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 boostering

- 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
  o RAM hoe
  o Headache ball
  o 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
  o Closest hole in pattern to nearest corner of house
  o 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, NOx
- 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