

Appendix 8
Blasting Protocol



BLASTING PROTOCOL

HIGHGATE/WOODLANDS DEVELOPMENT

REED ROAD

TOWN OF NORTH SALEM

WESTCHESTER COUNTY, NEW YORK

May 1, 2004

REV JULY 12, 2004

REV AUGUST 12, 2004

REV OCTOBER 15, 2005

REV MAY 7, 2010



BLASTING PROTOCOL

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FIGURES:

SCALED DISTANCE VS PARTICLE VELOCITY

VIBRATION CHART

DISTANCE VS CHARGE STRENGTH

DRILL HOLE LOCATIONS

DELAY CAPS

NYS UNIFORM FIRE PREVENTION

ROCK REMOVAL PROCEDURES

I. INTRODUCTION

The Highgate Woodlands EIS indicated that ledge rock removal was proposed, anticipated and required throughout the single family residential subdivision approval process. The purpose of this report is to outline the procedures and recommendations to minimize the environmental impact and disturbance to the surrounding area.

Blasting to prepare the land for construction of the site for the proposed project uses will conform with Town Code, Chapter 48, "Blasting and Explosives Law of the Town of North Salem" (Local Law No. 1 of 1999). The law requires that blasting be conducted between the hours of 8 A.M. and 5 P.M. except Sundays and Holidays (permitted only on special approval of the Building Inspector or in his absence by the Town Supervisor). Furthermore, that the person or company actually conducting the blasting must be permitted, insured and bonded to the Town to conduct such work. That the contractor must follow the blasting specifications set forth in Town Code, Chapter 48, "Blasting and Explosives Law of the Town of North Salem" (Local Law No. 1 of 1999) ie; minimum depth of bore holes, maximum charge size, safety features, etc. The blasting contractor's selected for this effort will comply with the requirements of Town Code, Chapter 48, "Blasting and Explosives Law of the Town of North Salem" (Local Law No. 1 of 1999).

Potential adverse impacts that could be experienced during blasting procedures include projectile fragments, vibration, noise, and subsurface movement.

II. VIBRATION AND DAMAGE CONTROL

The success of any blasting operation depends on the blasting contractor's capabilities and understanding of the operation. The contractor must select the appropriate explosive weight so that the disturbances are limited to less than a 1000 foot radius. In forecasting vibrations and damage control a "scale distance" formula is used. The scale distance is found by dividing the distance from the explosive device by the square root of the size of the explosive device. The visual representations provided which follow were taken from "The Standard Handbook for Civil Engineers", dated 1983.

For this project we are recommending that a scale distance of 50 feet or larger be utilized. Furthermore, a limit of vibration velocity to no greater than 2" per second should be used. With this in mind, according to the attached figures, vibration

damage is unlikely to occur at scale distances larger than 10 feet. For a margin of safety, we recommend the scale distances be kept at minimum of 50 feet.

Another important aspect of vibration control is the control of the emittance of vibration energy. Previous studies have found that damage from vibration is in the 4 to 12 Hertz frequency range. In this range we are suggesting that there should be a limit of to 0.5 inch per second.

III. PRE-BLAST SURVEY

A pre-blast survey shall be performed of all structures in close proximity to the blasting. The survey should include all existing structures within 1000 feet of any proposed blasting. The survey should be performed by a licensed professional blaster and should include photographs, detail descriptions of any cracks, separations, deformations and plumbness of structural elements.

