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PART II



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**DEPARTMENT OF  
THE INTERIOR**  
Office of Surface Mining  
Reclamation and  
Enforcement

**SURFACE COAL MINING  
AND RECLAMATION  
OPERATIONS**

Permanent Regulatory Program

required under Section 780.11(b) is necessary to insure compliance with the performance standards as follows: Paragraph (b)(1), Section 816.45-46, 48, 91-93; Paragraph (b)(2), Section 816.21-25, 71-74, 100-106; Paragraph (b)(3), Section 816.59, 150-176, 180; Paragraph (b)(4), Section 816.81-89, 91-93; Paragraph (b)(5), Section 816.181; and Paragraph (b)(6), Section 816.41-47, 96. Proposed Sections 780.11(b)(1) and (b)(2), major buildings and other facilities, and utilities services, respectively, have been deleted as suggested by comments. These changes have resulted in Section 780.11(b) being renumbered in the final regulations.

5. Several commenters suggested that proposed Section 780.11(b) implied that all of the listed facilities and structures be removed following mining. As pointed out by these comments, removal is not required in all cases. Accordingly, language has been added in Section 780.11(b) to clarify that removal of facilities need not be described if those facilities are being retained as part of the proposed post-mining land-use.

6. Some commenters suggested that a new requirement be added here as well as in the companion Section of the application requirements for underground mining operations that would require an operator to disturb only that amount of land necessary for the conduct of the mining and reclamation operations. These commenters cited Section 102(d) of the Act as support for their position. Section 102(d) of the Act states the general purpose that surface coal mining operations be conducted so as to protect the environment. All of Subchapter K (Permanent Program Performance Standards) is intended to implement this and the other stated purposes of the Act. (See Sections 810.2 and 816.71(a), for example.) To the extent that the Act requires information in the permit application regarding minimum disturbance of land, that information is to be submitted pursuant to Section 508(a)(6) of the Act and Section 780.18(b)(6) of these regulations. The Office believes it is without authority under Section 508 of the Act to require an entire plan directed toward minimum disturbance of land areas when this result is achieved under other regulations. Accordingly, no change has been made as a result to these comments.

#### § 780.12 Operation plan: Existing structures.

This is a new section in the final regulations which sets forth the operation plan requirements in permit applications for surface coal mining activities. The authority for this Section and its basis and purpose are discussed

in the preamble to 30 C.F.R. 701.11(e). This section was added in response to comments suggesting that the Office adopt an explicit rule for regulation of existing structures.

#### § 780.13 Operations plan: Blasting.

1. Authority for this Section is Sections 102, 201(c), 503, 504, 506, 507(g), 508(a) and 515(b) of the Act. This Section provides the regulatory authority with a narrative explanation and data for evaluation of the possible environmental and public health and safety consequences of the use of blasting agents during the proposed surface mining activities. This evaluation will be used to determine whether the activities can generally be expected to comply with Sections 816.41, 816.50-816.51, and Sections 816.61-816.68 of Subchapter K. This Section was renumbered from Section 780.12 of the proposed regulations. Technical literature considered in its development was the same as for Sections 816.61-816.68.

2. Proposed Section 780.12 would have required a blasting plan for the affected area, which could have been construed to call for a plan for the entire life of the proposed surface mining activities (e.g. for the "mine plan area"), given the way in which the terms affected area, permit area, and mine plan area have been defined. In response to comments which objected generally to requiring the application to cover areas outside the immediate permit area, the Office has specified that the blasting plan need only be provided for the proposed permit area in the final rules. These comments, as discussed below, indicated difficulty would exist in providing detailed information on blasting operations at the permit application stage. Thus, the Office will not require applicants to provide highly detailed data on blasting to be conducted many years in the future (i.e., beyond the first permit term increment), as would have been required under proposed Section 780.12.

3. One commenter found no problem in meeting the proposed requirements. It is true that, in some operations, information such as drillhole patterns, hole loading, and firing orders can be developed before mining operations are started. Where the geologic formations are constant and the mining operations will be relatively short-lived, providing detailed information for the blasting plan for the entire permit area would not be difficult for the applicant. However, as pointed out by other commenters, many mining operations have varying conditions which require frequent adjustments of drilling patterns, charge weights, and detonation sequences during mining operations.

