixed on the surface and piped to the face underground. A holding tank supplies the pump car with needed emulsion. Level transducers 4 to 20 milli-amps, monitors the tank car's emulsions level. All important information is displayed on a (MMI) man machine interface, such as levels, pressures, power status, and faults. This saves time when troubleshooting a problem. Most problems occur when the pump station is moved from one location to another. Loose connections and transducers out of calibration are some common problems.

## **CONCLUSION**

Preventive maintenance has been the success of our electrical department. Weekly and monthly checks are performed on all underground electrical equipment. Mining laws and electricity in coal mines is strictly enforced. The safety of workers is first and foremost. Important checks such as a ground fault and over current protection on power centers and vacuum breakers is stressed. This has helped avoid potential problems before they occur. Sometimes permissibility is not the most glamorous part of the job, but it needs to be done. I feel very lucky to work and to grow in a field I find challenging and rewarding.

## **WEEKLY MAINTENANCE LOG**

Week of May 4

- Dewatering pump permissibility
- Checked out coal storage bunker for proper operation
- Mine page phones checked for shorts and grounds on the system
- Tested Pyatt-Boone amplifier prototype mines page system
- Weekly shop tool permissibility
- PLC fault 1 west belt
- 2nd west headgate unit variable frequency drive belt slip on start up. Checked input signals with a scope set square wave to 60% duty cycle.

## Week of May 18

- Weekly power center permissibility
- Weekly fire deluge checks on conveyor belt system
- Blocked chute 2nd main west belt, cleared block chute
- Blocked chute coal storage bunker and cleared blocked chute
- Checked out emulsion tank levels 2nd west headgate longwall pump station, adjusted level transducers
- Trouble shot mine page phones, 2nd west headgate, repaired damaged cable

## Week of May 29

- Weekly and monthly CO monitor calibrations
- Replacing 12 volt mine page phone batteries
- Trouble shot leaky feeder system, no radio communication in the Galatia North. Reset leaky feeder amplifier #6 belt starter room
- Assisted Roy Walker, radio technician, trouble shot leaky feeder system. Checked gains and loss on the system with a spectrum analyzer
- Replacing bad sections of leaky feeder cable, also amplifiers with low or too high of a gain

## Week of June 1

- Dewatering pump permissibility
- Shop tool permissibility
- Changed the coal storage bunker discharge feeder speed. Edit the program
- PM vacuum breaker, cleaned and checked connections. Checked vacuum bottles open and close states. Hi-pot tested for corona
- Blocked chute 2nd west headgate belt. Cleared blocked chute
- 2nd west headgate belt reset winch fault. Checked fault log on variable frequency drives
- 1 west longwall belt, checked out VFD cooling fans and temperatures
- Belt tail update, moving up communication and tail CO monitor

## Week of June 8

- Communication failure comspec CO monitors. Checked supply voltages, also transmit and receive voltages. Found bad CO monitor card dragging the transmit voltage down
- Monthly power center permissibility
- Weekly fire deluge permissibility
- Installing a 20hp 480v dewatering pump, coal bunker sump