IV. PROCEDURES

1. Insurance certificates must be filed with the Town of North Salem prior to performing any rock removal on the site.
2. All blasting must conform to the New York State Uniform Fire Prevention and Building Code.
3. A copy of the blaster's license shall be placed on file with the Town of North Salem.
4. A copy of the "Pre-Blast Survey should be filed with the Town of North Salem.
5. Since there is no specific seismic information on the site, initial test charges should be limited to 4 lbs. of explosives @ 40% GEL per 25 millisecond delay cap. The test charge should be monitored at a distance approximately 300 feet away from the blast site. Based on field testing, the blasting contractor can create a field driven "scale distance". At that point in time, a request can be considered to increase the charge. The testing procedures must be performed using a chart recorder seismograph with air pressure and ground particle motion charted.
6. The applicant shall make arrangements to monitor a domestic well either within the property or a nearby residence. The water level shall be determined prior to blasting, during the blast and post blast. In the event that any well experiences adverse affects, the blasting shall cease and arrangements shall be made to replace the affected well.

7. It is evident from the geology investigation that overburden soils will have to be removed prior to blasting. Further, it is noted on the drawings of the project that rock ripping will be employed whenever possible. Once the overburden soil is excavated the rock surface shall be drilled, charges placed and heavy woven steel blasting mats shall be positioned so as to prevent projectile fragments.
8. Transportation of explosive material shall be as per New York State Industrial Code Rule 39 (12 NYCRR 39), 49 CFR 177 (U.S. Department of Transportation) and 29 CFR 1926 Subpart U (OSHA).

V. PROJECT OPERATIONAL NOISE

The project will lead to a source of operational noise which will not result in the contravention of those noise standards contained in the Town of North Salem's Zoning Ordinance. Zoning Section 250-58 sets certain limits such as specific band width (frequency) strengths (decibels) which are not to be exceeded. These values apply to the lot lines of commercial real estate and are reduced by 6 decibels for residential properties. All of the frequency values are within the range of hearing but the human ear responds to each range at a different level of sensitivity.

To simplify the discussion, these limits were converted by a tabular analysis to a decibel, A-weighted scale (dba). The A-weighting approximates the response of the human ear (i.e., hearing) to wave pressures in ambient air. The Town's approximate dBA level is 55 to 56 at the lot line of a commercial use and 49 to 50 at the lot line of the residential uses. This level is about the level of normal conversational speech.

The operation of the proposed residential and commercial projects will remain within these values. However, the Zoning Ordinance specifically exempts construction noise between 8 A.M. and sunset, warning devices and traffic. Construction equipment and vehicles will have muffling devices as specified by the U.S. Environmental Protection Agency, Occupational Safety and Health Administration (OSHA)

The ordinance also contains a standard of very low frequency wave pressures which are the cause of operational vibrations (i.e., wave pressures are felt rather than heard). Operational vibration caused by the project's operational equipment (i.e., office building air conditioner) will also meet the Town's standard.

VI. HYDROGEOLOGY

As indicated by the aforementioned investigation, rock removal is required in order to construct the subdivision roadway system. Blasting will occur from the surface elevation to a depth of 35 feet below existing grade. When rock is encountered at these depths, explosive charges are required. When below surface explosives are

used, they have the potential to disturb the subsurface environment. The extent of the disturbance relates to the size of the charge, duration of the blast, and the depth of the charge.

The underlying area of the proposed development consists of Fordham Gneiss Rock. This rock tends to be hard bedrock generally found in large formations with localized areas of multiple fractures. Ground water in the bedrock traverses through the fracture zones. Traditionally the ground water velocities are low and the yields are in the 5 to 10 gpm range