These conditions could be partially accounted for by only requiring that approximate drilling patterns be submitted with the application. However, this would still result in the frequent need to revise the permit application when conditions require drilling patterns different from those anticipated in the original application.

Therefore, the Office has modified the final rule at Section 780.13(b), to delete the requirement for detailed blasting operational data in the application itself. Instead, the applicant will be required to submit its plans to the regulatory authority for recording and reporting detailed blasting operational data during the actual conduct of mining operations.

The final rule will still provide the regulatory authority, through Section 780.13(a), with sufficient information to determine that the applicant will comply with the provisions of Sections 816.61-816.68, of Subchapter K. This also meets the requirements of Section 507(g) of the Act. To the extent that Sections 816.61-816.68, require prior regulatory authority approval of blasting, it is expected that detailed information of the kind originally contemplated for inclusion in the permit application will have to be supplied to the regulatory authority under sections 816.62 and 816.65 after the permit issuance, but before particular blasting operations are conducted. See the preamble to Section 816.65.

4. Commenters to the proposed rule noted an inconsistency between proposed Sections 780.12(b) and Section 816.68. The former would have required that a record of every blast be reported to the regulatory authority, while the latter required that records merely be retained at the permit area for public and regulatory authority inspection. This inconsistency was eliminated by appropriate modification to Section 780.13(b) in the final rule. Records ordinarily need only be retained on-site.

5. Some editorial changes were made to subparagraphs (b) (1)-(2) of the final rule to eliminate redundant language. The "configuration" requirement of (b)(1) and "placement" specification of (b)(2) were both eliminated as redundant of the phrase "drilling patterns, including size, numbers, depths, and spacing of holes," which was retained in the final rules at 780.13(b)(1).

6. The review of the regulations prompted by comments on other sections revealed an inconsistency in the regulations, because Section 816.65(b) requires regulatory authority approval of blasting under emergency conditions. Section 816.65(b) of Subchapter K states, "... except in those unavoidably hazardous conditions approved by the regulatory authority

ty, . . ." but no provision existed in the proposed regulations for the operator to submit, for regulatory authority approval, identification of emergency situations under which these deviations would be allowed. The logical place for such a description to be submitted is with the permit application. The types of emergency conditions involved are those for which weather information and other similar historical or physical data can be supplied by the applicant, as opposed to drill patterns and precise figures on charge weights which cannot necessarily be determined until operations are about to commence in the field. Section 780.13(f) has, therefore, been added to the final rules.

#### § 780.14 Operation plan: Maps and plans.

Authority for this Section is found in Sections 102, 201(b), 501(b), 503, 504, 507(b) and (g), 508(a) and 515 of the Act. In addition to the narrative plans required by other sections, this section of part 780 (presented in the proposed regulations as Section 780.13) requires that each application include certain described maps and plans. Some of these maps and plans must be prepared by specified professionals as required under Sections 507 and 515 of the Act. Accurate maps and plans are needed by the regulatory authority to determine whether the applicant can meet the performance standards of Part 816.

The Office has made several editorial and organizational changes in this section to make it consistent with other closely related sections and to clarify its provisions. The introduction has been reduced to a single sentence prefacing the three paragraphs of this section. Section 780.14(a) now includes material originally presented in the introduction and paragraphs (a) and (b). Reference to map scale has been moved to Section 771.23(e) and comments received thereon are discussed in the preamble to that Section. Section 780.14(b) now contains eleven paragraphs most of which were originally listed under paragraph (c).

Three paragraphs were deleted from Section 780.14(b). Maps for final surface configuration and location of water, air and wildlife monitoring points are now covered in Sections 780.14 and 779.25(b), respectively. The locations and descriptions of facilities which will remain permanently after reclamation are covered in the narrative statement required under Section 780.11(b). Other changes were made as a result of comments and are discussed below.

