APPENDIX I

SELF-STUDY QUESTIONS

SELF STUDY QUESTIONS

The questions to follow are design to help prepare you for the WV Blasters Certification Examination. They are arranged by chapter. If you have problems answering any questions, refer to the respective chapter to assist in determining the correct answer. Using the "Table of Contents" may help in finding the exact reference or equation faster. The answers corresponding to these questions are found in Appendix J.

Chapter 1: Explosives, Types and Physical Properties

1. Name the two primary components of an explosive _____ , _____

2. A blasting agent is _____

3. The letters ANFO stand for _____

4. What are two major classes of explosives? _____ and _____

5. What happens to ammonium nitrate as it cycles up and down through 0° and 90°F? _____
-
_____

6. List six (6) explosive physical properties and explain why they are important to the blaster.

   1)_____ - _____

   2)_____ - _____

   3)_____ - _____

   4)_____ - _____

   5)_____ - _____

   6)_____ - _____

7. Explosives with a density of less than one will _____ in water.

8. Loading density is _____

9. Bulk ANFO, with a specific gravity of 0.85, should not be loaded in wet holes because _____

_____

10. When using ANFO under wet conditions, it should be _____

_____

11. What effects do high and low temperatures have on explosives? _____

_____

12. What is the recommended percentage of Ammonim Nitrate to fuel oil in ANFO? _____

13. What two products are used to make a "Blend"? _____

14. Name the three basic types of dynamite. _____

15. Aluminum is often added to blasting agent to _____

16. Orange or brown fumes produced by a shot indicate _____

_____

17. As the hole diameter is increased, the steady state velocity of ANFO will _____

18. Name two sources of product information supplied by manufacturers. _____

_____

Chapter 2: Initiation Systems

1. What instrument is used to check for stray current at the blast site? _____

2. What is the minimum firing current (DC) for electric detonators in a series circuit? _____

3. The light on the CD blasting machine comes on to indicate? (Enter letter) _____
   a. the shot has gone off
   b. the machine's batteries are ok
   c. the capacitors are charged to the maximum and ready to fire

4. Explain why a crimping tool is used. _____
5. A sequential timer can be used to set off as many as _____ different series circuits.

6. For a shot suspected of misfiring with electric detonators, the required re-entry wait time is _____ minutes.

7. Why is it not permissible to use an electrician's meter to measure resistance in a blasting circuit? _____

8. When is it all right to use a 12 volt automobile battery to fire a blast?_____

9. Lightning, stray currents, static electricity and radio frequency energy are forms of _____

_____

10. Detonating cord fires at a rate of approximately _____
11. What types of surface delay connectors can be used with detonating cord initiation? _____

_____

12. Many non-electric delay systems provide two places where delays may occur. These two types of delays are _____ and _____ .

13. What is the burning rate of a safety fuse? _____
14. When using electric initiation in wet conditions, it is recommended that at least _____ % fewer detonators be used.

15. No deflection of the needle on a Blaster's galvanometer indicates _____

16. Resistance is measured in _____ .

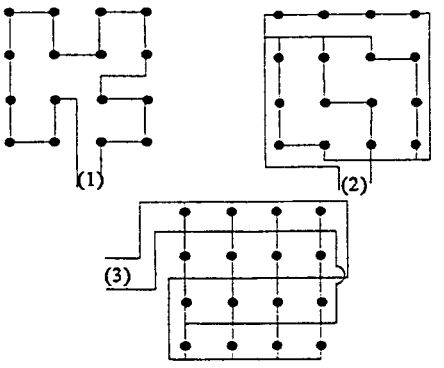
17. Which copper wire has a higher electric resistance, a 10 gauge or an 18 gauge wire?_____

18. Look at the wiring of the electric blasting caps in the three shots below. Identify each as either (a) series, (b) parallel or (c) parallel series.

1. _____

2. _____

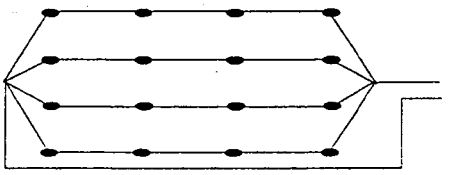
3. _____



19. A shot consists of four holes each containing two detonators. Each detonator has a resistance of 2.30 ohms and is wired in series. Calculated the resistance of the circuit. _____ ohms

20. A shot consists of five holes wired in parallel. Each hole contains a delay detonator with a resistance of 2.25 ohms. Calculate the resistance of the circuit. _____ ohms

21. You are to fire a shot with 16 holes wired in parallel series as shown in the diagram to the right. Using delay detonators with a resistance of 2.80 ohms, calculate the resistance of the circuit.

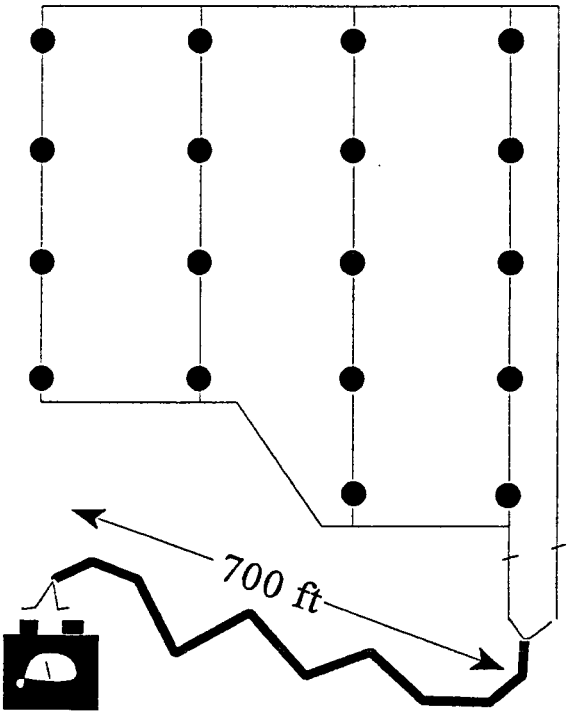


_____ ohms

22. Under what conditions is it permissible to place both shock tube and detonating cord in the same bunch block? _____

23. What is the proper way to prepare a non-electric lead line for a blast?_____

24. This shot consists of 18 holes wired as shown. Each hole contains an ACME detoantor with 40 foot copper leg wires. 1,000 feet of No. 18 AWG gauge copper connecting wire is used to connect the blast circuit to the firing line. The firing line is a 2 conductor No. 10 AWG gauge copper wire and is 700 feet long. Before connecting the lead lines to the blasting machine, you check the total resistance of the circuit with a blaster's galvanometer. Using Tables 2.A and 2.B determine the resistance, in ohms, you should read?



