Federal Blaster Certificate Program

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Abstract

Blasting represents the highest risk of any surface coal mining activity that could result in injury and/or property damage off the permit area. In addition, blasting related issues e.g. flyrock, vibrations, air blast, etc., are responsible for a large percentage of citizen complaints. Thorough and consistent regulation of individuals certified to conduct blasting by the Office of Surface Mining Reclamation and Enforcement in Federal Program states and on Indian Lands under Federal jurisdiction is vital, as it serves to: facilitate coal production to meet the nation's energy needs; protect people and property on and adjacent to Federal mining permits; form a basis for states to grant reciprocity certificates to Federal blasters; and be a positive example to primacy states. OSM issues Federal blaster certificates for blasting on Federal surface coal mine permits. The certification program includes experience, training and testing components similar to many of the states. But where a state program may focus on the specific blasting applications within its boundary, the OSM certificate requires a very diverse test to cover all potential blasting applications and products across the nation. Therefore, the Federal certificate is a good surface mining credential for blasters anywhere in the United States.

Background

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) created the Office of Surface Mining Reclamation and Enforcement (OSM) to regulate the surface effects of coal mining across the United States. OSM is responsible for striking a balance between the energy needs of the country with the reclamation and public protection requirements of SMCRA as represented in the OSM logo (Figure 1). OSM's authority extends to only coal mining states (Figure 2) and is divided into three regions: Appalachian, Mid-Continent and Western. States within each region may receive regulatory authority or primacy to govern the coal mining activities within their boundaries. In states with no coal, OSM has no regulatory authority. SMCRA contains two requirements for blasters.

Section 515(b)15(D) states that the regulatory authority shall:

> *"require that all blasting operations be conducted by trained and competent persons as certified by the regulatory authority"*

Section 719 SMCRA states:

> *"In accordance with this Act, the Secretary of the Interior (or the approved State regulatory authority as provided for in section 503 of this Act) shall promulgate regulations requiring the training, examination, and certification of persons engaging in or directly responsible for blasting or use of explosives in surface coal mining operations."*

To implement SMCRA requirements, OSM promulgated two sets of rules. 30 CFR Part 850 contains the permanent program template for all regulatory programs (48 FR 9486, March 4, 1983). This part provides the minimum standards for each Federal or state regulatory program. Part 955 of 30 CFR establishes rules pursuant to part 850 of 30 CFR for the training, examination and certification of blasters by OSM for surface coal mining operations in States with Federal programs and on Indian Lands under Federal jurisdiction (51 FR 19444, May 29 1986). The principal OSM offices currently granting Blaster Certificates are the Knoxville Field Office in Tennessee and the Albuquerque Area Office in New Mexico.

The certification of blasters is an important regulatory function. Highly-trained and skilled blasters are crucial to ensure safe, efficient and compliant blasts in coal mining operations. Properly trained blasters can design and conduct blasts that use the best technology currently available, while meeting the regulatory performance standards of SMCRA. Highly-competent and successful blasters also maintain a responsible relationship with surrounding residents, thereby reducing the number of complaints. The states and OSM are responsible for certifying blaster competence based upon the right mix of experience, training and testing.

An OSM blaster certificate authorizes the blaster to conduct blasting operations in any Federal Program State or on Indian lands under Federal jurisdiction and furthermore may seek certificates from other RAs through reciprocal certification arrangements. While most blasters successfully maintain spotless performance records, OSM also tracks blaster certificates and performance histories and will suspend or revoke certificates as appropriate.

Figure 1, OSM Logo.