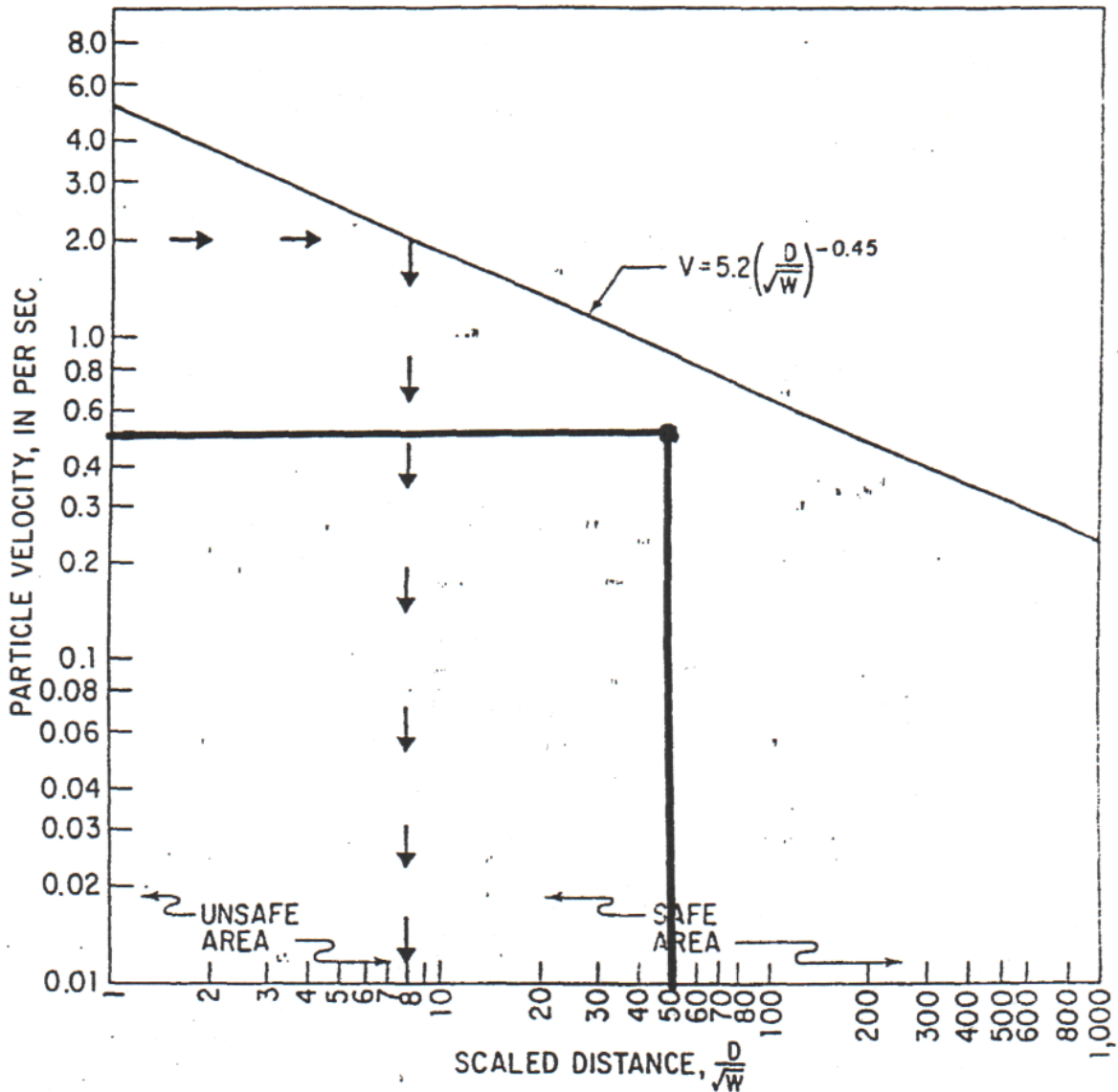


Fig. 13-23. Relationship between particle velocity (vibration) and scaled distance for a specific site, for which $H = 5.2$ and $\beta = 0.45$, in Eq. (13-22). For a maximum particle velocity of 2 in/s, the scaled distance is 8. Hence, vibration damage is unlikely at scaled distances larger than 8.

