

Office of Surface Mining Reclamation and Enforcement



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OSM Responsibilities

- Balance Nation's Energy Needs vs. Environmental Needs
- Regulate Active Mines – Surface effects
 - Reclamation/Land Productivity, Protect Water, Slope Stability, **Blasting**
- Passes Responsibility to the States
 - OSM conducts oversight
 - Provides funding at 50%
- Fix Abandoned Mine Problems
 - Backfilling, Subsidence, Fires, Landslides, Water

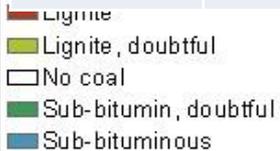


Coal Mining States

State/ Coal	2005 (million tons)	2006 (million tons)	2007 (million tons)	2008 (million tons)	2009 (million tons)
WY	404	447	454	468	431
WV	154	152	154	158	137
KY	120	121	115	120	107
Total	1131	1163	1147	1172	1075

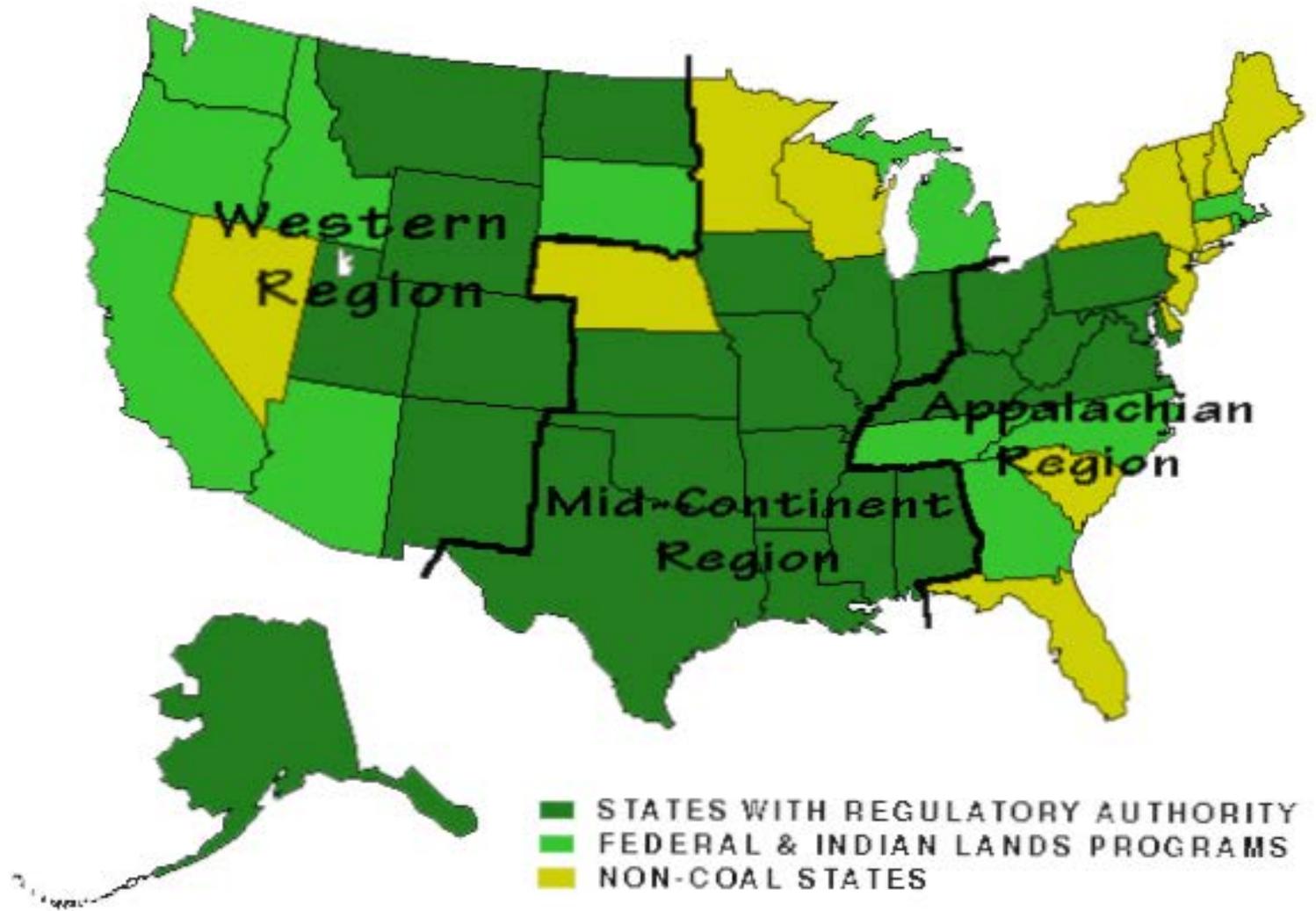


State/ Explo.	2005 (tons x1000)	2006 (tons x1000)	2007 (tons x1000)	2008 (tons x1000)	2009 (tons x1000)
WY	582	628	638	676	378
WV	474	530	489	425	349
KY	370	357	368	388	293
Total	3200	3160	3,150	3420	2270





OSM & Regulatory Authorities





Surface Mining Control and Reclamation Act of 1977 (SMCRA)

SECTION 515(b) General performance standards shall be applicable to all surface coal mining and reclamation operations and shall require the operation as a minimum to --

(15) insure that explosives are used only in accordance with existing State and Federal law and the regulations promulgated by the regulatory authority, which shall include provisions to -

(A) provide adequate advance **written notice** to local governments and residents who might be affected by the use of such explosives by publication of the planned blasting schedule in a newspaper of general circulation in the locality and by mailing a copy of the proposed blasting schedule to every resident living within one-half mile of the proposed blasting site and by providing **daily notice** to resident/occupiers in such areas prior to any blasting;



SMCRA

- (B) maintain for a period of at least **three years** and make available for public inspection upon request **a log** detailing the location of the blasts, the pattern and depth of the drill holes, the amount of explosives used per hole, and the order and length of delays in the blasts;

- (C) limit the type of explosives and detonating equipment, the size, the timing and frequency of blasts based upon the physical conditions of the site so as to **prevent (i) injury to persons, (ii) damage to public and private property outside the permit area, (iii) adverse impacts on any underground mine, and (iv) change in the course, channel, or availability of ground or surface water outside the permit area;**



SMCRA

- (D) require that all **blasting operations be conducted by trained and competent persons** as certified by the regulatory authority;
- (E) provide that upon the request of a resident or owner of a man-made dwelling or structure within one-half mile of any portion of the permitted area the applicant or permittee shall conduct a **pre-blasting survey** of such structures and submit the survey to the regulatory authority and a copy to the resident or owner making the request. The area of the survey shall be decided by the regulatory authority and shall include such provisions as the Secretary shall promulgate.



Use of Explosives Rules - 30 CFR (1983)