Section 780.14(a) requires information on the lands, facilities and features of the proposed mine plan and adjacent areas which will be affected or changed by the proposed operation.

This information will give the regulatory authority an overview of the entire operation which will supplement the information on plans for the proposed permit area required under Section 780.14(b). Information on the proposed mine plan and adjacent areas is necessary in order to assess the cumulative impacts of the entire mining operation. Section 780.14(b) requires identification of structures, facilities and areas which will be used or affected by the mining operation. This information is required for the proposed permit area except that identification of the land area to be affected according to the sequence of mining and reclamation must be made with respect to the proposed mine plan area. Section 780.14(c) requires that maps identifying certain areas and facilities be prepared by or under the direction of and certified by a qualified registered professional engineer or professional geologist, with assistance from experts in related fields such as land surveying and landscape architecture. However, Section 780.14(c) further requires that plans for sedimentation ponds be prepared only by qualified registered engineers, and that plans for spoil disposal facilities be prepared only by qualified registered professional engineers. These requirements are in accordance with Section 515 of the Act. The purpose of Section 780.14(c) is to insure high quality planning, design and documentation of maps required in the application.

Some commenters suggested that Section 780.14(a) be revised to limit the scope of the map information required to the proposed permit area for the first five years of operation. As proposed, this Section would have required maps for the proposed permit area but without a specified time period. Section 508(a)(1) of the Act, upon which Section 780.14(a) of the regulation is based, clearly states that the application must identify "the lands subject to surface coal mining operations over the estimated life of those operations . . ." (emphasis added). Maps of the total mine plan area will be required to give a complete picture of the entire mining operation and to assess its cumulative effects. As a result, these comments were not adopted and Section 780.14(a) was revised to require maps and plans for the proposed mine plan and adjacent areas.

These commenters also suggested that the information required under Section 780.14(b) be limited to the proposed permit area. These comments were adopted and revisions made to Section 780.14(b) with one exception. As required by Section 508(a)(1) of the Act, the identification of areas to be affected under Section 780.14(b)(2)

must be given with respect to the proposed mine plan area.

Some commenters suggested that Section 780.14(b)(9) relating to identification of facilities used to protect or enhance fish and wildlife and related environmental values was ambiguous and should be deleted. "Facility" as used in this section is intended to refer to structures such as fences, under passes and overpasses, and habitat components such as vegetation groupings and planned wetlands which are designed to mitigate the effects of mining and, where possible, enhance valuable fish, wildlife and other environmental values. This information is necessary to insure compliance with Section 816.97 and is an important aspect of postmining land use planning. No change was made as a result of these comments.

A few comments suggested that the reference to design and construction specifications in section 780.14(b)(11) be deleted. The Office agrees that specifications are inappropriate for inclusion as part of a map. (See Section 780.25 for requirements for construction of the facilities listed in Section 780.14(b)(11)). Accordingly, the reference to specifications has been deleted.

Some commenters suggested that the final surface configuration map which was proposed to be required under this section (see Section 780.13(c)(11) of the proposed regulations) not be required in all cases. As discussed above in this preamble, this requirement has been moved in the final regulations to Section 780.18(b)(3). As a result of this comment and other comments discussed in the preamble to section 780.18, either contour maps or cross sections of the proposed final surface configuration may be provided in the permit application.

A few commenters suggested that Section 780.14 be revised to include an additional requirement relating to identification of reference areas on maps. Since this information is required under Section 779.24(f), a duplicative requirement was not added to Section 780.14(c). A number of commenters suggested that Section 780.14(c) be revised to state that registered professional engineers as well as professional geologists be permitted to prepare, supervise the preparation of, and certify the maps listed there. The Office agrees that this language would be more in accordance with the Act, and, accordingly, has made this change. Except for the limitations set forth in Sections 780.14(c) (1) and (2), any qualified professional may prepare the maps required under this section. The reader may wish to refer to the preamble to Section 779.24 for additional discussion of comments relat-

sponse to comments, with which the Office agreed, pointing out that the requirement for maximization of recovery should not be viewed as superseding other performance standards, but should be viewed as a requirement of equal importance to others in Part 816. The additional language places the regulation in perspective.