VIBRATION CONTROL IN BLASTING 13-37

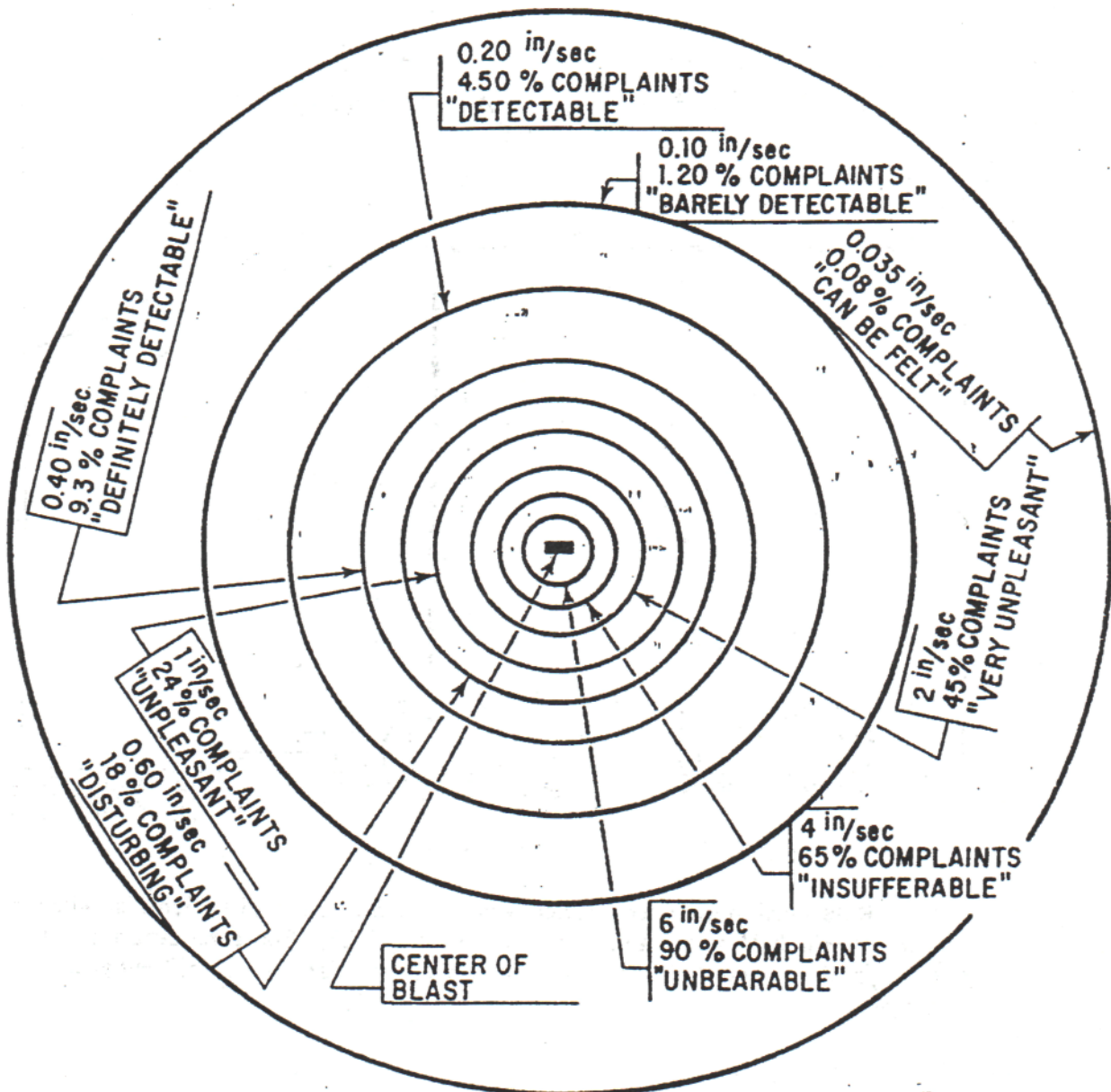


Fig. 13-24. Public reaction to blasting is indicated by the percentage of the total number of families exposed to a specific particle velocity that should be expected to complain, plotted to a logarithmic scale.

Most courts have accepted the fact that a particle velocity not exceeding 2 in/s will not damage any part of any structure. This implies that, for this velocity, vibration damage is unlikely at scaled distances larger than 8 (see Fig. 13-23).