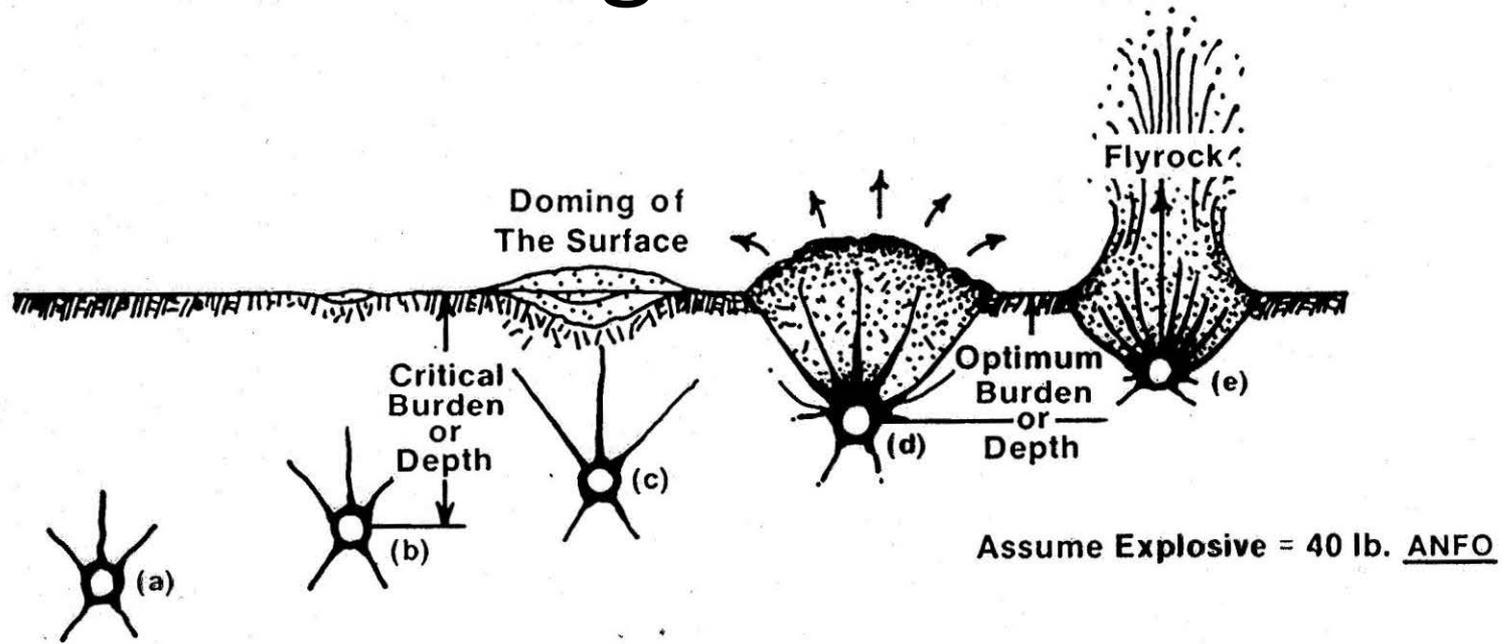
- Blast Plans (780.13)
- General requirements (816.61)
- Preblasting surveys (816.62)
- Blasting schedules (816.64)
- Blasting signs, warnings, and access control (816.66)
- **Control of adverse effects (816.67)**
- Records of blasting operations (816.68)
- **Certification of blasters (850)**



Adverse Effects

- Standards for ground vibrations and airblast, USBM based
 - 4 tier ground vibration standard
 - 4 airblast levels based on sensitivity of the microphone
 - Adopted by most regulatory authorities, IME and NFPA
- Flyrock is distance or property based
- Fumes and dust as an imminent danger

Blasting Basics



(a) B = 15'

Completely contained, only failure is pulverisation near the charge and radial tensile failure running out from it.

(b) B = 12'

Start of surface failure. Burden not broken. Some doming of the surface.

(c) B = 9'

Surface and subsurface failure almost meet. There will be a shelf of unbroken rock between the two. Doming or surface bulging.

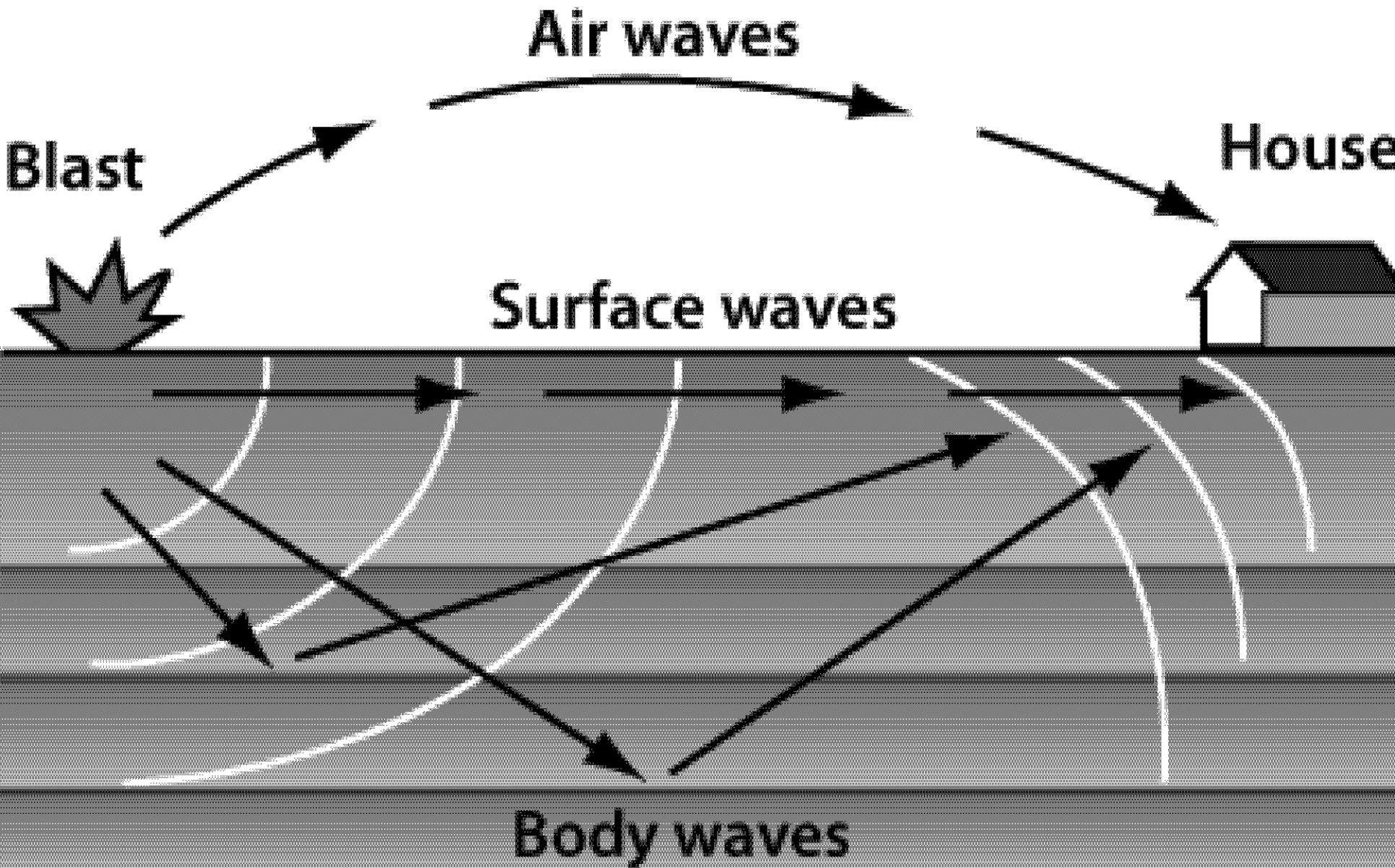
(d) B = 6'

Full crater, burden completely broken out. Surface and subsurface failures run through to the surface.

(e) B = 3'

Full crater, lower volume than optimum fine fragmentation. Noise flyrock, bowl shaped crater.

Figure 7.17. Schematic of the Effect of Decreasing the Burden on Charges Fired in Rock.