_____ ohms

Chapter 3: Blast Design

1. Define burden _____

2. Define spacing _____

3. Name the four areas of focus for good blast design _____ , _____

   _____ , and _____

4. How do you figure column charge length?_____

5. Study the drawing below, using the numbers given, fill in the following dimensions:

   a. Burden distance _____

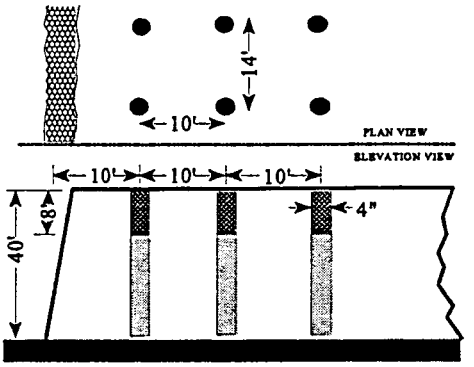
   b. Spacing distance _____

   c. Depth of drill hole _____

   d. Depth of stemming _____

   e. Column charge length _____

   f. Blasthole diameter _____



6. What is the formula for volume of rock per borehole? _____

7. List the factors that are important for determining burden and spacing. _____

   _____

8. Determine the volume per borehole for a blast with 15 foot burden, 20 foot spacing and 30 foot hole depth. _____ cubic yards

9. Determine the volume per borehole for a blast with a 10 foot burden and 15 foot spacing and a 40 foot depth. _____ cubic yards

10. What is loading density? _____

11. A six-inch borehole is loaded with a water gel that has a density of 1.15 g/cc. Stemming height is eight feet; hole depth is 40 feet.

a) Find the pounds of explosives per foot of borehole (the loading density). _____

b) Find the total pounds of explosive per borehole. _____

12. Each hole in a blast contains 215 pounds of ANFO. The burden is 12 feet; the spacing is 18 feet; the hole depth is 30 feet. Find the powder factor. _____

13. You are working on a shot with the following dimensions:

Burden = 13 ft	Diameter = 6 inches
Spacing = 16 ft	Stemming = 8 ft
Depth = 30 ft	Number of holes = 24

You are loading with ANFO which has a density of .85 g/cc. Calculate the following:

a) Volume of rock per borehole _____ bcy

b) Volume of rock per shot _____ bcy

c) Loading density _____ lbs/ft

d) Pounds of explosive per hole _____ lbs

e) Powder factor _____ lbs/bcy

f) Is this shot practical?_____ Why or why not? _____

_____

14. You are working on a shot with the following dimensions:

Burden = 10'	Diameter = 4 3/4"
Spacing = 15'	Stemming = 7'
Depth = 20'	Number of holes = 20

You are loading with wet hole tubes of ANFO-HD, tube diameter 4" and density 1.05 g/cc. Calculate the following:

a) Volume of rock per borehole _____ bcy

b) Volume of rock per shot _____ bcy

c) Loading density _____ lbs/ft

d) Pounds of explosive per hole _____ lbs

e) Powder factor _____ lbs/bcy

f) Is this shot practical?_____ Why or why not? _____

_____

15. What three energy factors must the blaster keep in balance in blast design? _____ ,

_____ , and _____

16. List three types of presplit loading configurations. _____ , _____ ,

and _____

17. How can voids be identified?_____

18. What is a deck charge used for? _____

_____

19. Insufficient collar stemming above the explosive charge can result in:

a. _____

b. _____

20. Hole depths should not be less more than _____ the burden.

21. What is the powder factor most useful for?_____

22. Using the Loading Density Chart, Table 3.B, what is the loading density of an explosive with a density of 1.30 in a package 8 inches in diameter. _____ lbs/ft

23. What is the final water height for a 6 inch diameter hole with an initiato water height of 3 feet loaded with 4½ inch packaged explosive? _____ feet

24. Name two design considerations for controlling flyrock and airblast on front row holes where open face burdens vary. _____

Chapter 4: Shot Timing

1. List the steps for calculating pounds of explosives per delay.

   1) _____

   2) _____

   3) _____

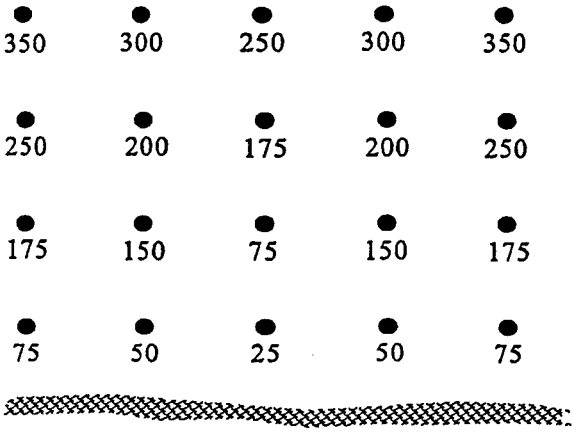
   4) _____

   5) _____

2. A blast is loaded so that four holes detonate per delay. Each hole contains four 50 pound bags of ANFO and a 1 pound cast booster. Calculate the maximum pounds of explosives per delay.

   _____ lbs/delay

3. Study the electric shot design below. Each hole contains 402 lbs. of explosives. What is the maximum amount of explosives per delay period? _____



4. List six items that should be considered when designing the delay timing of a blast:

   1) _____

   2) _____

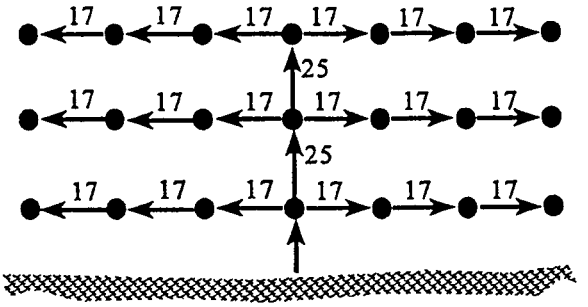
   3) _____

4) _____

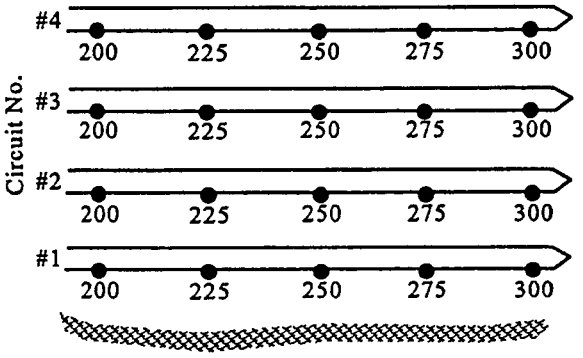
5) _____

6) _____

5. Study the non-electric shot design below. Each hole contains 304 Ibs. of explosives. Figure the maximum pounds per delay. _____