**§§ 816.61-816.68 Use of explosives.**

**Introduction**

These sections establish performance standards regulating the amounts, methods of use, timing, and monitoring of blasting in the course of conducting surface mining activities. The statutory authority for and general basis and purpose of these sections were explained in the preamble to the proposed regulations, 43 FR 41753-41758 (Sept. 18, 1978).

The fundamental purpose for these sections is to establish regulatory controls on the use of explosives and blasting agents used in surface mining activities, because of the great potential for damage to public health and safety and water resources that improper blasting can cause. Congress was well aware of these dangers when it enacted the Act, as was explained through a review of relevant portions of the legislative history in the preamble to the proposed regulations. To protect against these dangers, Congress required the establishment of rigorous regulatory controls, particularly under Section 515(B)(15) of the Act.

1. Regarding Congress' perception of the dangers that may occur from blasting in surface mining activities, some commenters criticized what they felt to be the Office's reliance on a report presented in 1977 to the House Subcommittee on Energy and the Environment by the Center for Science in the Public Interest (CSPI). This report's conclusions were briefly discussed in the preamble to the proposed rules.

These commenters felt that the Office should not utilize the CSPI report because of asserted inaccurate assumptions about the extent of blasting effects made by the authors of the report. The Office has carefully reviewed these comments and the report and has concluded that, while the report's quantitative estimates of annual damages from surface mining blasting are indeed open to debate, changes in the regulations are not needed on that basis. The CSPI report was described in the preamble to the proposed rules as material illustrating the basis for Congress' general concern with the adverse potential for blasting, because it contained reports of firsthand observations of the effects of blasting in surface mining activities. Those observations, rather than quantitative pre-

dictions in the report, were used by the Office. Those observations were not challenged by commenters. As a result, the Office notes that the CSPI study is entitled to some weight to generally illustrate that significant problems can occur, if blasting is not properly controlled.

2. Materials considered by the Office in developing these regulations include:

1. Ash, R. L. 1968, *The Design of Blasting Rounds*, pp. 373-396, Chapter in *Surface Mining*, American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, 1,061 pages.

2. Ashley, C., and Parkes, D. B., 1976, *Blasting in Urban Areas: Tunnels & Tunnelling* (British Tunneling Society), September, 1976, pp. 60-67.

3. Barnes, Jack (John B.) 1977, *The Effects of Strip Mine Blasting on Residential Structures—Ayshire Mine, Warrick and Vanderburg Counties, Indiana*. Paper presented to the Indiana Academy of Science, Indianapolis, Indiana, October 28, 1977, 19 pp.

4. Coal Mine Health and Safety Act of 1977 and 71 CFR, Subpart D.

5. Committee on Hearing, Biocoustics and Biomechanics, Assembly of Behavioral and Social Sciences, 1977, *Guidelines for Preparing Environmental Impact Statements on Noise*, 162 pp.

6. Dvorak, A. 1962, *Seismic Effects of Blasting in Brick Houses*, Geotysikalni Shornik, No. 169.

7. Grim, E. and Hill, R. 1974, *Environmental Protection in Surface Coal Mining* (U.S. Environmental Protection Agency, No. 1BB040).

8. Gustafsson, Rune 1973, *Swedish Blasting Technique*, SPI, Gothenburg, Sweden, 323 pp.

9. Kentucky Department of Mines and Minerals, 1977 *Laws and Regulations Governing Explosives and Blasting*, Lexington, Ky., p. 1.

10. Laadegard-Pederson and Dally, 1975, *A Review of Factors Affording Damage in Blasting*, National Science Foundation.

11. Maryland Geological Survey, Bureau of Mines, 1973, *Blasting restrictions (08.06.05.09) and Regulations governing blasting (08.06.05), in Bituminous coal strip mines and auger regulations*, Maryland Department of Natural Resources Rules and Regulations, p. 23.

12. Medearis, Kenneth, 1976, *The Development of Rational Damage Criteria for Lowrise Structures Subjected to Blasting Vibrations*. A Report of the National Crushed Stone Association, Kenneth Medearis Associates, Fort Collins, Colo., and Valley Forge, Pa., 94 pp. (duplicated report).