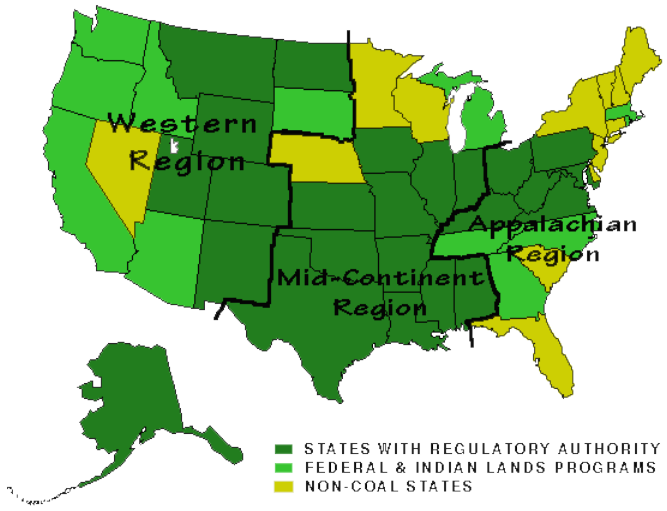

Figure 2. OSM/State Jurisdiction.

Application

Form OSM-74 is the Application for an OSM Blaster Certificate in Federal Program States and on Indian lands under Federal jurisdiction. OSM will verify training and experience information in the application. A fee must be submitted with the application as specified at 30 CFR 955.13. A check or money order must be made payable to "The Office of Surface Mining Reclamation and Enforcement". The fee is good for one application and testing.

The applicant must document blasting related training and experience, and demonstrate a pattern of conduct consistent with the acceptance of responsibility for blasting operations. Pattern of conduct criteria is met if the applicant has been deemed an Employee Possessor or Responsible Party by the Bureau Alcohol Tobacco Firearms and Explosives (ATF) under 27 CFR 555.11.

The applicant must be 21 years of age to become certified. Four types of certificates are available:

- Issued – Applicant passes the OSM Blaster Certificate Examination, good for 3 years.
- Renewal – 3 years after issuance, the blaster may renew the certificate for an additional 3 years.
- Re-issued – 6 years after issuance, the blaster must retake the OSM Blaster Certificate Examination.
- Reciprocity - An OSM Certificate is granted to a blaster holding a blaster certificate from a acceptable state program.

For both issued and reissued certificates the blaster must take and pass the OSM examination.

Effectively the blaster must retest every 6 years. Renewal is granted at the midterm of the six year testing interval. By retesting every 6 years the applicant must stay abreast of changes in blasting products, blast design procedures, monitoring tools, regulatory requirements and other changes in the blasting industry through continuing education venues or on-the-job training.

A reciprocity certificate may be issued to anyone with a certificate from a state with an OSM approved regulatory program. Quite often the applicant is from a state adjacent to a Federal program area and simply needs a certificate for temporary blasting work. Others may not want to take the more rigorous examination that covers national blasting applications and prefer to test on only local conditions. In either event the knowledge, experience, training and testing requirements are deemed satisfied by virtue of having a state issued certificate. However a reciprocal OSM certificate is contingent on successful maintenance of the state certificate. If the state certificate expires, is suspended or is revoked, OSM must take commensurate action on the OSM certificate.

Training

The applicant for certification must have received on-the-job training, completed a training course, and obtained satisfactory evidence of having completed classroom training. The training should include diverse mix of blasting products, blast design, field experiences, blast monitoring and regulatory issues. At this time, training almost completely relies on a blaster mentoring a blaster apprentice. In the future industry should move towards more formal training.

On-The-Job Training: Section 955.12(a) specifies this requirement. Success of the applicant is strongly dependant on the level and quality of on-the-job training provided by the certified blaster, i.e. the mentor. Without this valuable guidance the applicant will not adequately learn the technical nuances and safety protocols of the trade.

For certificate issuance, the apprentice must receive on-the-job training, including practical field experience in blasting operations, from a blaster for 2 out of the 3 years preceding application. Furthermore the apprentice must provide evidence from a blaster, employer, or other knowledgeable source, that satisfactory on-the-job training was received.

On-the-job training should be verifiable for 24 of the 36 months prior to application and may include the activities listed in Table 1. An apprentice that obtains a wide variety of experiences in many geologic conditions has the best chance of passing the examination.