6. Study the sequential timer shot design below. Each hole contains 14 bags of ANFO each weighing 50 pounds and two water gel boosters. There are 22 water gel boosters to a case and a case weighs 55 pounds. The sequential timer is set for a delay of 33 milliseconds. Figure the maximum pounds per delay. _____



Chapter 5: Environmental Effects

1. The peak particle velocity may not exceed _____ inch(es) per second at a protective structure, 500 feet from a surface mine blast.

2. What is the scaled distance (SD) factor? _____

_____

3. Using the scaled distance formula, determine the maximum weight of explosives that may be detonated if the nearest structure is 1,000 feet. _____ lbs

4. Find the maximum amount of explosives that can be detonated if the nearest home is 5,250 feet from the blast. _____ lbs

5. A shot design consisting of 50 holes is loaded with 252 pounds of explosives per hole. The nearest structure is 2,000 feet away. What is the maximum number of holes that can be detonated in any one delay period? _____ holes

6. What is the estimated peak particle velocity on a structure 1500 feet from a normally confined blast when a maximum charge weight per delay of 450 pounds is used? _____ ips

7. Preblast surveys must be conducted if requested by residence living within _____ mile(s) of the permitted mine blast area.

8. What is the maximum air overpressure level at a structure using a seismograph capable of monitoring at a lower frequency limit of 2 hertz? _____ dB

9. List five factors that a blaster should take into account when trying to control air blast.

   1) _____

   2) _____

   3) _____

   4) _____

   5) _____

10. What blasting problem is a leading cause of onsite fatalities? _____

11. How are ground vibrations levels measured? _____

12. What is the peak particle velocity limit allowed at a structure 210 feet from the blast site?

    _____ ips

13. What are the two primary concerns to address in reducing high vibration?

    1) _____

    2) _____

14. What is the minimum time period which constitutes a delay? _____

15. What is the regulatory limit for flyrock? _____

    _____

16. Define protected structure. _____

    _____

17. All residence within ½ mile of the permit area shall be notified in writing _____ days prior to blasting, how they may request a preblast survey.

18. The USBM / OSMRE Plot, considers vibration _____ as well as particle velocity in assessing potential damage criteria.

Chapter 6: Blasting Safety and Procedures

1. Blasting, as a part of a surface mine permit, is not allowed within _____ feet of any occupied dwelling unless the owner has provided a written waiver and a blast design plan has been approved by WVDEP.

2. Revisions to a blasting schedule must be republished at least _____ , but not more than _____ days before the time change is to take effect.

3. WVDEP issues surface blasters certifications for a period of _____ years.

4. What is the minimum number of persons that must be present, excluding the certified blaster, at the time of detonating a blast? _____

5. To whom may a certified blaster delegate his blasting responsibility? _____

_____

6. The term secondary blasting refers to _____

7. A warning signal should have an audible range of _____ mile(s).

8. What are the three methods for disposing of a misfire in order of preference?

   1) _____

   2) _____

   3) _____

9. Dynamite punches must be made out of _____

10. What is the proper procedure for disposal of damaged or unwanted explosive materials?

_____

11. In open pit blasting of overburden, what is the minimum length of the firing line? _____ feet

12. How soon after the boreholes are loaded should they be fired? _____

13. What are the two parts of a primer? _____ and _____

14. Under what conditions is it permissible to use a tamping pole to force a primer past an obstruction in a blasthole? _____

15. Prior to loading a blast, list four items the blaster should check.

   1) _____

   2) _____

   3) _____

   4) _____

16. At least _____ minutes before loading begins, the blast site must be barricaded, clearly marked, and all unnecessary equipment removed.

17. Primers should be assemble _____

_____

18. When should the firing line be removed from the blasting machine? _____

_____

19. Where should the primer be located in a blasthole? _____

_____

20. The blast warning signal shall be sounded _____ minutes prior to the blast.

21. Any person remaining in the blast area must be located _____

_____

22. A misfire is _____

_____

23. What is the primary cause of misfires _____

24. List five clues that might indicate that a misfire has occured

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

25. The all clear signal should not be sounded until _____

_____

Chapter 7: Explosives Handling

1. An area of at least _____ feet around magazines must be kept clean of dry leaves, grass undergrowth, trash and other debris.

2. Except when explosives are being deposited or withdrawn, magazines must be kept _____

3. Explosives and detonators transported in the same vehicle must be separated by a _____ inch thick hardwood partition.

4. Each vehicle carrying explosives must be equipped with a _____ pound or large portable, dry chemical fire extinguisher at all times

5. Detonating cord should be stored in the magazine containing: (a) high explosives, or (b) detonators. _____

6. When taken to the shop for repairs, a truck must _____

   _____

7. The separation distance between a magazine containing explosives and an inhabited building can be determined using _____

8. The interior of an explosive compartment must be made of _____

9. The signs used for posting a storage magazine location must be located so that _____

   _____

10. Door construction on magazines must be steel plate at least _____ inch(es) thick.

11. No smoking is allowed withing _____ feet of magazines containing explosives.

12. Damaged explosives shall not be unpacked within _____ of a magazine.

13. What regulatory agency must provide permission for destruction of distressed explosive materials? _____

14. What regulatory agency must be notified within 24 hours of lost or stolen explosives materials?

    _____

15. The minimum separation between a detonator and an explosive magazine is_____ feet

Chapter 8: Record Keeping

1. Use the information given below, complete the blank inventory form. You ae inventoring ACME Dynamite "A", 2 x 12. Your initial inventory on May 3, 1996 is 10 cases of the dynamite. Each case of ACME 2 x12 Dynamite "A" weighs 50 pounds and contains 25 sticks. On May 5th you removed and used 114 sticks of dynamite. That same day you order another 8 cases which are delivered and put in the magazine by you on May 6th. On May 8th, you remove 157 sticks of dynamite to load a shot. Because of three bad holes you were unable to load, you return 19 sticks at the end of the day. On May 11th, you remove and use 78 sticks of dynamite. You order and receive 12 cases on May 14th. Your boss requests that you take a mid-month inventory on May 15th. Bob on the other job has run short of dynamite and you send him 6 cases from your magazine on May 17th. That same day you remove 265 sticks and use 253 sticks in the day's shot. The rest of the sticks are returned to the magazine at the end of the day. The safety director has just notified you that only 1000 pounds of dynamite may be stored in the magazine. You look at your inventory sheet and tell him there are only _____ pounds in storage currently and the maximum stored todate is only _____ pounds.