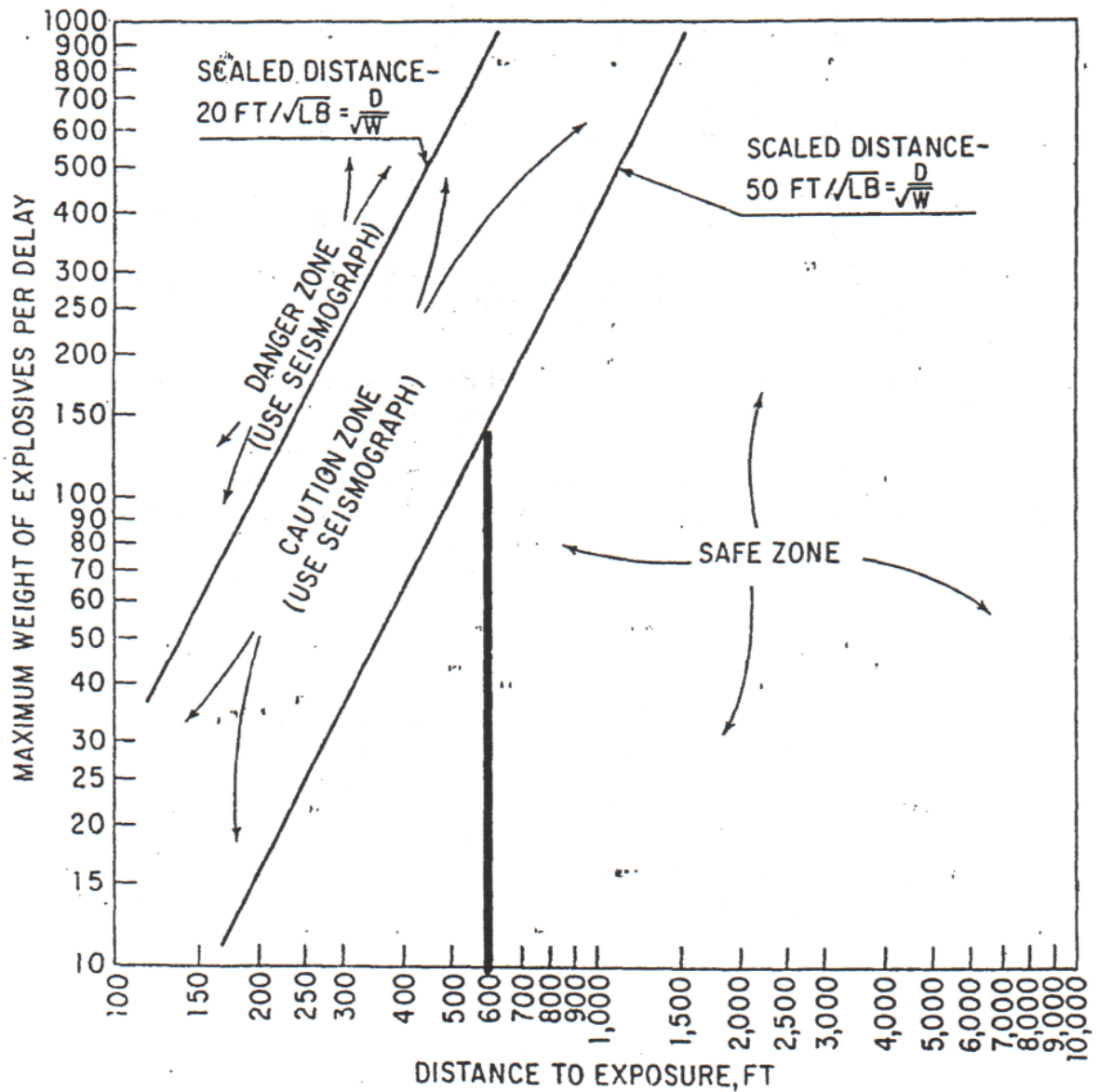


Fig. 13-22. Explosive weight and distance limits for prevention of damage by blasting vibrations.