13. Miller, P. H. (no date), *Blasting Vibrations and Air Blast*: Park Central, Ill., Atlas Powder Co., 16 pp.

14. Nicholls, H. R., Johnson, C. F., and Duvall, W. I. 1971, *Blasting Vibrations and Their Effects on Structures*. U.S. Bureau of Mines Bulletin 656, 105 pp.

15. Old Ben Coal Company, Comments to Office of Surface Mining (1978).

16. Pennsylvania Department of Environmental Resources, Rules and Regulations, Title XXV, Pennsylvania Code, Ch. 211.

17. Research Energy of Ohio, Inc. Comments to Office of Surface Mining, 1978.

18. Siskind, D. E., 1977, *Structure Vibrations from Blast Produced Noise*, in 18th International Rock Mechanics Symposium, June 1977, Keystone, Colo., Proceedings, pp. 1A3-1-1A3-5.

19. Siskind, D. E., Stachura, V. J., and Radcliffe, K. S. 1976, *Noise and Vibrations in Residential Structures from Quarry Production Blasting—Measurements at Six Sites in Illinois*. U.S. Bureau of Mines Report of Investigation RI 8186, 17 pp.

20. Siskind, D. E., and Stachura, V. J. 1977, *Recording System for Blast Noise Measurement*. Sound and Vibrations Journal, pp. 20-23.

21. Siskind, D. E., and Summers, C. R. 1974, *Blast Noise Standards and Instrumentation*. U.S. Bureau of Mines, Environmental Research Program, Technical Progress Report ("TPR 78").

22. Siskind, D. E. 1978, Bureau of Mines Special Study Submitted to OSM, 5 pp.

23. Tynan, A. E. 1973, *Ground Vibrations—Damaging Effects to Buildings*, Special Report No. 11, Australian Road Research Board.

24. University of Maryland, An Investigation into Delay Blasting 1975, NSF Contract APR 75-05171 to the University of Maryland and Subcontract No. M-218907 to Martin Marietta Laboratories.

25. Duvall, W. J. Devine 1968, *Air Blast and Ground Vibration from Blasting*, pp. 398-411. Chapter in *Surface Mining*. American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, 1,061 pages.

26. Grubb and Ryder, 1972, and

27. USGS, 1974 (a), vol. 1.

3. Several of the materials were criticized by one commenter as being inappropriate for use by the Office as the basis for some or all of Sections 816.61-816.68. In part, this comment was based on the presentation in the preamble to the proposed rules (43 FR 41753), that the Office "used" the cited materials to "develop" Sections 816.61-816.68, thereby indicating that

the Office was relying upon each source listed in the Preamble as justification for the proposed rules. In fact, the Office considered all of these sources, but found justification for the proposed rules in only some of them. Those that were believed to justify the regulations were discussed in portions of the preamble to the proposed rules related to particular sections of the regulation.

For the final rules, the Office has listed above all materials considered. That literature which provides the actual basis for particular sections of the regulations questioned by commenters is cited in succeeding portions of this preamble. The Office has also specifically considered the criticisms of the commenter who questioned the applicability of several articles listed in the preamble to the proposed rules—

(a) The Medearis study was consulted frequently by the Office in the preparation process, as is indicated by frequent citations in the final preamble. While the Office did not, as explained below, feel that the structural response technique proposed by Medearis is adequately developed for the purpose of adoption in these regulations (as an alternative to the peak particle velocity ground vibration limitation) the report does contain a considerable amount of useful information in other areas.

(b) The Siskind paper, "Structure Vibrations from Blast Produced Noise," points out that significant structure vibrations can be produced by airblast alone and that an airblast criteria based on damage should be considered. The specific data in the paper were not used as a basis for the final regulations. The noise decibel limits of Section 816.65 were derived, instead, from a special study done for the Office by the U.S. Bureau of Mines and from comments of a State agency.