ABC MINING COMPANY - MAGAZINE 002 - PERMIT S-12345
INVENTORY FOR _____

DATE	IN	OUT	BALANCE	INITIALS

2. What does FIFO mean? _____

3. Retention time for inventory records is _____ years.

4. If explosives are lost, stolen, or unlawfully removed, BATF must be notified within _____ hours.

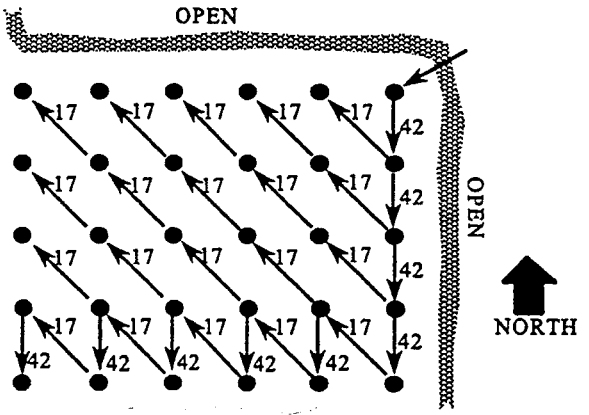
5. What is the retention time for blasting logs? _____ years

6. Where are the blasting logs to be kept? _____

7. Does a blasting log require the name of the explosive suppier? _____

8. May the public inspect blasting logs? _____

9. Imagine you are working as a certified blaster for the Capable Mining Company. Your boss, John Jones has you load the shot drilled at location B-14 on your grid map of mine permit S104-92. Your license number is 149-79. You have loaded 30 holes (6 rows of 5 holes each) which are 9 inches in diameter. Holes are 60 feet deep on a drilled burden and spacing of 18 x 18 feet. The drillers log says you are shooting layered shale and sandstone. You have loaded each hole with bulk ACME ANFO and two ACME one pound cast boosters. You used 32,350 lbs. of bulk ANFO to load the entire shot. This leaves 14 feet which you stem with drill cuttings. The closest building is the Smith residence located 2,540 feet northwest of the blast and at which your boss will setup and run the Vibs-System seismograph. The seismograph was last calibrated January 12, 1996. Its trigger level is set for 0.04 ips on the geophone and the trigger on the microphone is disabled. The lower frequency level for the microphone is 2 hertz. You have used a shock tube system to initiate and delay the blast. Each hole contains two 450 in-hole delay detonators. The surface is delayed on an echelon with 42 milliseconds between the holes in a row and 17 milliseconds on diagonal between the row of holes. You detonated the blast at 2:15 p.m on April 10, 1996 using 750 feet of shock tube lead line and a percussion cap block. The weather at the time of detonation was 80°F and overcast with no wind. You did not need to use mats or other protective devices. John reported back to you that the seismograph readings were 0.15 longitudinal, 0.09 transverse, 0.11 vertical and 113 dB air blast. He also said that he did not intend to have the data analyzed at this time. The shot layout is diagrammed below. Complete theWV Blasting Log provided on the following pages.



EB-37
Rev. 02/04

State of West Virginia
Department of Environmental Protection - Office of Explosives and Blasting

Shot No._____

BLASTING LOG

General Information

Permittee _____ **Permit No.**_____
Operator Name _____ **Date/Time** _____
(Approved MR-19 Contract Operator, if applicable)
Company Conducting Blast _____
(Contract Blaster i.e.; Shot Service, if applicable)
Location of Blast _____
(Specify grid designation from blasting grid map, GPS location if available, and type of shot.)
Nearest Protected Structure _____
(Specify name of homeowner/structure owner and structure number from blasting map)
Direction and Distance to Nearest Protected Structure *(Feet)* _____
Nearest Other Structure _____
(Specify name of owner, identifying no., describe i.e.; gas well, gas line, power line, phone line, water line, barn, etc.)
Direction and Distance to Nearest Other Structure *(Feet)* _____
Weather Conditions _____ **Wind Direction and Speed** _____
(Include estimated temperature, precipitation, sky conditions, speed and direction wind is blowing from shot)
Type(s) of Material Blasted _____
Mats or Other Protection Used _____

Blast Information

Type(s) of Explosives: Blasting Agent _____ **Density**_____
(Include percent blend of emulsion to anfo) *(Product density in g/cc)*
High Explosives (Primers) *(Include type, unit weight and number)* _____
Total Weight of Explosives: Blasting Agent _____lbs. **+ Primers** _____lbs. **=** _____lbs.
Blast hole Data: Number _____ **Diameter** _____ **Depth** _____ **Burden** _____ **Spacing** _____
(For varying hole depth, diameter, stemming, burden and/or spacing, list additional data in 'Comments' and illustrate on 'Sketch' on Page 2)
Powder Column _____ft. **Stemming: Type of Material** _____ **Length** _____ft.
Delay Type, Brand and Delay Periods _____
(Include surface and down hole delay periods)
Maximum Weight of Explosives Allowed (per 8 MS Delay Period) _____lbs.
[Show appropriate formula and answer for: 0-300 ft. $W=(d/50)^2$, 301-5,000 ft. $W=(d/55)^2$ or Over 5,000 ft. $W=(d/65)^2$]
Maximum Weight of Explosives Used (per 8 MS Delay Period) _____lbs.
Weight of Explosives Used per Hole/Deck _____ lbs.
(If not the same for every hole/deck, include each weight or average weight and explain)
Method of Firing and Type(s) of Circuits _____

Seismograph Data

Date and Time of Recording from the Seismogram: _____
Type (Brand and Model Number) of Instrument: _____ **Sensitivity:** _____Hz.
Person and Company Who Installed Seismograph: _____
Person and Firm Taking Readings: _____
Person and Firm Analyzing Readings: _____
(Attach full waveform seismograms, for all seismograph recordings for this blast. Include calibration signal even if no trigger)
Signature of Person Analyzing Readings: _____
Location of Seismograph: _____
(Specify owner's name and structure number from the blast map, including distance from blast)
Trigger Levels: Ground: _____ips **Air:** _____dB **Length of Recording Time:** _____sec.
Vibrations Recorded: Longitudinal: _____ **Transverse:** _____ **Vertical:** _____ **Air Blast:** _____
Frequency: Longitudinal: _____ Hz. **Transverse:** _____ Hz. **Vertical:** _____ Hz. **Air Blast:** _____ Hz.