ROCK-EXCAVATION BLASTING 13-31

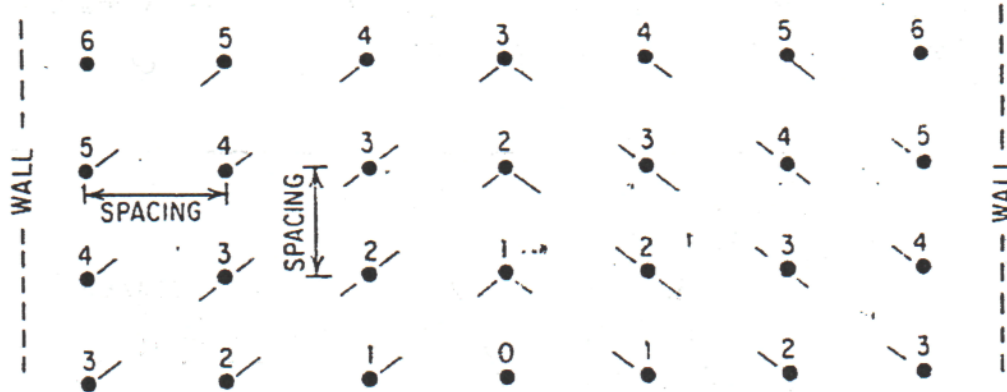


Fig. 13-18. Drill pattern for conventional blasting with holes all of the same diameter. Numbers indicate order of firing with delays.

TABLE 13-17 Powder Factor for Drill Pattern of Fig. 13-18

Spacing of holes, ft	Burden, yd ³	Powder factor*
FOR 9-IN -DIA HOLES, 25 FT DEEP, 10 FT LOADED, 207 LB OF AMMONIUM NITRATE		
20 × 18	333	0.62
18 × 16	267	0.78
16 × 14	207	1.00
14 × 12	156	1.33
12 × 10	111	1.57
FOR 6-IN -DIA HOLES, 25 FT DEEP, 16 FT LOADED, 147 LB OF AMMONIUM NITRATE		
18 × 16	267	0.55
16 × 14	207	0.71
14 × 12	156	0.94
12 × 10	111	1.32
10 × 8	74	1.99
FOR 5-IN -DIA HOLES, 25 FT DEEP, 17 FT LOADED, 109 LB OF AMMONIUM NITRATE		
16 × 14	207	0.52
14 × 12	156	0.70
12 × 10	111	0.98
10 × 8	74	1.47
8 × 6	44	2.46

*Pounds of ammonium nitrate, density 47 lb/ft³, per cubic yard of burden.

ROCK-EXCAVATION BLASTING 13-29

TABLE 13-15 Characteristics of Millisecond Delay Caps*

Delay period	Nominal firing time, ms	Interval between delay periods, ms
0	12	
SP-1	25	13
SP-2	50	25
SP-3	75	25
SP-4	100	25
SP-5	135	35
SP-6	170	35
SP-7	205	35
SP-8	240	35
SP-9	280	40
SP-10	320	40
SP-11	360	40
SP-12	400	40
SP-13	450	50
SP-14	500	50
SP-15	550	50
SP-16	600	50
SP-17	700	100
SP-18	900	200
SP-19	1,100	200
SP-20	1,300	200
SP-21	1,500	200
SP-22	1,700	200
SP-23	1,950	250
SP-24	2,200	250
SP-25	2,450	250
SP-26	2,700	250
SP-27	2,950	250

*Courtesy of Hercules Powder Co.