Classroom Training and Duration: The responsibility of the use of explosives in surface coal mining operations falls in the hands of the certified blaster. It is of critical importance that the blaster have adequate classroom training and hands-on experience. Each applicant, within the two years prior to application for a certification, shall complete classroom training that covers the technical aspects of blasting operations and State and Federal laws governing the storage, transportation and use of explosives, including the topics specified in Table 2. Neither the rules nor the preamble define the depth of training or duration of the classroom training. In order to cover all the subjects listed in Table 2, sufficient time should be given to present the course material and to allow the students to have enough

time to practice solving problems. Considering the wide range of topics to be covered, a minimum 32-hour classroom training session over the course of many weeks is recommended.

Available Classroom Training Classes: The Federal rules require that OSM provides courses or otherwise makes certain that persons seeking a blaster certificate are able to find the training needed. Neither SMCRA nor the Federal regulations at 30 CFR Section 955 specifies or lists the methods to be used and the degree of involvement by OSM. Across the nation, training classes are available from explosive suppliers, universities, professional organizations, consultants and states. Blasting apprentices should select training that enhances their technical skills and provides the information necessary to pass the examination.

Unfortunately, no technical schools outside of the conventional 4-year engineering schools have been available to the blaster apprentice for in-depth instruction in the United States. The only existing technical training programs are with individual vendors, explosives manufacturers or blasting service providers. In the Spring of 2010, Bridgemont Community and Technical College in West Virginia will offer an Associate in Applied Science degree in Blasting Technology (www.bridgemont.edu). This will provide a significant resource to the blaster apprentices. The only other North America option is Fleming College in Ontario, Canada which offers a Blasting Techniques certificate (www.flemingcollege.com).

Table 1. Potential On-the-Job training activities.

Blast site management	Adverse affects control (seismology, acoustics, fumes)
Different explosives products	Blasting seismograph use
Different initiation systems	Calculations
Blast design	Flyrock control
Site preparation	Record keeping
Borehole loading	Regulations
Geology evaluation	Public Relations
Blast plan development	Software use
Blast area determination	Importance of spatial relations
Inventory tracking	Blast record completion
Blast hole drilling	Crew training
Recognizing unique conditions	Handle misfires
Explosives storage	Safety procedures
Explosive transportation	Preblast surveys

Table 2. Classroom training, examination subjects and question distribution.

30 CFR 850.13 Subject	Technical	Regulatory
1(i) Explosives – selection of type to be used	3	
1(ii) Explosives – determination of the properties which will produce desired results at an acceptable level of risk	3	
1(iii) Explosives – handling, transportation, and storage		2
2(i) Blast designs – geologic and topographic considerations	5	
2(ii) Blast designs – design of a blast hole, with critical dimensions	8	
2(iii) Blast designs – pattern design, field layout, and timing of blast holes	6	
2(iv) Blast designs – field applications	8	
3 Loading blastholes, including priming and boostering	5	
4 Initiation systems and blasting machines	6	
5 Blasting vibrations, airblast, and flyrock	3	
5(i) Blasting vibrations, airblast, and flyrock – monitoring techniques	3	
5(ii) Blasting vibrations, airblast, and flyrock – methods to control adverse affects	7	
6 Secondary blasting applications	1	
7 Current Federal and State rules applicable to the use of explosives		3
8 Blast records		7
9 Schedules		2
10 Preblasting surveys		1
10(i) Preblasting surveys – availability		1
10(ii) Preblasting surveys – coverage		1
10(iii) Preblasting surveys – use of in blast design	2	
11 Blast-plan requirements		5
12 Certification and training		1
13 Signs, warning signals, and site control		4
14. Unpredictable hazard including Lightening, Stray currents, Radio waves and Misfires	3	
Total	**63**	**27**
Percent	**70**	**30**

Completion of Classroom Training: Each applicant will obtain from the training provider satisfactory evidence of training completion that covers all the topics of Table 2. The applicant has the burden of demonstrating to the satisfaction of OSM that the training was completed (51 FR 19450). Satisfactory evidence of completed training includes, but is not limited to: 1) Certificate of Attendance, 2) Letter of Attendance, or 3) Transcript with passing grade. For the purpose of applying for an issued certificate (i.e. taking the examination), this training requirement is met if the applicant has a valid blaster certificate issued by one of the state regulatory authorities.