Coal Mine Terms

Spatial Relationships

Blast Site

Blast Area

Permit Area

 **Complainant**

House 2



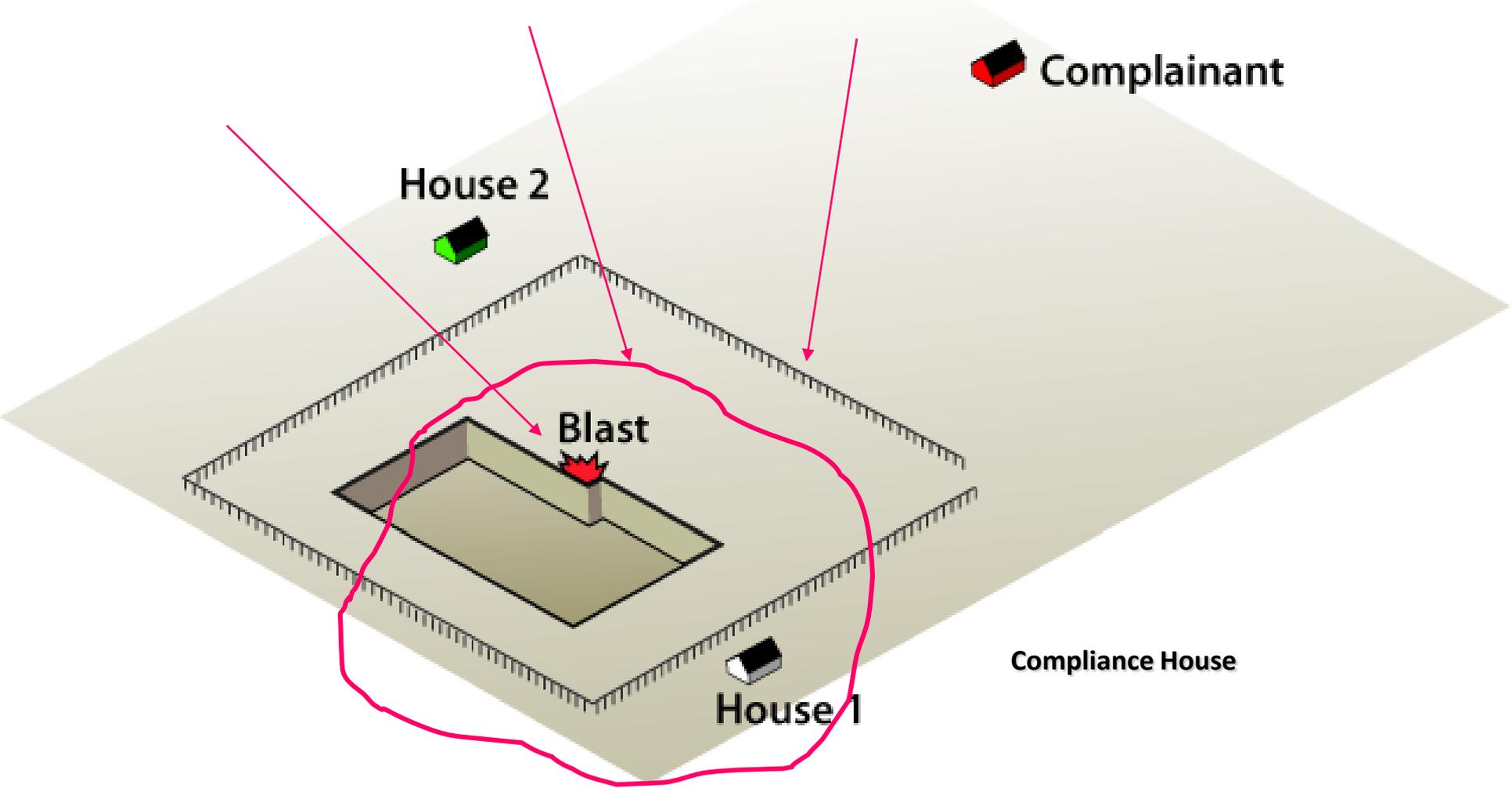
Blast



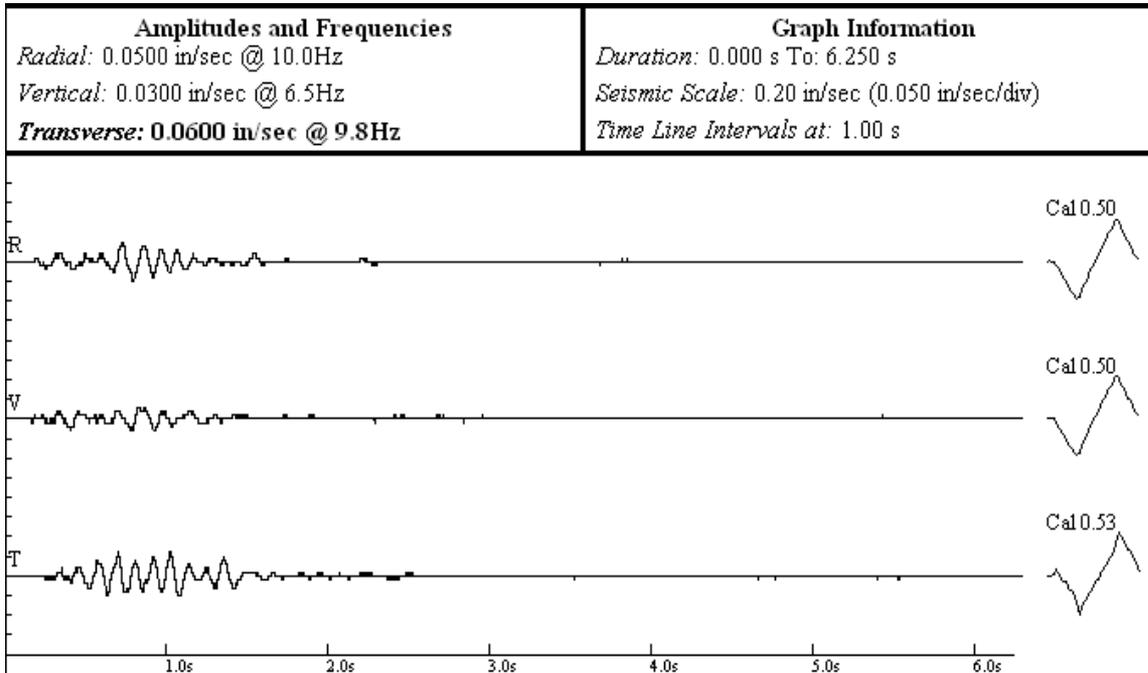
House 1



Compliance House

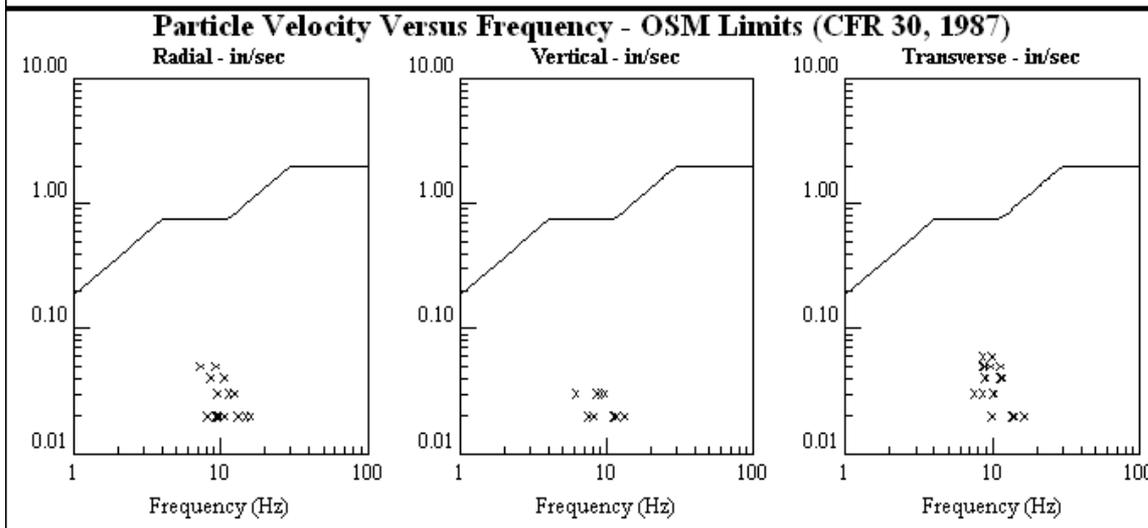


Ground Vibration Limits



Based on Structure Response

Pre 1980 – 2.0 in/s





Annoyance

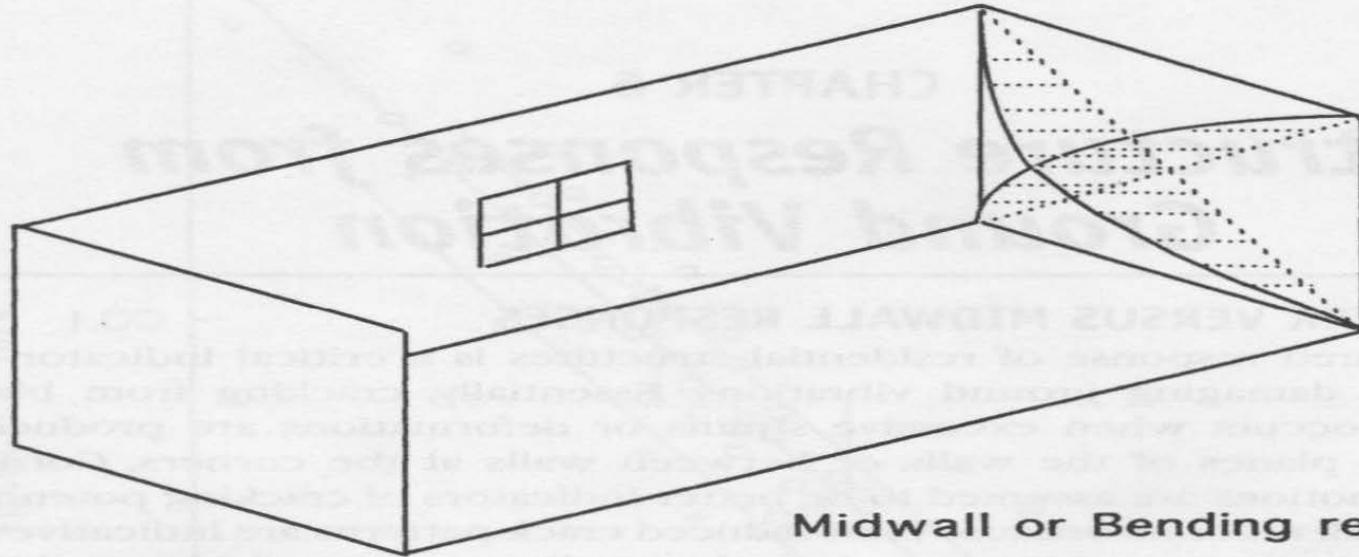
- Rattling Windows
- Wall Hangings Misaligned
- Trinkets Moved
- Startle
- Fear