RE: STANDARD HANDBOOK FOR CIVIL ENGINEERS @ 1983

Types of rock	Explosive factor, lb/yd ³
Shales	0.25-0.75
Sandstone	0.30-0.60
Limestone	0.40-1.00
Granite	1.00-1.50

NEW YORK STATE UNIFORM FIRE PREVENTION AND BUILDING CODE



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PART 1176 EXPLOSIVES, AMMUNITION AND BLASTING AGENTS**1176.1 General Requirements**

1176.1a This Part shall apply to explosives, ammunition, blasting agents, and pyrotechnics, except that nothing in this Part shall be construed as applying to the following material listed in 1176.1a-1, 1176.1a-2, 1176.1a-3, 1176.1a-4, 1176.1a-5, 1176.1a-6, 1176.1a-7, 1176.1a-8: and 1176.1a-9

1176.1a-1 Such material used by the Armed Forces of the United States or the State Militia.

1176.1a-2 Explosives in forms prescribed by the official United States pharmacopeia.

1176.1a-3 Fireworks.

1176.1a-4 Small arms ammunition or special industrial explosive devices for personal or industrial use.

1176.1a-5 Quantities of smokeless propellant not exceeding twenty pounds total for hand loading of small arms and small arms ammunition for personal use.

1176.1a-6 Quantities of black powder not exceeding five pounds total for use in firing of antique firearms or artifacts or replicas thereof.

1176.1a-7 Quantities of small arms primers and percussion caps not exceeding 10,000 total for use in initiating smokeless propellant and black powder for the said uses.

1176.1a-8 Fifteen pounds or less of explosives or blasting agents, exclusive of smokeless propellants in educational, governmental or industrial laboratories for instruction or research purposes when under direct supervision of experienced competent persons.

1176.1a-9 Explosives, ammunition and blasting agents of the United States Bureau of Mines, the Federal Bureau of Investigation, the United States Secret Service, and police and fire departments acting in their official capacity.

1176.1b Listed fire extinguishing equipment shall be provided where explosives, ammunition or blasting agents are manufactured or stored.

1176.1c Smoking, matches, spark producing devices and open flames shall be prohibited where explosive material is stored, handled or used, and

- 1176.1d** Explosive material, including special industrial explosive material and any newly developed and unclassified explosives, shall be stored in magazines. This shall not be construed as applying to wholesale and retail stocks of small arms ammunition, fuse lighters, fuse igniters and safety fuses in quantities involving less than 500 pounds of explosive material; nor shall it apply to explosive-actuated power devices, when employed in construction operations in populated areas, in quantities involving less than 50 pounds of explosive material.
- 1176.1e** Magazines shall be located an appropriate distance from buildings, structures, railroads and highways commensurate with the type and quantity of explosives stored.
- 1176.1f** Magazines shall be kept locked except when being inspected or when explosives are being placed therein or being removed therefrom.
- 1176.1g** Magazines shall be kept clean, dry and free of grit, paper, empty packages and rubbish.
- 1176.1h** Combustible materials shall not be stored within 50 feet of magazines.
- 1176.1i** The land surrounding magazines shall be kept clear of brush, dried grass, leaves, trash and debris for a distance of at least 25 feet.
- 1176.1j** Blasting caps, electric blasting caps, detonating primers and primed cartridges shall not be stored in the same magazine with other explosives.
- 1176.1k** Blasting agents separate from explosives shall be stored in an area free from debris and empty containers. Spilled material shall be cleaned up promptly and safely removed.
- 1176.1l** Sale or display of explosives or blasting agents on highways, sidewalks, public property or in places of assembly is prohibited.
- 1176.1m** Explosives shall not be transported on public conveyances.
- 1176.1n** Vehicles used for transporting explosives shall be in accordance with the United States Department of Transportation Code of Federal Regulations Title 49. Smoking, carrying matches, flame-producing devices, firearms or loaded cartridges shall be prohibited while in or near a vehicle transporting explosives.
- 1176.1o** Wherever explosives regulated by this Part are stored or manufactured, legible, clearly visible warning signs or placards shall be displayed. Locations of such signs shall be established by the code enforcement official.