Certificate of annual calibration must be maintained at the mine site.

Form available at www.wvdep.org

EB-37
Rev. 02/04

Shot No._____
Date/Time _____
Permit No._____

Sketch of Delay Pattern

Show North Arrow & Direction to Nearest Protected/Other Structure. Include Firing Time for Each Hole or Deck.

Comments

Include any special design features, such as decking (use sketch), variable hole depth, etc., reasons and conditions for unscheduled blasts and any unusual events or circumstances (i.e.; flyrock, excessive air blast or ground vibration, etc.). Include attachments as needed.

_____

_____

_____

_____

_____

_____

_____

_____

Blaster Information

Name of Blaster-in-Charge (Print or Type): _____

Signature of Blaster-in-Charge: _____

WVDEP-OEB Certification Number of Blaster-in-Charge: _____

Form available at www.wvdep.org

Blaster's Certification Affidavit

The applicant is required to complete this affidavit as part of the West Virginia Blaster Certification Program. Please complete the following information and return this document with your completed study guide questions to the West Virginia Department of Environmental Protection, Office of Explosives and Blasting, 601 57TH Street SE, Charleston, WV 25304. Please contact OEB to pre-register for the blaster's eight (8) hour training and examination.

I, _____, the undersigned, hereby certify that I personally have read, studied and completed all the attached study guide questions without any assistance.

_____ _____

Signature of Applicant Date

_____

Employer

Subscribed and sworn to before me this _____ day of _____, _____

_____

Notary Public for the State of West Virginia

(Seal)

My commission expires: _____

EB-37
Rev. 02/04

State of West Virginia
Department of Environmental Protection - Office of Explosives and Blasting

Shot No._____

BLASTING LOG

General Information

Permittee _____ Permit No._____
Operator Name _____ Date/Time _____
(Approved MR-19 Contract Operator, if applicable)
Company Conducting Blast _____
(Contract Blaster i.e.; Shot Service, if applicable)
Location of Blast _____
(Specify grid designation from blasting grid map, GPS location if available, and type of shot.)
Nearest Protected Structure _____
(Specify name of homeowner/structure owner and structure number from blasting map)
Direction and Distance to Nearest Protected Structure *(Feet)* _____
Nearest Other Structure _____
(Specify name of owner, identifying no., describe i.e.; gas well, gas line, power line, phone line, water line, barn, etc.)
Direction and Distance to Nearest Other Structure *(Feet)* _____
Weather Conditions _____ Wind Direction and Speed _____
(Include estimated temperature, precipitation, sky conditions, speed and direction wind is blowing from shot)
Type(s) of Material Blasted _____
Mats or Other Protection Used _____

Blast Information

Type(s) of Explosives: Blasting Agent _____ Density_____
(Include percent blend of emulsion to anfo) *(Product density in g/cc)*
High Explosives (Primers) *(Include type, unit weight and number)* _____
Total Weight of Explosives: Blasting Agent _____lbs. + Primers _____lbs. = _____lbs.
Blast hole Data: Number _____ Diameter _____ Depth _____ Burden _____ Spacing _____
(For varying hole depth, diameter, stemming, burden and/or spacing, list additional data in 'Comments' and illustrate on 'Sketch' on Page 2)
Powder Column _____ft. Stemming: Type of Material _____ Length _____ft.
Delay Type, Brand and Delay Periods _____
(Include surface and down hole delay periods)
Maximum Weight of Explosives Allowed (per 8 MS Delay Period) _____lbs.
[Show appropriate formula and answer for: 0-300 ft. $W=(d/50)^2$, 301-5,000 ft. $W=(d/55)^2$ or Over 5,000 ft. $W=(d/65)^2$]
Maximum Weight of Explosives Used (per 8 MS Delay Period) _____lbs.
Weight of Explosives Used per Hole/Deck _____ lbs.
(If not the same for every hole/deck, include each weight or average weight and explain)
Method of Firing and Type(s) of Circuits _____

Seismograph Data

Date and Time of Recording from the Seismogram: _____
Type (Brand and Model Number) of Instrument: _____Sensitivity: _____Hz.
Person and Company Who Installed Seismograph: _____
Person and Firm Taking Readings: _____
Person and Firm Analyzing Readings: _____
(Attach full waveform seismograms, for all seismograph recordings for this blast. Include calibration signal even if no trigger)
Signature of Person Analyzing Readings: _____
Location of Seismograph: _____
(Specify owner's name and structure number from the blast map, including distance from blast)
Trigger Levels: Ground: _____ips Air: _____dB Length of Recording Time: _____sec.
Vibrations Recorded: Longitudinal: _____Transverse: _____Vertical: _____ Air Blast: _____
Frequency: Longitudinal: _____ Hz. Transverse: _____ Hz. Vertical: _____ Hz. Air Blast: _____ Hz.
Certificate of annual calibration must be maintained at the mine site.