Continuing Education: Applicants for reissuance of an OSM blaster certificate, must show training that covers any significant changes in the topic areas of Table 2 unless OSM determines that no significant change have occurred. Significant changes in blasting products, blast design processes, monitoring tools, etc. happen annually and many blasting conferences that cover these topics are available annually throughout the country. The blaster must receive and complete at least 24 hours of continuing education within the 6 years before application for reissuance.

Experience

The applicant must demonstrate that the appropriate level of experience was obtained within the 3 years prior to certificate application. OSM will accept as equivalent all experience gained in activities which reasonably approximate the environment, procedures, blast size, and hazards of surface coal mining (51 FR 19448). This experience must be obtained by working with explosives or within activities associated with explosives use either inside or outside the coal industry. The necessary amount of experience depends on the type of certificate application.

- Issuance – worked for 2 years in any capacities as listed in Table 1.
- Reissuance or renewal – worked for 1 year in any capacities as listed in Table 1

Examinations

Once the applicant has met the training and experience requirements, a written examination is scheduled. The rules do not specify the language of the written examination. However, the preamble clearly state that the written examination should be in English. "The laws and regulations governing blasting are written in the English language. All the information published by the Institute of Makers of Explosives on the safe storage, transportation and use of explosives is in the English language. In order to understand the technical specifications of explosives, prepare blast designs, submit required records, interpret safety notices and other information, and give on the job training to persons under his or her supervision, a blaster must be able to read and write the English language. The only way to adequately measure a candidate's ability to understand these materials and do these things is through a written examination in the English language." (51 FR 19454)

An objective examination, with a good balance of technical and regulatory questions is the backbone of the blaster certification program. The examination will test the applicant's knowledge, abilities and critical thinking skills and cover topics specified in Table 2 with:

- Objective questions;
- Blasting log problems; and
- Initiation system and delay sequence problems

Two fundamental categories of topics exist: Technical and Regulatory. The Blaster Certificate Coordinator will maintain a pool of questions categorized by the topics in Table 2 to ensure complete coverage of the required topics. From the question pool, the examination will consist of:

- Multiple choice questions
- 80 to 90 questions
- 100 points
- Single to five point questions
- A blast log completion problem

The examination will be formulated by the Blaster Certificate Coordination. A 70% Technical / 30% Regulatory split of exam questions will best establish blaster competency. Table 2 shows the approximate guideline on the number of questions to be presented on each test for each category to place proper emphasis on the required topics based on 90 questions. The last 10 questions will be blast design and record keeping problems.

The technical part of the examination assumes that the blaster has control over all blast design items except:

- Geology
- Depth to grade or mineral and
- Distance to nearest structure.

A critical part of the examination is to evaluate the applicant's critical thinking skills and ability to perform blasting calculations in blast design and vibration control. The correct answers to all blast design related questions will be obtained by using the Rules-of-Thumb contained in Appendix A. This handout will be provided as part of the testing package. Successful completion of the examination will require the use of a calculator to perform all blasting calculations. Any explosive storage, transportation and safety questions will be in reference to the Institute of Makers of Explosives guidelines.

The regulatory questions will be related to the Federal regulations on blasting. Most of the questions will focus on the OSM rules that are meant to prevent injury to persons and damage to public and private property. The prevention of injury to persons includes the workforce as well as people outside

the permit boundary. At least one question from the regulations of the Bureau of Alcohol Tobacco Firearms and Explosives (ATF) and the Mine Safety and Health Administration (MSHA) will be on the examination. These questions will have been approved by those regulatory authorities prior to inclusion. This will ensure broad regulatory coverage in the training programs.

A minimum **passing score of 80%** on the written examination is necessary to demonstrate competency and receive an OSM blaster certificate.

Reciprocity

Reciprocity applicants will complete the necessary items in the OSM-74 application. Applicants do not need to meet the age, experience, knowledge, competence, training or examination requirements as required to receive an issued certificate. These requirements are satisfied once the application is deemed complete and certification in an OSM approved state regulatory program is verified. The applicant must then obtain a photograph at the nearest OSM office and present two forms of identification.