Damage

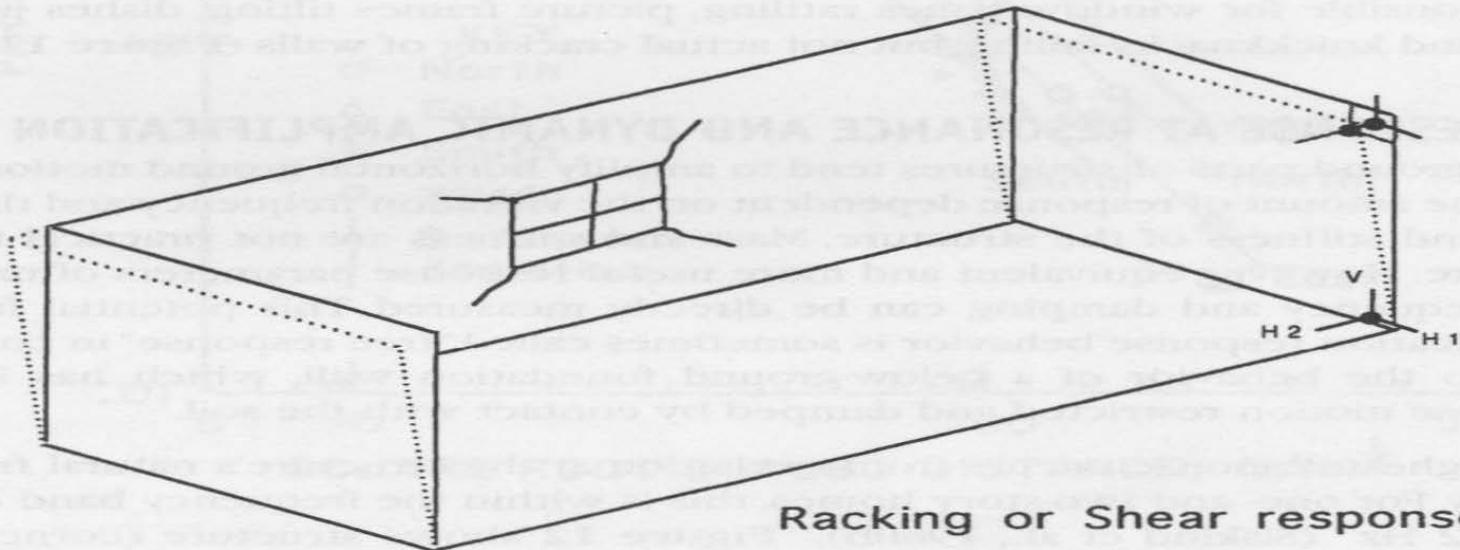
- Broken Trinkets
- Cracks in Plaster & Sheetrock
- Broken Windows
- Cracks in Masonry Joints
- Cracks in Block & Brick
- Cracks in Concrete



Two modes of structural response:



Midwall or Bending response



Racking or Shear response

FIGURE 11. Idealized racking and midwall responses of a low-rise structure.

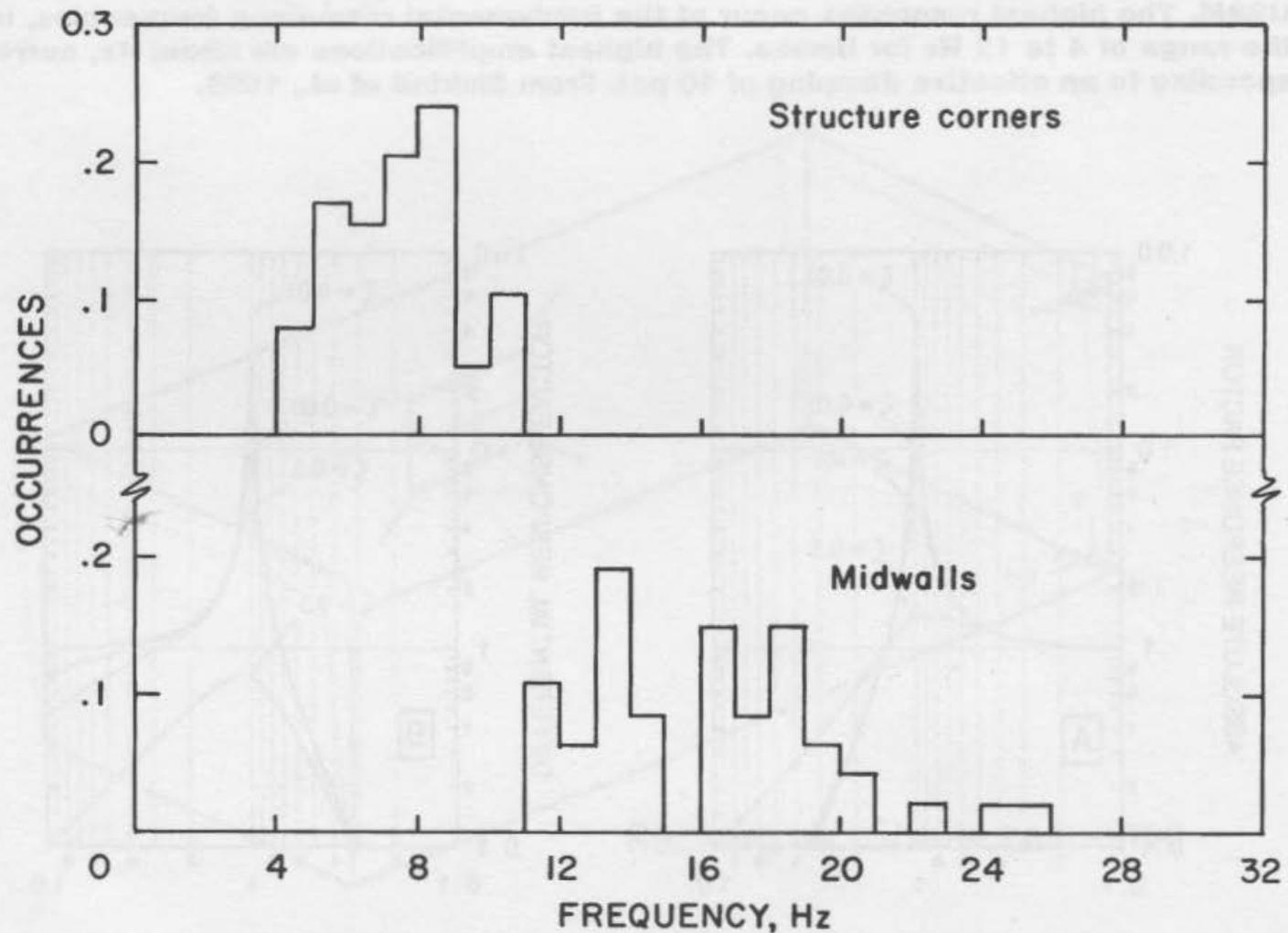


FIGURE 14. Natural frequencies of homes as reported in USBM RI 8507 (Siskind et al., 1980b). Corners represent racking of whole-structure response, and midwalls represent membrane-type flexure with associated secondary noises and rattling. The lighter and more flexible walls have higher natural frequencies and relatively large motions.

