

## **Appendix A**

### **Blaster Training Requirements § 850.13(b)**

The following is a list of potential topics to be covered in blaster training and testing based on the Federal rules.

#### **1(i) Explosives – selection of type to be used**

- ANFO
- Emulsions
- Cast Primers
- Blends 25/75 50/50 75/25
- Detonating Cord
- Initiators
- Dynamite
- Pre-split

#### **1(ii) Explosives – determination of the properties which will produce desired results at an acceptable level of risk**

- Water Resistance
- Gas Pressure (Detonation)
- Detonation Velocity
- Sensitivity
- Coupling
- see IC 8925
- Density
- Fume class
- Sensitiveness
- Relative Bulk strength

#### **1(iii) Explosives – handling, transportation, and storage**

- IME
- RESPA Registration
- Internal Controls/ Accountability
- Vehicle requirements
- Magazine requirements
- Handling requirements

### **2(i) Blast designs – geologic and topographic considerations**

- Rock Type
- Rock Integrity
- Structure/Dip
- Fractures
- Voids
- Phreatic Surfaces
- Outcrops
- Drilling – Logs
- Equipment requirements
- Overburden type, amount and placement
- Steepness of slope
- Old mine works
- Auger holes

### **2(ii) Blast designs – design of a blast hole, with critical dimensions**

- Site Selection
- Burden
- Stemming
- Spacing
- Depth
- Sub Drill
- Decking
- Geology
- Explosive Column
- Hole diameter
- Deck stemming
- Bench Height to burden ratio
- Air decks
- Drill selection
- Angle holes
- Guide holes / line drilling
- Powder factor
- Loading factor

### **2(iii) Blast designs – pattern design, field layout, and timing of blast holes**

- Drill Patterns
- Location Holes (Tapes, Surveys, GPS)
- Chevron, Echelon, Square, Row by Row
- Left, Box-Cuts, Presplit, Coal, Conventional, Cast
- Timing – Rock Response Time
- Delay Intervals

- Cushion blasting
- Left Lift (sinking, center pull, drop cut, sump shot)
- V-Cut
- Adverse effects to expect (pros and cons) and address different
- Terminology for the different types
- Contour
- Pattern Layout Methods
- Step Benches
- Binder / Inner Burden / Parting Shots
- Face Velocity
- Boulders (block holing / mud capping)
- Air Gapping
- Bench Preparation

#### **2(iv) Blast designs – field applications**

- Keeping blasts inside permit area
- Keep within blast area
- Blast for equipment type
- Sediment Ponds
- Haul Roads
- DO NOT – rock in culvert or stuck silos
- Reclamation
- Secondary Blasting
- Nearest Protected Structures
- Design Application
- Coal Blasts
- Confinement of Material
- Confinement Factors
- Burden Pole / Laser Profiler
- Free Face Conditions
- Hole Deviation

#### **3 Loading blastholes, including priming and boosting**

- Review Drill Logs
- Communication with Driller
- Direct vs. Indirect (Primer Location)
- Taping the Holes
- Decking
- Boosters – When and Where
- Primer Makeup
- Primer Diameter – Optimum
- Primer Location
- Size of Primers
- Stemming Material / Type

- Selection of Primer
- Tamping Methods and Applications
- Secondary Priming (Insurance)
- Auger vs. Re-Pump
- Loading Methods
- Bulk Bag

#### **4 Initiation systems and blasting machines**

##### Initiation Systems

- Electric (Electronic)
- Non-electric
  - Det. Cord
  - Shell Tube
- Energy Distribution
- Delay Types
- Lead-in Line
- Remote / Wireless Systems
- Site-Specific Conditions
- Pros and Cons of Applications
- Circuit Testing Methods
- Failure Mode Analysis and Prevention
- Electricity

##### Blasting Machines

- Plunger
- Twister
- Capacitor Discharge
- Sequential
- Cap Fuse
- Shot Gun Primer

#### **5. Blasting vibrations, airblast, and flyrock**

- Capability of the machine / interpretation of the data
- Utilization of Data
- Documentation and Proper Location Based on Conditions
- Scale Distance Calculations
- Frequency Determination
- Ground Vibration Prediction and Limitations
- Waveform Interpretation – Blast Identification
- Weather Effects

## **5(i) Blasting vibrations, airblast, and flyrock – monitoring techniques**

### Flyrock Monitoring

- Video
- Photographs
- Evaluation Tools (Seismogram)
- Post Blast inspections

### Ground Vibration Monitoring

- ISEE “Field Practice Guidelines for Blasting Seismographs”
- Sensor placements/coupling
- Sensor location
- Blasting Seismograph
  - Record duration and calibration
  - Trigger levels
  - Waveforms
  - Frequency

### Airblast Monitoring

- Microphone placement
- Microphone location

## **5(ii) Blasting vibrations, airblast, and flyrock – methods to control adverse affects**

### Flyrock - Methods to Control

- Require Drill Logs
- Laser Profile Face / Burden Poles
- Stemming Type, Amount, Delivery, and Placement
- Proper Shot Performance Documentation
- Bench Height to Burden Ratio
- Shot Size
- Powder Factor
- Face Orientation
- Unconsolidated Material
- Matting / Backfill / Burming
- Confinement
- Partial Misfires
- Geology
- Hole Deviation
- Timing
- Explosive Type
- Pre-inspection of blast site
  - Excessive toe
  - Back break
  - Weathered surface rock