As reciprocity certifications increase, so too does the need for reliable, up-to-date information on the status of a blaster's certificate. Currently, if an application is received for reciprocity, OSM must contact the state to verify certification. Then the state must manually search the certification files for the current status of blasters. OSM is currently developing a tracking system to facilitate certificate reviews and performance history queries. Furthermore, a blaster certificate tracking system will help identify irresponsible blasters from repeating poor performance in the OSM Regions and states.

OSM certificates issued through reciprocity require continued certification (i.e., renewed, in good standing, etc.) in the original issuing jurisdiction. If the original issuing jurisdiction suspends or revokes a certificate, OSM must suspend the reciprocal certificate until the original certificate is reinstated. When OSM revokes or suspends a reciprocal certificate, the state with original certificate will be notified about the action of any necessary action. Both OSM and the states depend upon the assistance of each other to carry out this part of their program and to ensure that blasters with poor performance histories are either retrained or restrained from blasting at coal mines.

Certificates

Once an applicant has fulfilled the requirements of training and passed the examination, the blaster obtains an OSM blaster certificate as shown in Figure 3. Certificates are issues at the local OSM Region and will be issued the within 20 days of the examination. Each certificate will expire as described at 30 CFR 955.15(c). A digital color photograph of each applicant will be taken at the time of testing of each applicant and each photograph will be good for 6 years.

OSM BLASTER CERTIFICATE
IDENTIFICATION CARD

NAME OF BLASTER		
SIGNATURE OF BLASTER		
ADDRESS		
BIRTH DATE	HEIGHT	WEIGHT
COLOR HAIR	COLOR EYES	ISSUE DATE

CERTIFICATE NUMBER OSM-955-1701	EXPIRATION DATE 12/17/2011	
NAME & TITLE OF ISSUING OFFICER	CERTIFICATION TYPE	
	ISSUANCE	
	RENEWAL	
SIGNATURE OF ISSUING OFFICER	REISSUANCE	
	REPLACEMENT	
	RECIPROCITY	

- Notify OSM within 30 days of any change in address
- If found, drop in U.S. mail box: Office of Surface Mining, 1951 Constitution Ave. NW, Washington, DC 20240
- Property of the U.S. government, counterfeiting, alteration, or misuse is a violation of Section 499 and 701, Title 18 U.S. Code

OSM Office of Surface Mining. Technical Support Division

Figure 3. OSM Blaster Certificate Card.

Resources and Contacts for Federal Blaster Certificates

Table 3 lists the current OSM resources and contacts for blaster certificate applications and questions. In particular the Appalachian Region Blasting Download Page (www.ARblast.osmre.gov) has applications, regulations, US Bureau of Mines Publications, OSM research reports, training aids and numerous subject matter related papers on blasting. OSM is committed to making technology information readily available to the blaster and is willing to post information as requested.

Table 3. OSM Rules, Regulation, Research and Resources

Application for an OSM Blaster Certificate, information on testing, and training resources	www.ARblast.osmre.gov
OSM Blaster Certificate Coordinator, Appalachian Region	Kenneth Eltschlager, (412) 937-2169
Mid-continent Region	David Best, (618)-463-6463 ext. 5123
Western Region	Gene Hay, (303)-293-5036
Knoxville Field Office application center	Dennis Clark, (865) 545-4103 x137
Albuquerque Area Office application center	Rade Orell, (505)-248-5086

Conclusion

OSM policy is to ensure that only qualified, competent individuals are granted and maintain OSM Blaster Certificates. OSM is beginning to conduct more rigorous testing that emphasizes the necessity and breath of blaster responsibility.

Blasters must have knowledge and authority to blast in an efficient and safe manner. The OSM certificate program includes experience, training and testing components similar to many of the states. In the absence of a technical trade school for blasting, the blasting apprentice strongly relies on the certified blaster (mentor) to learn the technical, safety and regulatory aspects of the profession. A

national blaster certificate program is vital as it serves to: facilitate coal production to meet the nation's energy needs, protect people and property on and adjacent to Federal mining permits, and forms a basis for states to grant reciprocity certificates to Federal blasters. But where a state program may focus on the specific blasting applications within its boundary, the OSM certificate requires a very diverse test to cover all potential blasting applications and products across the nation. Therefore, the Federal certificate is a good surface mining credential for blasters anywhere in the United States.