Damage Levels

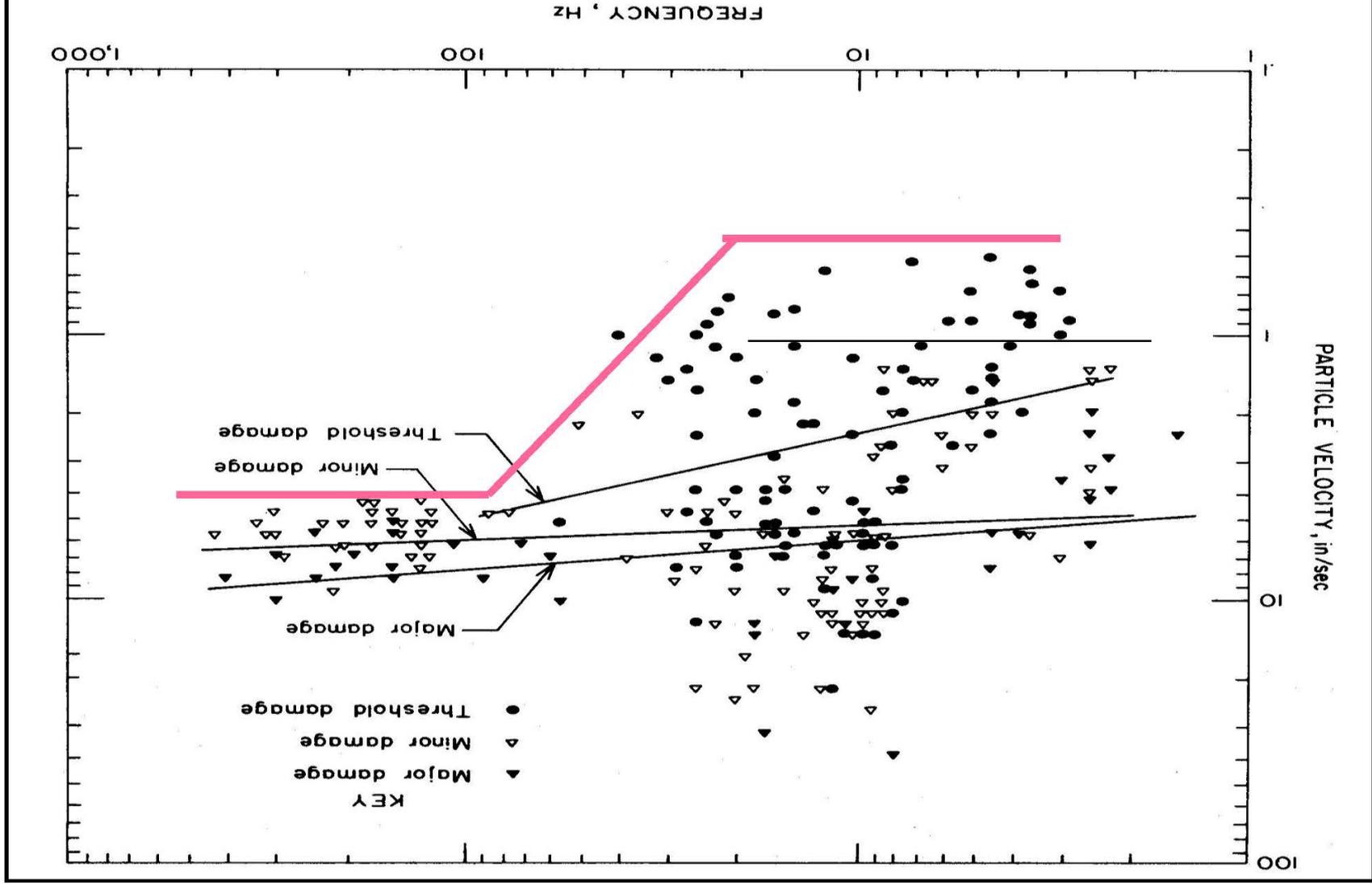


Figure 54.—Velocity versus frequency summary, set 7 mean and variance analysis.

RI 8507 – Appendix B

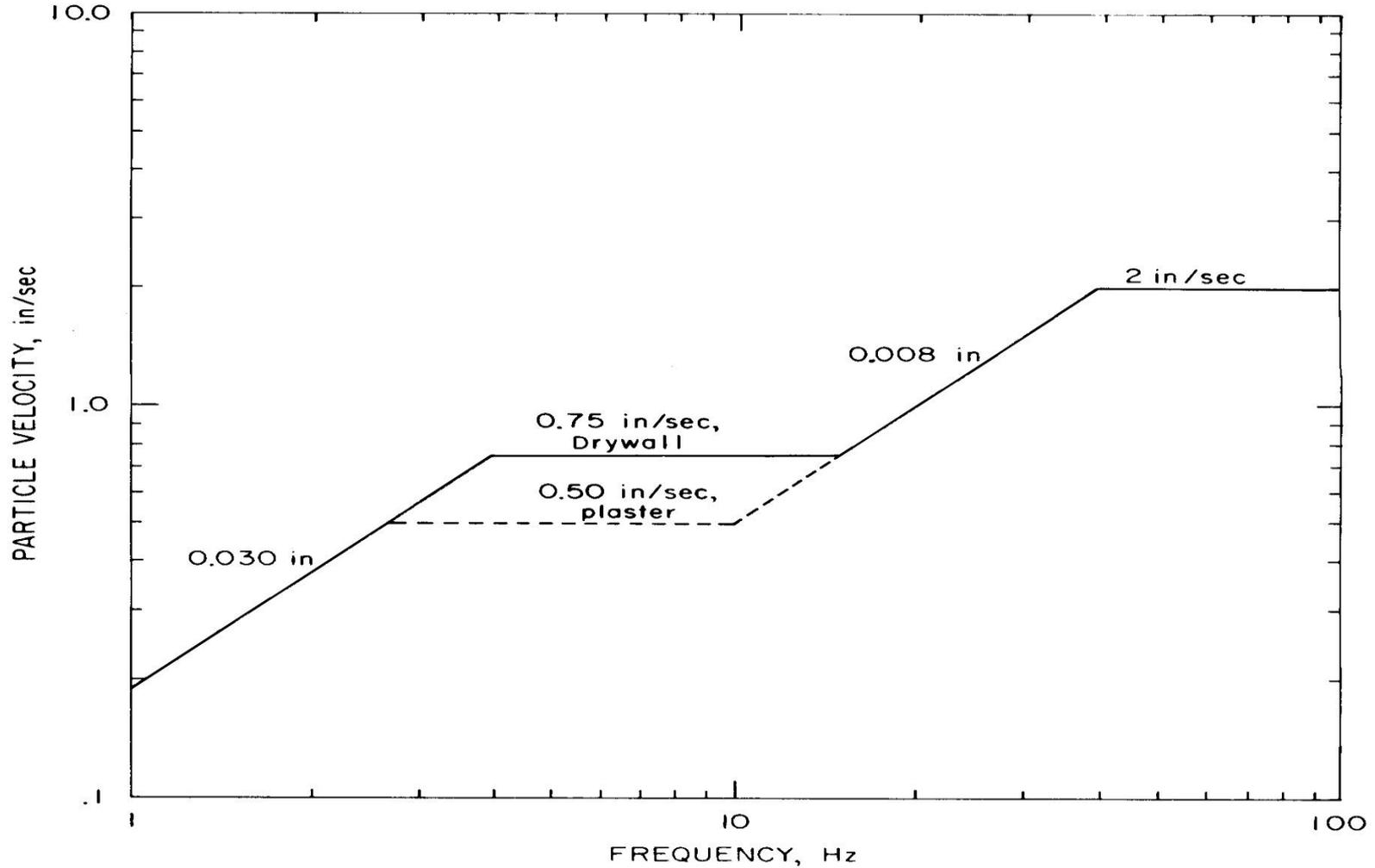
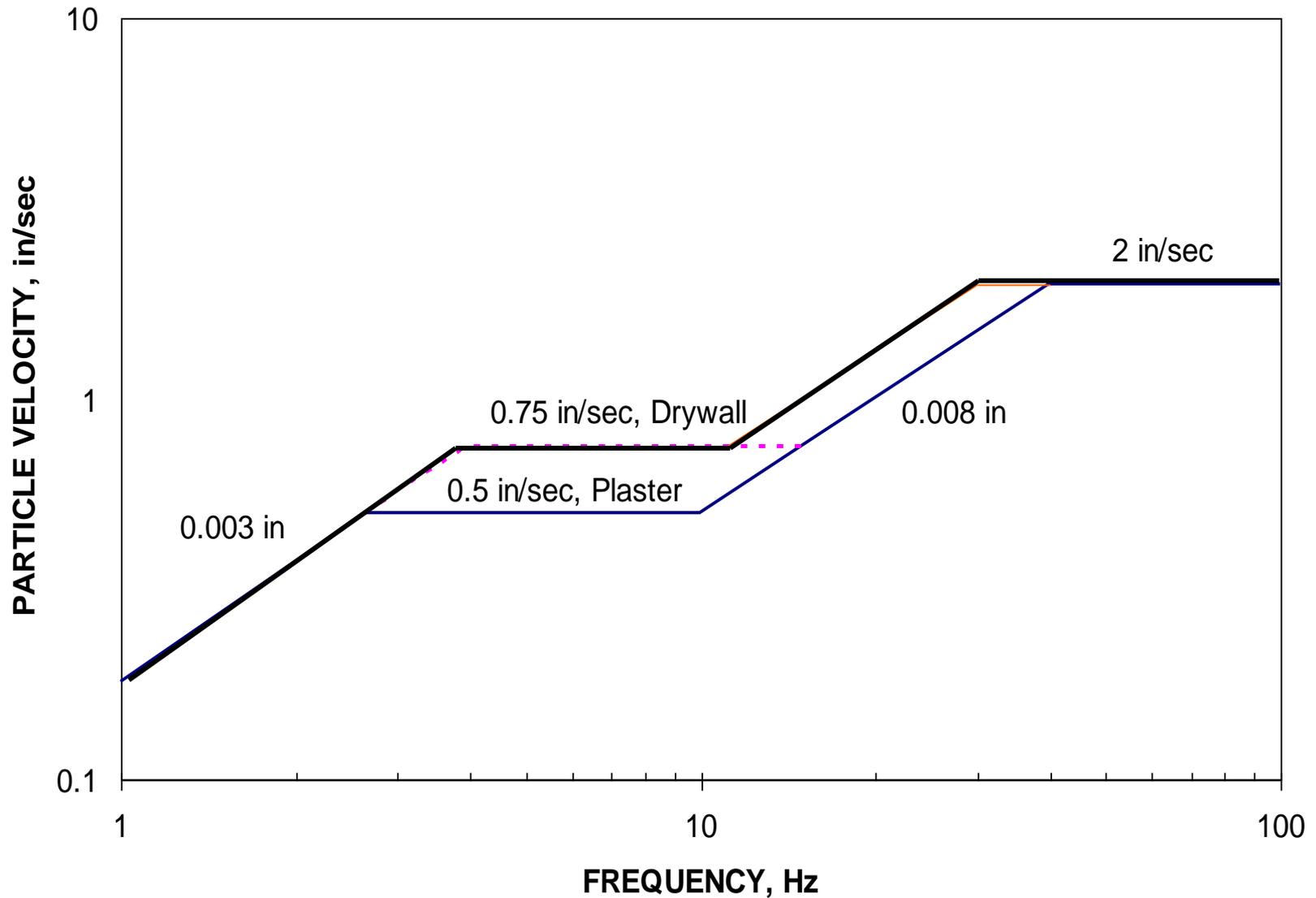