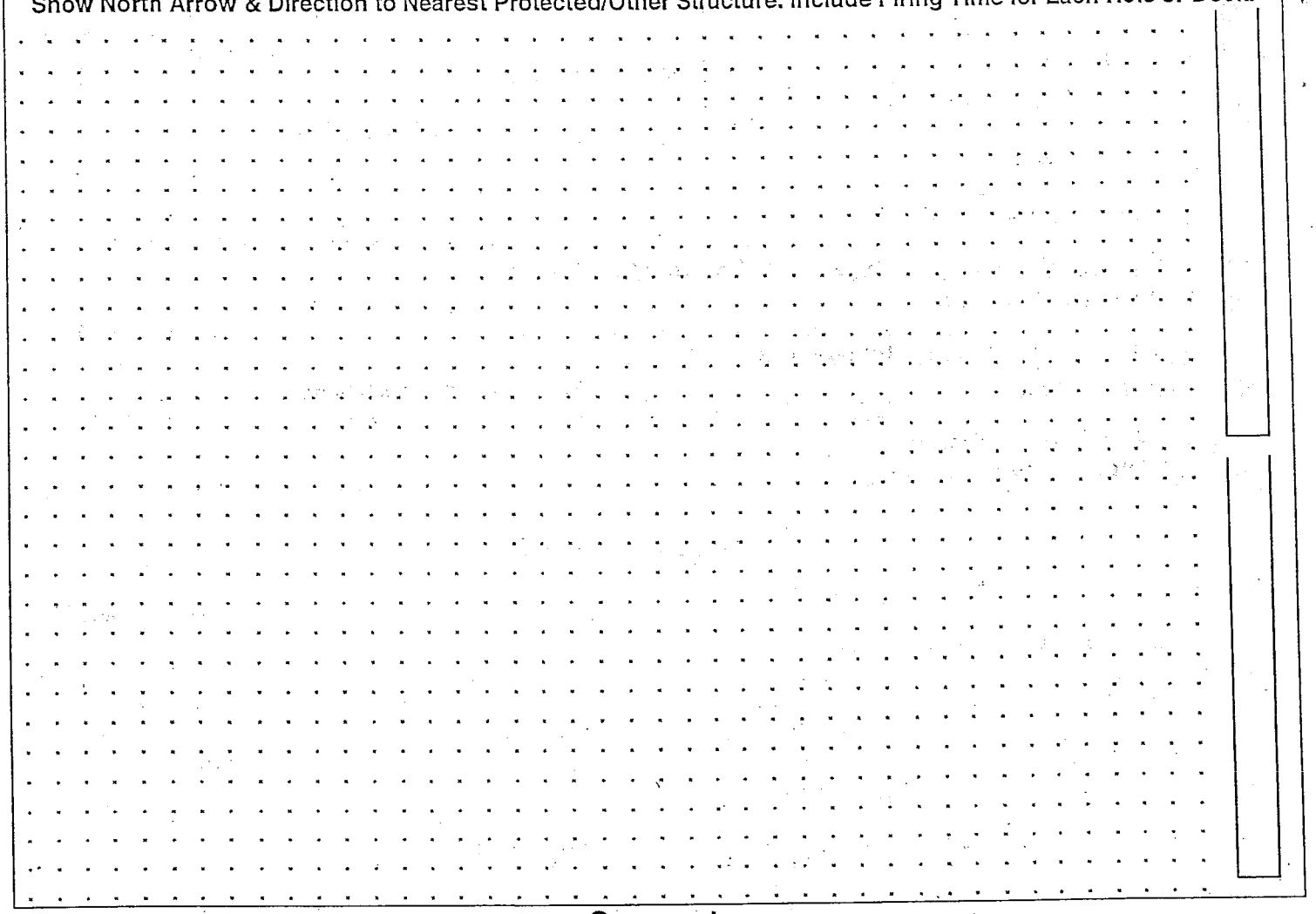
Form available at www.wvdep.org

EB-37
Rev. 02/04

Shot No._____
Date/Time _____
Permit No._____

Sketch of Delay Pattern

Show North Arrow & Direction to Nearest Protected/Other Structure. Include Firing Time for Each Hole or Deck.



Comments

Include any special design features, such as decking (use sketch), variable hole depth, etc., reasons and conditions for unscheduled blasts and any unusual events or circumstances (i.e.; flyrock, excessive air blast or ground vibration, etc.). Include attachments as needed.

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Blaster Information

Name of Blaster-in-Charge (Print or Type): _____

Signature of Blaster-in-Charge: _____

WVDEP-OEB Certification Number of Blaster-in-Charge: _____

Form available at www.wvdep.org

State of West Virginia
Department of Environmental Protection - Office of Explosives and Blasting

INSTRUCTIONS FOR COMPLETING BLASTING LOG

OEB Form EB-37 (revised 2/04)

GENERAL INFORMATION

The blast log must be completed within 24 hours of the shot. If there are any unusual events associated with the blast, the log must be completed that day by the blaster-in-charge before leaving the mine site. Shot number should be used to consecutively number each blast for a permit.

1. **Permittee**
   The permittee is the Article 3 permit holder name as it appears on the approved WV DEP Surface Mining Permit (MR-2). List the full name not partial or abbreviated. Typically this permit name should be the same as on the approved blasting map and correspond directly with the permit number associated with the blasting activities on this blast log. The permittee is also identified on the sign (also known as the permanent monument) that is located at the entrance to the mine site.

2. **Permit Number**
   The "permit number" is the WV DEP assigned number for the specific surface mine where the blasting activities are being conducted. This number will be the same as the permit number as it appears on the blasting map. This permit number corresponds with the blasting plan approved for this surface mine. A typical permit number has a alpha prefix followed by a four digit number followed by two digits that represent the year the application was submitted (i.e. S-4001-04). The permit number is identified on the sign (also known as the permanent monument) that is located at the entrance to the mine site. This is not the MSHA or NPDES permit numbers for this mine.

3. **Operator Name**
   The name of the company mining the coal as it appears on the WV DEP approved MR-19. MR-19 is a form that allows a company to mine coal on the permit that is not the permit holder.

4. **Date/Time**
   This is the date and time that the shot was detonated. If there are misfires, the details of detonation of those misfires, including time, should be noted on page 2 in the comment section of the blast log.

5. **Company Conducting Blast**
   Provide the name of the company conducting the blasting if different from the Permittee or Operator. Provide full name of the shot service provider, no abbreviations.

6. **Location of Blast**
   This is the location of the blast identified by grid and/or GPS. The grid is located on the blasting map and are normally no larger than 250' x 250'. If grids are larger, the blaster should identify what area of the grid the blast is located by use of quadrants as identified in the permit application. When blasting within 1000 feet of protected structures, a more accurate method of locating the blast should be used in addition to grids. Use of GPS is strongly recommended to provide accurate distance to structures and location of the blast.

Include the name of the coal seam associated with the overburden or binder being blasted. The type of shot (i.e. binder, cast, production, contour, breakdown, pre-split, bolder, etc.) should be identified.

7. Nearest Protected Structure

"Protected Structure" is defined by 199CSR 2.36 as any of the following structures that are situated outside the permit area; an occupied dwelling, a temporarily unoccupied dwelling which has been occupied within the past ninety (90) days, a public building, a habitable building for commercial purposes, a school, a church, a community or institutional building, a public park or a water well. Identify the full name of the homeowner or structure owner and include the structure number from the blasting map. The structure name may change with a change in ownership but the structure number as shown on the approved blast map shall never change. The structure numbers indicated on the blasting map are also listed in Section T of the mining permit.