References

1. Certification of Blasters in Federal Program States and on Indian Lands, 30 Code of Federal Regulations, Section 955, 2009.
2. Federal Blaster Certification Program and Blasting Enforcement, Directive Reg-33, Office of Surface Mining Reclamation and Enforcement, 2009
3. Federal Register, Volume 48, Number 44, March 4, 1983.
4. Federal Register, Volume 51, Number 109, May 29, 1986.
5. Lippencott, Stanley L., Training and Licensing Requirements for Blasters, ISEE, Annual Conference on Explosives and Blasting Technique, 1995.
6. Standards for Certification of Blasters, 30 Code of Federal Regulations, Section 850, 2009.

Appendix A
BLAST DESIGN RULES OF THUMB

HOLE DIAMETER (d) = hole depth (H) divided by 5 to 10.

d(in) = H(ft) / 5 to H(ft) / 10 (Typically H/7)

BURDEN (B) = 2 to 3 times the diameter.

B(ft) = 2 X d(in) to 3 X d(in) (Typically 2.5 X d)

SPACING (S) = 1 to 2 times the burden.

S(ft) = 1 X B(ft) to 2 X B(ft) (Typically 1.5 X B)

STEMMING (T) = 0.5 to 1.0 times the burden.

T(ft) = 0.5 X B(ft) to 1.0 X B(ft) (Typically 0.7 X B)

POWDER COLUMN (PC) = hole depth minus stemming.

PC(ft) = H(ft) - T(ft)

LOADING DENSITY (LD) = 0.34 times the explosive density times the hole diameter squared.

LD(lb/ft) = 0.34 X density(gm/cc) X d^2(in)

CHARGE WEIGHT (CW) = powder column times the loading density.

CW(lb) = PC(ft) X LD(lb/ft)

POWDER FACTOR (PF) = powder per hole divided by rock volume per hole.

PF(lb/yd^3) = CW(lb) / (B(ft) X S(ft) X H(ft) / 27)

SCALED DISTANCE (SD) = Distance to structure divided by square root of the charge weight.

SD(ft/$lb^{1/2}$) = distance(ft) / $CW^{1/2}$($lb^{1/2}$) (Greater than 55)

PEAK PARTICLE VELOCITY (PPV) = 438 times scaled distance to the -1.52 power.

PPV(in/s) = 438 X $(SD)^{-1.52}$ (Maximum expected)

Electric Circuit Formulas

RESISTANCE OF SERIES

Total Cap Resistance = $R_1+R_2+R_3+\ldots R_n$
Total Cap Resistance = Resistance of one cap X number of caps in circuit (if all caps are the same)

RESISTANCE OF PARALLEL CIRCUIT

$$\text{Total Cap Resistance} = \frac{\text{Resistance of one cap}}{\text{Number of caps in circuit}}$$

RESISTANCE OF SERIES PARALLEL

$$\text{Total Cap Resistance} = \frac{\text{Resistance of series}}{\text{Number of series}}$$

RESISTANCE OF WIRE

$$\text{Wire Resistance} = \frac{\text{length of wire (ft) X Resistance from table}}{1000 \text{ ft}}$$

TOTAL RESISTANCE OF CIRCUIT

Total Circuit Resistance = Cap Resistance + Wire Resistance

OHM'S LAW

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}} \quad \textbf{or} \quad \text{Voltage} = \text{Current} \times \text{Resistance} \quad \textbf{or} \quad \text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

Nominal resistance of EB caps with copper leg wires

Wire length (ft)	Resistance (ohms)	Wire length (ft)	Resistance (ohms)
4	1.4	24	2.3
6	1.6	28	2.4
8	1.7	30	2.2
10	1.8	40	2.3
12	1.8	50	2.6
16	1.9	60	2.8
20	2.1	80	3.3

Resistance of copper wire per 1000' @ 68 degrees (ohms)

Gauge	6	8	10	12	14	16	18	20	22
Resistance	.395	.628	.999	1.59	2.53	4.02	6.39	10.15	16.1