### Ground vibrations - Methods to Control

- Rules
- Distance/Charge weight
- Confinement

#### Airblast - Methods to Control

- Rules
- Distance/Charge weight
- Stemming type
- Initiation system
- Decking weak zones

### **6 Secondary blasting applications**

- Big rocks into small rocks
- Airblast/Flyrock
- Mud Capping/ Confinement
- Drilling
- Limit # of holes
- Cover with blast first
- Specialty products
- Other Options
  - RAM hoe
  - Headache ball
  - Jack hammer

### **7 Current Federal and State rules applicable to the use of explosives**

- OSM
- MSHA
- State specific information
- ATF
- OSHA
- EPA
- Placards (addressed by MSHA and in the ATF regulations)

### **8 Blast records**

Focus on:

- Location of blast
- Accurate sketch/Dimensions
- Distance reported
  - Closest hole in pattern to nearest corner of house
  - Calculating distances from blasts to homes with various coordinate systems (State plane, local, UTM, Lat-Long)
- Amount of explosive/Hole

- Timing/Sequence of detonation
- Seismograph location at house
- Initiation system

Other items:

- Name of operator conducting the blast
- Location, date, and time of the blast
- Name, signature, and certification number of the blaster conducting the blast
- Identification, direction, and distance in feet, from the nearest blast hole to the nearest dwelling, public building, school, church, community of institutional building outside the permit area, except those described in 816.67.
- Weather conditions, including those that may cause possible adverse blasting effects
- Type of material blasted
- Sketches of the blast pattern including number of holes, burden, spacing, decks, and delay pattern
- Show special relationship of blast site to surrounding area
- Freeface
- Resulting highwall
- North arrow
- Previous shot material (muck pile)
- Azimuth of primary freeface
- Diameter and depth of holes
- Types of explosives used and amounts
- Total weight of explosives used per hole
- The maximum weight of explosives detonated in an e-millisecond period
- Initiation system
- Type and length of stemming
- Mats or other protections used
- Seismographic and airblast records, if required, which shall include
  - Type of instrument, sensitivity, and calibration signal or certification of annual calibration
  - Exact location of instrument and the date, time, and distance from the blast
  - Name of the person and firm taking the reading
  - The vibration and/or airblast level recorded
- Reasons and conditions for each unscheduled blast
- Detonator quantities
- Booster quantities
- Timing of the actual hole
- Delay time sequence
- Cap firing time
- Hole-to-hole and in-hole delays
- Explosive column / hole cross section
- Firing times

- Coal seam shooting down to
- 3-D location
- Direction to protected structures
- Exact location of blast and methods of obtaining location
- Document coordinates and method
- Use of a blasting map / pit map
- GPS
- Survey
- Record time (duration of the shot) for seismograph
- Site security measures
- Verification of what was done and the crew present for the shot
- In comments document misfires
- Seismograph operation should be documented
- Attach the printout from the seismograph if available
- Trigger levels of the seismograph
- Attach the full wave form printout
- Document the seismograph set up
- Label multiple pages with shot number and date or some unique number

## **9 Schedules**

- Distribute annually
- Utilities, residents.
- Warning signals
- Mail to all within ½ mile of permit area
- Audible outside ½ mile of the blast
- Awareness of permit blast plan
- MSHA joint approvals with underground mines
- Include public safety – outdoor activity, school schedule, welfare considerations
- If beyond the blast schedule, list reasons and conditions in the blast record
- State specific regulations
- Optimum blasting times (nuisance awareness and annoyance)
- Safety considerations
- Atmospheric or weather conditions (fumes / dust)
- Wind direction and temperature

## **10 Preblasting surveys**

- How to conduct surveys

### **10(i) Preblasting surveys – availability**

Letter (certified)

- ½ Mile of permit area
- Free to owner
- Get copy to owner
- Proof of offering
- Right of review/Comment



## **10(ii) Preblasting surveys – coverage**

- ½ Mile of permit area

## **10(iii) Preblasting surveys – use of in-blast design**

- Historic structures/ Sensitive structures
- Changing vibration limits

## **11 Blast-plan requirements**

- Address all the performance standards 816.61-68 in permit
- Public safety issues
- Active underground mine issues w/ MSHA
- Public utilities – Consultation
- Recognize site-specific requirements
- Blast plan development
- Prepared by a certified blaster – state specific

## **12 Certification and training**

- Rules
- State specific regulations and/or federal regulations
- Revocation
- Time frames
- Application fees
- Continuing education requirements
- Renewals
- What a certified blaster should be training the crew on – OJT
- Reinstatement

## **13 Signs, warning signals, and site control**

### Warning Signals

- Horns
  - Truck
  - Air
  - Bugle
  - Air compressor
- Conditions affecting audibility
  - Wind – direct
  - Atmospheric conditions
  - Ambient noises
- Adequate blast area
- Location – all access points
- Define responsible parties for each aspect
- Training of flag personnel
- Individual notification before each blast (phone or in-person)
- Public notification

- Communication methods for site security personnel
- Pre-project meeting with the mine
- Public roads
- ATV's

**14. Unpredictable hazard including Lightening, Stray currents, Radio waves and Misfires**

- Stray gas – CO, NO<sub>x</sub>
- Cell phones
- Lightening
- Stray currents
- Radio waves/RF
- Misfires
- Power lines
- Underground voids
- Gas wells/lines
- Radar sites (airport)
- Untrained helpers / assistants
- Recognition
- Ways to deal with them
- Avoidance
- Reporting
- Remedy