8. Direction and Distance to Nearest Protected Structure

The **direction** is always orientated from the blast site to the structure, using compass points and/or azimuth (with zero degrees being due north). The **distance** is to be measured from the shot location to the nearest protected structure. If GPS is not used to identify the blast site dimension and location, the distance from the nearest corner of the blasting grid to the protected structure as measured on the blasting map will be used to provide the most conservative blast design when the exact location of the blast cannot be determined. Provide the distance to the nearest protected structure, no matter how far away. Compass bearing should be used to define direction from the shot to the nearest protected structure. When using GPS for location also provide the NAD settings for the GPS (i.e. NAD27, NAD83, etc), these should be the same as those identified on the blasting map.

9. Nearest Other Structure

List type of structure, owners name and structure number as shown on the blast map. "Other structures" are defined as but not limited to outbuildings, gas lines, water lines, towers, airports, underground mines, tunnels, dams, gas wells, etc. Provide the type of nearest "other structure" as identified on the blast map. Gas wells identified on the approved blasting map as "plugged" are not considered as structures that must be protected. When plugged gas wells are encountered, go to next nearest "other structure" for blast design and performance compliance. If the "other structure" is closer than the nearest "protected structure" and you do not have an approved waiver allowing alternate peck particle velocities (PPV's), then you must apply the allowable scale distance limits or maximum vibration limits for this shot to this "other structure" as specified in 199CSR1 for protected structures. If the nearest "other structure" has an approved waiver to exceed the PPV's, design to the next nearest structure. List both on the blast log. Waviers for alternate PPV's at "other structures" shall not reduce the level of protection for the "nearest protected structure".

10. Direction and Distance to Nearest Other Structure (feet)

The direction and distance is to be measured from the shot location to the nearest "other structure" using the same criteria as measuring nearest "protected structures". If GPS is not used to identify the blast site dimension and location, the distance form the nearest corner of the grid to the "other structure" as measured on the approved blasting map will be used to provide the most conservative blast design when the exact location of the blast cannot be determined. Provide the distance to the nearest "other structure" if within 7/10 mile radius. Compass bearing should be used to define direction from the shot to the nearest "other structure".

11. Weather Conditions
Be as descriptive and accurate as possible. List estimated values if actual measurements are not available for temperature, precipitation, sky condition, wind speed, and compass direction that wind is blowing from the shot .

12. Type(s) of Material Blasted
List type of geology including voids, mud seams, fractures, subsidence cracks, etc. Attach drill logs if utilized for identifying geology type and the anomalies identified above.

13. Mats or Other Protection Used
List any safety or protective measure taken i.e. cleared blast area, block all roads, used warning signals, backfilling or padding provided for secondary blasting, etc.

BLAST INFORMATION

14. Type(s) of Explosives:
Blasting Agent: List type of blasting agent and include percent blend of emulsion to ANFO if applicable.
Density: Provide blasting agent density and/or density of blended products in specific gravity or in g/cc.

15. High Explosives (primers)
List brand and type of boosters, the individual unit weight of the boosters and the total number of boosters used for this blast. Also, provide length and grains per foot of detonator cord if utilized.

16. Total Weight of Explosives:
Provide the total weight of blasting agent in pounds and total weight of boosters (primers) detonated in this shot.

17. Blasthole Data:
Provide the total **number of holes** loaded, **diameter** of holes in inches, and **depth** of holes in feet. List the **depth** of the longest hole. The **depth** is the length of borehole as measured by the blaster. Include sub drilling if applicable. Provide **burden** in feet as measured perpendicular to the free face. Provide **spacing** in feet as measured parallel to the free face (or perpendicular to the burden). This is typically the distance between holes in individual rows. If you have a combination shot which would cause varying hole depth, diameter, stemming, burden and/or spacing, note this in the "comments" and illustrate details in the "sketch" on the back. List worst-case information in **Blasthole Data** blanks provided on front.

18. Powder column
The total length of explosives placed in the blasthole, in feet. In the case of decks provide the details and dimensions on page 2 of this log.

19. Stemming:
The **length** (of stemming) is the measured distance in feet from the collar of the borehole to the top of the explosive column. In the case of air decks, where the stemming is not directly on top of the powder column, the **length** is the distance from the borehole collar to the top of

the packing devise supporting the stemming. Identify the type of stemming material used i.e. drill cuttings, gravel, etc. Do not include backfill or decks in **length** of stemming. **Backfill** is the material placed in the borehole by the blaster before loading the hole with explosives. Where backfilling or decking is involved the blast hole should be dimensioned on the sketch (page 2) to identify actual length of stemming and length of powder column.

20. **Delay Type, Brand and Delay Periods**
Provide type, brand (manufacturer), and both surface and down hole delay periods for all detonators utilized in this shot. Identify the length of surface and down hole detonators leads.

21. **Maximum Weight of Explosives Allowed per Delay Period**
Calculate the maximum weight of explosive allowed utilizing the appropriate Scaled Distance Formula to the nearest structure. Identify which formula is used by either circling the appropriate formula on the log or by showing the scaled distance calculation in the blank provided. Include the result in pounds of explosive in the blank provided.

22. **Maximum Weight of Explosives Used per Delay Period**
This is the total weight of explosives in pounds of all holes or decks detonated in any 8 millisecond time period. This includes all overlaps, which are evidenced by the hole timing shown on the sketch.

23. **Weight of Explosives Used per Hole or Deck**
This is the calculated maximum weight of explosive in pounds used per hole or deck, initiated by a single detonator. List any variations in blast hole or decks on page 2 of the log.

24. **Method of Firing and Type(s) of Circuits**
Provide type of firing method and type of initiating system (i.e. electric, non-electric, electronic, remote control, stomper, snap gun, electric cap, sequential timer, nonel, shock tube, detonating cord, optimizer, etc).

SEISMOGRAPH DATA

To be filled out by the blaster or the company providing the seismic monitoring . If there was a problem with the shot, the seismograph data should be filled out within 24 hours. A copy of the seismic data needs to be attached to the blast log including full wave form recordings if available. If seismographs are used to monitor this blast but not required for compliance (i.e. the blast is designed using the scale distance formula) the records of the seismographs shall still be made a part of the blasting log and maintained with the blast logs for review. A copy of the certificate of annual calibration for the seismograph shall be maintained at the mine site.