Figure B-1.—Safe levels of blasting vibration for houses using a combination of velocity and displacement.

OSM Blasting Level Chart

RI 8507 APPENDIX B. -- ALTERNATE BLASTING LEVEL CRITERIA



Ground Vibration Limits

<u>Distance</u>	<u>SD</u>	<u>PPV</u>
0 - 300	50	1.25
301 – 5000	55	1.00
5001 and beyond	65	0.75

** Distance is used to account for frequency!!

** Modified scaled distance, 4th option

Amplitudes and Frequencies

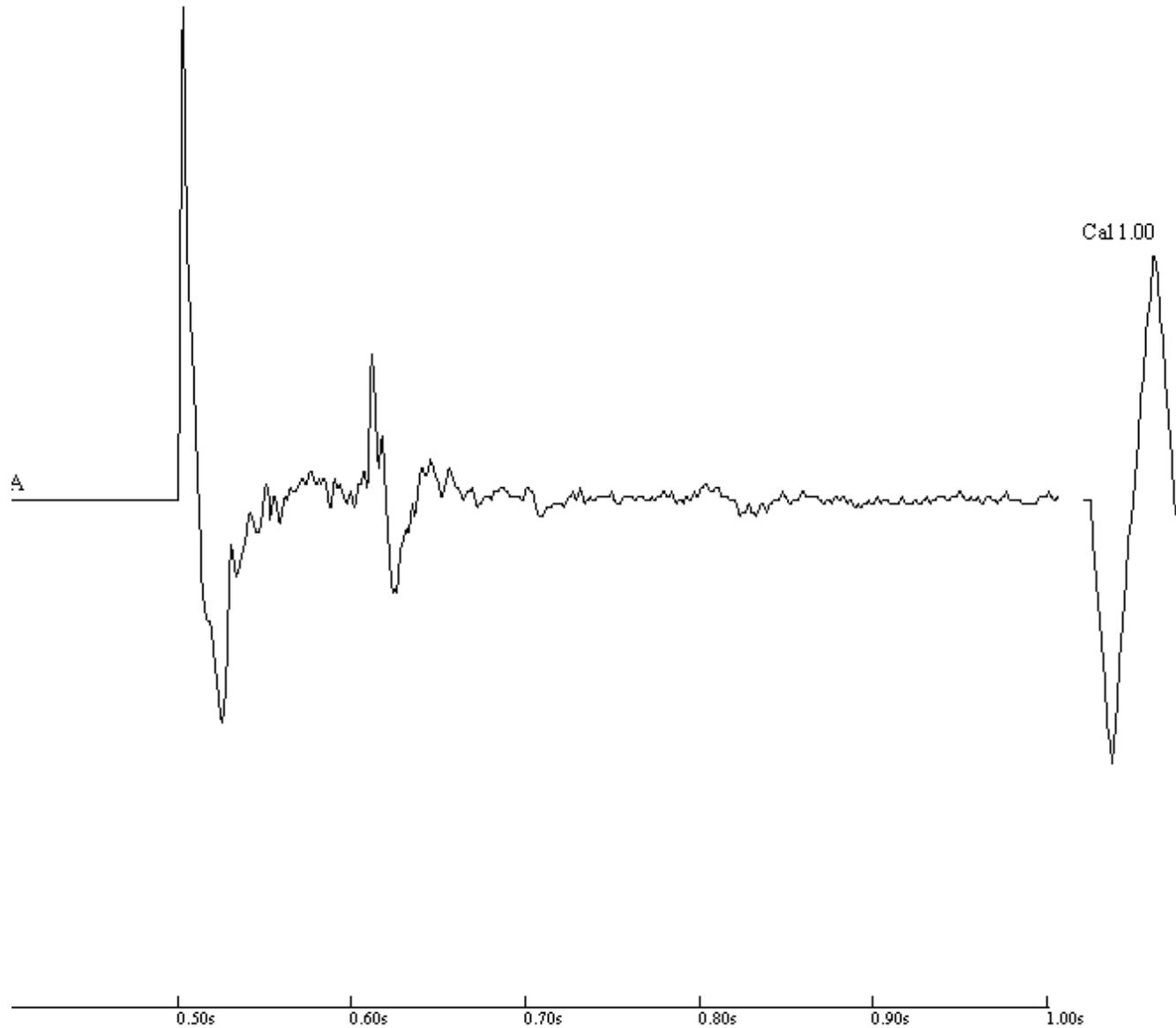
Acoustic: 148 dB, 4.88 Mb, 0.0708 psi, 0.4880 kPa @ 40