25. **Date and Time of Recording from the Seismogram**
This is the date and time from the seismic recording and should correlate with the vibration and air blast monitoring of this blast.

26. **Type (Brand and Model Number) of Instrument**
List model number, manufacturer, or type of the seismic instrument utilized for monitoring of this blast event.

27. **Sensitivity**
Provide the lower frequency limit of the airblast measuring system in hertz (Hz). This is for the establishment of the maximum allowable limit on airblast(dB) as specified at 199CSR1, 3.6.c.1. of the rules.

28. **Name of Person and Company Who Installed Seismograph**
Provide the name of individual and the name of company he or she represents who installed the seismograph for monitoring of this blast. If there are multiple seismographs installed for monitoring of this blast, attachments may be used to provide the required data.

29. **Name of Person Taking Readings**
Provide the name of the person that downloads the seismic and air blast data from the seismograph(s) utilized for the monitoring of this blast.

30. **Name of Person and Firm Analyzing Readings**
Provide the name of the person and the company he or she represents that analyzed the seismic recordings from the data obtained from the seismograph. This is the person who reviews the seismic data and identifies what recordings are of a blasts and what are not recordings of a blast event. The seismic data of blast shall include full waveform seismograms including the calibration signal. If there are no events triggered by a blast then the calibration signal associated with this blast event should be provided to indicate the seismograph was functioning properly.

31. **Signature of Person Analyzing Readings**
This is the signature of the person listed in the item above.

32. **Location of Seismograph**
Provide the type of structure, name of the structure owner, and structure number from the blast map. Include the distance from the seismograph to the blast that is being monitored.

33. **Trigger Levels**
Provide seismograph trigger levels for both the ground vibrations in inches/second and for airblast in dB set for initializing the instrument. The recording time is the length of the vibration recording time for an event in seconds.

34. **Vibrations Recorded**
List for this blast the seismic data recorded in the three mutually perpendicular directions as identified on the seismic record of ground vibration velocities. The values must be listed for the maximum vibration velocities (inches/second, ips) measured in the **Longitudinal, Transverse, and Vertical** direction as recorded by the seismograph for this blast. List the maximum recorded **Air Blast** in decibels, dB for this blast. Attach to this blast log a printout tape or copy of downloaded data for this blast including full waveform recordings.

35. **Frequency**
List the recorded frequency in hertz, Hz of the **Longitudinal, Transverse, and Vertical** ground vibrations and **Air Blast** records associated for the maximum values measured for this blast as listed above.

Instructions for page 2 of Blast Log

36. Sketch of Holes and Delays

Provide a plan view sketch of the blast design (i.e. a proportional representative drawing). Identify each hole in the blast site including the orientation of the free face(s) relative to the blast site. The direction and distance to nearest Protected Structure and nearest Other Structure should be identified on the sketch. Show a north arrow, orientate the blast site and structures accordingly.

Provide the firing time of each hole or deck. Show all surface delays between holes and between rows. If all down hole detonators are the same millisecond delay, indicate on the sketch with a note and surface timing of each hole may be shown. However, if the blast design has different down hole delays, the actual down hole timing for initiation of the powder column must be shown when timing out the shot. Provide sketch of the blast hole to depict each different hole/deck design, including dimensions (feet). If there are different blast hole loading configurations, identify what holes the cross section(s) is depicting in your blast design including depth (feet) and diameters (inches). Identify physical conditions surrounding the blast site i.e. shot material, solid, open face, etc.

37. COMMENTS

Provide a brief explanation of the blast. List any abnormalities such as flyrock, wet holes, etc., or any other unusual circumstances associated with this blast. Any details of misfires and secondary detonation(s) associated with the blast should be described. Explanation for any unscheduled detonations outside the approved times in the blasting schedule should be described in detail as well as the name and time of contact with the OEB personal providing approval for the unscheduled blast. Identify any excessive air blasts or ground vibrations resulting from this blast and the cause. Training by the blaster in charge for blasting personnel in the safe use of explosives may be detailed including the names of blasting crew members being trained.

38. BLASTER INFORMATION

Print legibly the full name of the blaster-in-charge. Signature of Blaster-in-Charge must be included. Provide the current Surface Mine Blaster Certification number as issued by the WVDEP, Office of Explosives and Blasting, for the Blaster-in-Charge. The Blaster-in-Charge is the certified person responsible for supervising the loading and detonation of a blast.

Definitions

Term "structure" and "other structure":

STRUCTURE as defined under 38CSR2 2.118

Structure means, except as used in the context of subsection 3.8 of this rule, any mad-made structures within or outside the permit areas which include, but is not limited to: dwellings, outbuildings, commercial buildings, public buildings, community buildings, institutional buildings, gas lines, water lines, towers, airports, underground mines, tunnels, and dams. The term does not include structures built and/or utilized for the purpose of carrying out the surface mining operation. (this takes in protected structures and other structures)

3.8 of this rule reads

"New and Existing Structures and Support Facilities:

3.8a. Each application for a permit will contain a description, plans, and drawings for each support facility to be constructed, used, or maintained within the proposed permit are……

3.8b. Each application shall contain a description of each existing structure or facility proposed to be used in connection with or to facilitate the surface mining and reclamation operation….."

PROTECTED STRUCTURE as defined under 38CSR2 2.97

Protected Structures means for purposes of blasting, dwellings, public buildings, schools, churches, or community or institutional buildings.

Community or Institutional Building

As defined under 38CSR2 2.34

Community or Institutional Building means any structure, other than a public building or an occupied dwelling, which is used primarily for meetings, gatherings or functions of local civic organizations or other community groups; functions as an educational, cultural, historic, religious, scientific, correctional, mental health or physical health care facility; or is used for public services, including, but not limited to, water supply, power generation or sewage treatment.

Public Building

As defined under 38CSR2 2.98

Public Building means any structure that is owned or leased by a public agency or used primarily for public business or meetings.

Blasting Control for OTHER STRUCTURES are defined under 199-CSR-1, 3.7.a. as all other structures in the vicinity of the blasting area which are not defined as protected structures at subsection 2.35 of this rule shall be protected from damage by establishment of a maximum allowable limit on ground vibration, specified by the operator in the blasting plan and approved by the Secretary. If alternate maximum allowable limits on vibrations are not included on the approved blast plan, the operator shall comply with the limits specified for protected structures as identified in 199-CSR-1, 3.6.h. and 3.6.i. of the rules. The plan submitted under this subsection shall not reduce the level of protection for other structures otherwise provided for in this rule.