Graph Information

Duration: 0.400 s To: 1.000 s

Acoustic Scale: 148 dB

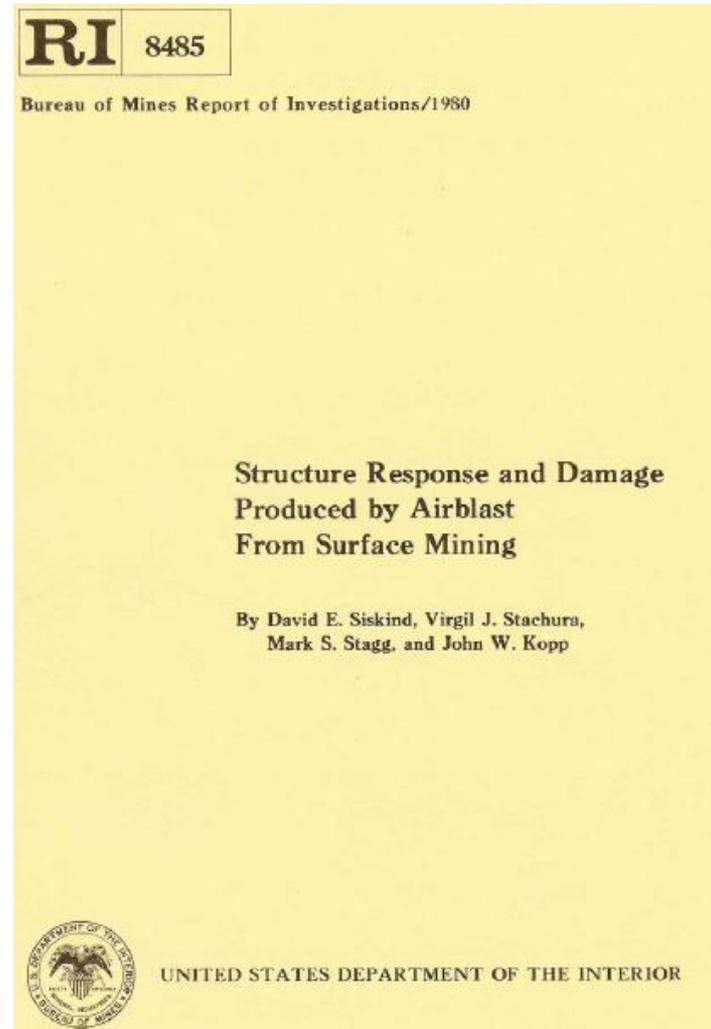
Time Line Intervals at: 0.10 s



Air blast

Damage / Injury Levels

- 133 dB generate the same structure response as 0.5 in/s
- 0.03 psi or 140 dB -windows may break
- 2-4 psi, ear drum rupture (Hirsch, 1968)
- The pressure of the wind at 40 mph is equal to about 140 dB



Lower frequency limit of measuring system, in Hz (+/- 3 dB)	Maximum level, in dB
0.1 Hz or lower--flat Response¹	134 peak
2 Hz or lower--flat Response	133 peak
6 Hz or lower--flat Response	129 peak
C-weighted--slow response¹	105 peak dBC

Air blast Limits

- 2 Hz microphone 133 dB
- No Scaled Distance counterpart.
- All seismographs manufactured today have 2 Hz lower frequency response range.
- 0.1 Hz, 6 Hz and C-Weighted scale type microphones are not appropriate with today's technology

Compliance and Damage

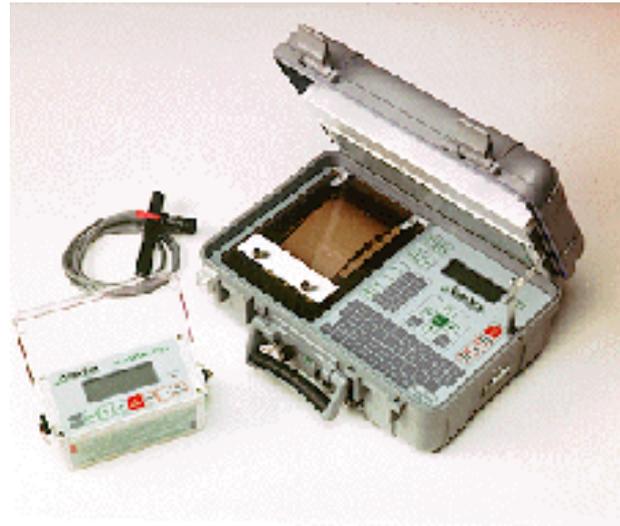
- Compliance with ground vibration and airblast numerical limits
- **If necessary to prevent damage**, the regulatory authority shall specify lower maximum allowable airblast levels than those in 816.67(b)(1) for use in the vicinity of a specific blasting operation.
- The maximum allowable ground vibration shall be reduced by the regulatory authority beyond the limits otherwise provided 816.67(d)(5), **if determined necessary to provide damage protection.**

ISEE Recommendations

- Standards Committee
- Seismograph Section to NFPA
- Blasters' Handbook

BLASTING SEISMOGRAPHS

- Establish Compliance with Rules
- Evaluate Blast Performance
- Provide Liability Protection

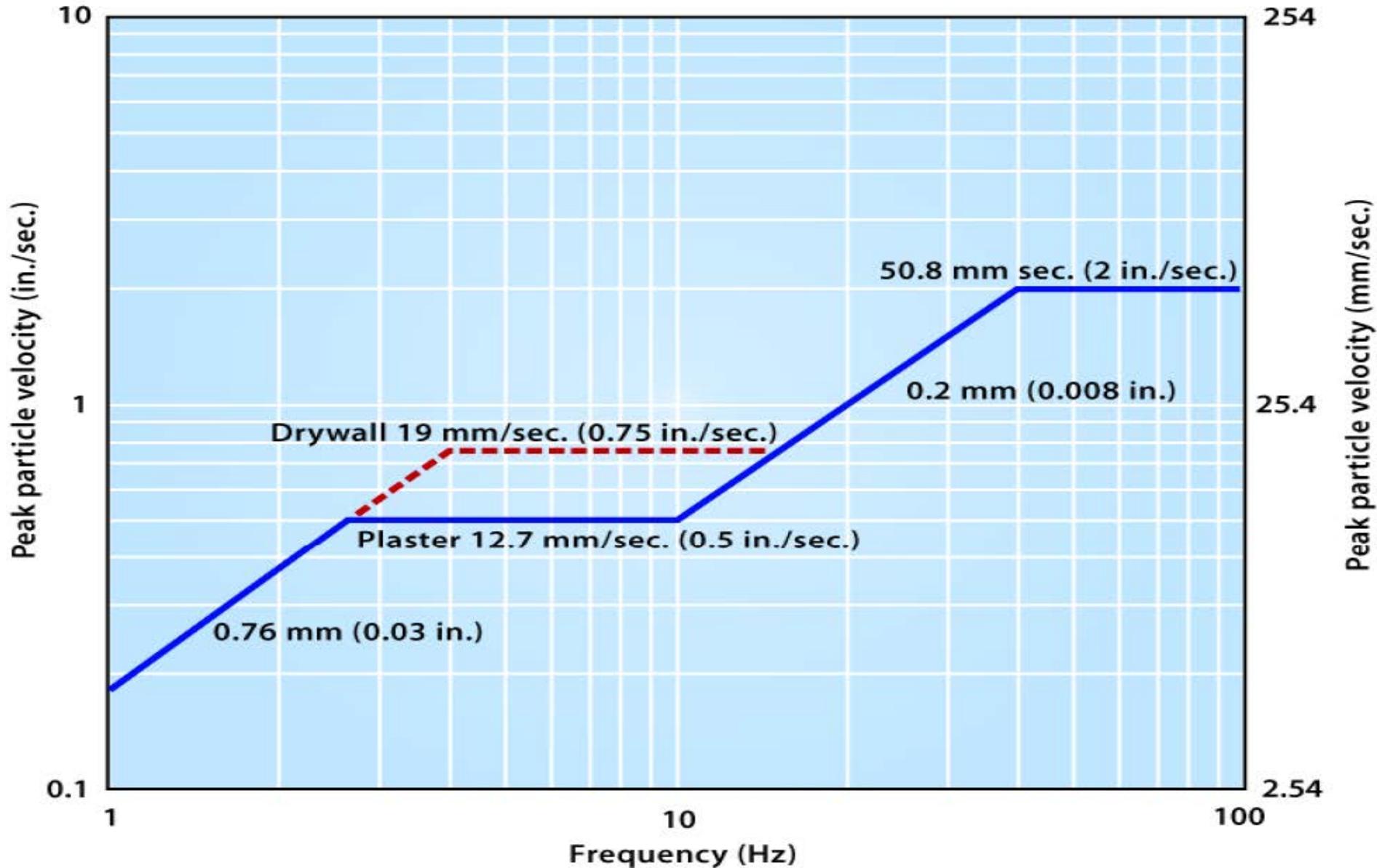


Recordings are controlled by:

- How the seismograph is made
 - ISEE Performance Specifications for Blasting Seismographs (2000)
- How the seismograph is placed in the field
 - ISEE Field Practice Guidelines for Blasting Seismographs (2009)
- For specifications on each, go to:
<http://www.isee.org/sections/blast.htm>

Ground Vibration Recommendations

RI 8507 Alternate blasting level criteria



Scaled Distance Equations

Distance From the Blast Site (R) meters [feet]	Allowable Charge-Weight per delay (W) kilogram [pounds]
0 to 91 m [0 to 300 ft]	$W = \left(\frac{R}{22.6} \right)^2$ $W = \left(\frac{R}{50} \right)^2$
92 to 305 m [301 to 1000 ft]	$W = \left(\frac{R}{24.9} \right)^2$ $W = \left(\frac{R}{55} \right)^2$
305 m and over [1001 ft and over]	$W = \left(\frac{R}{29.4} \right)^2$ $W = \left(\frac{R}{65} \right)^2$

Air Vibration Recommendation

- Air overpressure shall not exceed the maximum limit of 133 decibel (0.9 millibars or 0.013 pounds/square inch) at the location of any building. The limit of 133 decibels is primarily based on perception and has no potential to cause damage to buildings.

Other Limits

Higher vibration limits for buildings, man-made structures or utilities other than those described above may be independently established based on technical justifications by engineers or qualified personnel familiar with blasting related projects.

Industry Standards For Damage Prevention

Organization	Standard
Institute of Makers Of Explosives (IME)	Safety Library Publication 17 <i>Safety In The Transportation, Storage, Handling, and Use Of Explosive Materials</i>
National Fire Protection Association (NFPA)	NFPA 495 <i>Explosive Materials Code, Chapter 11</i>

Flyrock

Material that is ejected from a blast that travels through the air or along the ground.



Regulatory Limits

Flyrock shall not be cast:

- More than half the distance to the nearest dwelling or occupied structure
- Beyond the boundary of the protected blast area
- Beyond the permit area.

Blasting: The Most Likely Activity that can Cause an Off-site Fatality!!!

- Flyrock can travel thousands of feet from a blast site
- Particularly difficult to control at steep slope mines,

Federal Blaster Certificate

OSM BLASTER CERTIFICATE

IDENTIFICATION CARD



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



Blaster Certificates

- OSM policy: qualified and competent personnel
- Experience, Training and Testing
- Mentoring is the primary source of trainee education
- Testing is the only tool available to the RA to gauge competency
- Better blasters will:
 - Facilitate coal production
 - Reduce complaints and liability

Federal Blaster Certificates

- National in scope for mining
- Demonstrate knowledge
- Second tier Certificate
- Establish higher level of competence
- Good credential for regulatory and legal purposes
- Facilitate state reciprocity
- Recognized by AL, IN, KS, KY, MD, MO, MT, OH, PA, UT, VA, WV, WY

Benefits

- States
 - Less testing
 - Minimize application processing
 - Cost reduction!
- Blasters
 - Less testing
 - Facilitate multiple state certifications
 - Better perception
 - More authority
 - Justify promotions

Examination and Question Pool

- Currently 1200+ questions
- Multiple choice
- 14 categories per 30 CFR 850
- The test is 70% Technical and 30% Regulatory
- Blast log problems
- Blast Design problems to test critical thinking skills
- Blaster has control of all blasting parameters
- 80% pass

Blaster Certificate Tracking



Blaster Certification System

V1.1 02/23/07

Main Menu

- | | |
|---|---|
|  | Add New Information |
|  | Modify Existing Information |
|  | Delete a Record |
|  | Queries and Reports |
|  | About this system |



Blaster Certification - Add Blaster -

Certification Number:*

Last Name:*

First Name:*

Middle Name:

Address Line 1:*

Address Line 2:

City:*

State:* **Zip Code:*** (#####)

Day Phone #:* (###-###-####)

Home Phone #: (###-###-####)

Last 4 digits of SSN:*

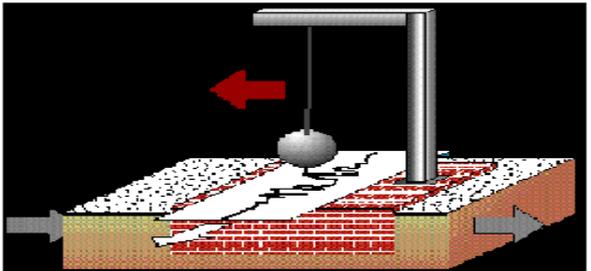
ID Card *	Certification Status *	Certification Type *	Issue Date *	Expiration Date *
<input type="text" value="Card"/>	<input type="text" value="Certification Status"/>	<input type="text" value="Certification Type"/>	<input type="text"/>	<input type="text"/>
			(MM/DD/YYYY)	(MM/DD/YYYY)
	Reciprocal State **	Reciprocal State Card ID **	Reciprocal Card Exp. Date **	
	<input type="text" value="Recip State"/>	<input type="text"/>	<input type="text"/>	
			MM/DD/YYYY	

Performance History:

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Technology Transfer

- Help the states use the best technology currently available for active mine reclamation and enforcement
 - Training
 - Applied Science
 - Technical Assistance
 - Technical documents (clearing house)
- Blasting Download Page
www.ARblast.osmre.gov



Blasting Download Page

Office of Surface Mining Reclamation and Enforcement

Rules, Regulations, Research and Resources
 Updated: 12/15/09

Contact: [Ken Eltschlager](#) or 412.937.2169

The Federal Surface Mining Control and Reclamation Act of 1977 requires that blasting shall be conducted to prevent injury to persons, damage to public or private property outside the permit area, adverse impacts on any underground mine, and change in the course, channel, or availability of surface or ground water outside the permit area. This page is provided as a resource to the people responsible for meeting this mandate.

Date	OSM Blasting Regulations
1977	Surface Mining Control and Reclamation Act of 1977 - Blasting Authority
1982	Proposed Blasting Rule Preamble, Part 1 , Part 2 , Part 3
1983	Final Blasting Rule Preamble, Part 1 , Part 2 , Part 3
1983	Surface Blasting Rules: Blast Plans (Sec 780) and Performance Standards (Sec 816)
1983	State Blaster Certification Template Rule Preamble and Template Rule (Sec 850)
1986	Federal Blaster Certification Program Preamble and Federal Rule (Sec 955)
2009	Old Blasting Webpage

Date Posted	Federal Blaster Certificates
12/17/08	OSM-74, Application for an OSM Blaster Certificate - Recognized for reciprocity in KY, MD, OH, PA, WV, WY
5/18/09	Directive, Reg-33 , Federal Blaster Certification Program and Blasting Enforcement
12/14/05	Training and Potential Testing Topics
11/26/07	Federal Examination Instructions
11/26/07	OSM Blast Design Rules of Thumb
11/26/07	Excel Blast Design Estimator based on the Rules of Thumb
12/22/08	Blaster's Training Modules Link

Training

- National Technical Training Program
 - Blasting and Inspection
 - Advance Blasting: Investigation and Analysis of Adverse Effects
 - Coal Field Communications
 - Developing a Mine Gas Class
- Technical Innovations and Professional Services (TIPS)
 - Blast Log Evaluation Program
 - Introduction to GPS
- <http://www.tips.osmre.gov>

Applied Science Projects

- 2007 Acoustic Response of Structures to Blast Vibrations, B. Lusk, UK
- 2007 Seismograph Geophone Coupling Protocols, C. Aimone-Martin
- 2009 Advance Detonator Applications in Surface Coal Mine Blasting, B. Lusk
- <http://www.techtransfer.osmre.gov>
- Anticipate 2011 RFP (request for proposals)



Technical Assistance

- Appalachian Region – Pittsburgh, PA
 - Ken Eltschlager, Mining/Explosives Engineer
 - keltschlager@osmre.gov or (412) 937-2169
- Mid-Continent Region - St. Louis, MO
 - Kevin Garnett, Civil Engineer
 - kgarnett@osmre.gov or (618) 463-6463 x5135
- Western Region – Denver, CO
 - Gene Hay, Mining Engineer
 - ghay@osmre.gov or (303) 293-5036

Questions?



Imminent Danger - 30 CFR 843.11

If an inspector finds any condition or practice that creates an imminent danger to the health or safety of the public

- Potentially relates to Flyrock or Fumes

Imminent Danger – 30 CFR 701.5

- The existence of any condition or practice which could **reasonably be expected** to cause substantial physical harm to people outside the permit area.
- A **reasonable expectation** of serious injury exists if a rational person, subjected to the same conditions giving rise to the peril, would avoid exposure to the danger.