(c) The Siskind and Stachura paper, "Recording System for Blast Noise Measurement," provided background information essential to the understanding of airblast recording systems. It contained no data which were directly used in support of a quantitative limit in the final regulations.

(d) The Atlas Powder Company brochure, "Blasting Vibration and Airblast," contained no data other than that contained in Bureau of Mines Bulletin 656 and TPR 78. It did, however, show that a major powder company considers Bureau of Mines publications as authoritative sources. Since the Bureau work contributed heavily to the regulations, it was important to know that industry has confidence in Bureau work. This is clearly shown by Atlas' preparation of a users' pamphlet based primarily on Bureau work.

(e) Bureau of Mines TPR 78, "Blast Noise Standards and Instrumentation," contained a good deal of background on airblast reduction techniques, some typical airblast levels measured on various instruments, and general recommendations. Although TPR 78 was used as a basis for the 128 dB standard in the interim regulations (see 30 CFR 715.19), the final standard was based on the special Bureau of Mines study. TPR 78 did, however, provide much of the rationale for parts of the airblast regulation, as indicated by frequent citations in the final preamble.

(f) The Ashley and Parkes reference was not relied upon in developing the vibration standard. Although not a study involving original research, it does present reasoned opinion, based on experience of the authors, that the one-inch-per-second peak-particle velocity standard is reasonable. This paper is an example of one which was considered, but which did not weigh heavily on the writing of any particular section of the regulations.

(g) Bulletin 656, "Blasting Vibrations and their Effects on Structures," was frequently used in the writing of the regulations. The data on propagation of blast vibrations was especially useful. The scaled distance formula requirement of Section 816.65 was also developed from that publication. Bulletin 656 stated that the two-inch-per-second criterion will keep the probability of damage below five percent. However, as explained further below, because of the inadequacy of a two-inch standard and information in several other technical reports (references 5, 6, 8, 12, and 13) the one-inch-per-second criterion was adopted in the final rules. The Office agrees with the statement that a scaled distance of 50 will protect against vibration of two-inches-per-second. The same graphs used for that conclusion support the use of a scaled distance of 60 to protect against vibrations of one-inch-per-second.

(h) RI 8168, by Siskind, Stachura, and Radcliffe, gave an insight on the correlation between structure vibrations induced by ground vibrations and airblast. No recommendation as to damaging levels from blasting was made. This publication merely gives background information on the technology and was not specifically used in writing the regulations.

(i) The preamble to the interim regulations referred to studies by the National Coal Board as part of the rationale for a one-inch-per-second limitation. This information was not used as a basis for the one-inch-per-second limitation in the final regulations and has not been incorporated in the list of references.

(j) The Barnes study, "The Effects of Strip Mine Blasting on Residential Structures . . ." has been criticized by many commenters. It was considered in the writing of the regulations, because it demonstrates the annoyance of the public that can result from blasting conducted at a large surface coal mine. Because the explanation in the Barnes study of causes of much of the damage observed was subject to qualification because of the lack of pre-blasting data, the study points out the desirability of preblast surveys. This report was not, however, directly used in the writing of the final regulations.

(k) The Research Energy of Ohio comments to the Office were used to show that an alternative to traditional delay detonators exist for reducing peak particle velocities and to indicate that the industry can meet the one-inch-per-second standard. The use of these materials with respect to delay detonation is to allow for the only alternative that may be available for some operators who want to blast at very close distances to structures, i.e., within 300 to 1,000 feet.

(1) The University of Maryland, "An Investigation into Delay Blasting," describes inaccuracies in firing times of commercial electric blasting caps which have been known for a long time. The commenter stated that these inaccuracies cast doubt as to the ability of operators to meet the one-inch-peak-particle-velocity limitation, by using a scaled distance equation based on eight-millisecond delay intervals. However, the scaled distance studies described in Bulletin 656, upon which the Office's scaled distance formula in the final rules is based, were empirical studies employing standard commercial detonators which would have the inaccurate firing times described by the commenter. Thus, those empirical studies accommodate and account for the inaccuracies described by the comments.

The University of Maryland publication itself was used only to justify Sections 816.65(o) and 817.65(p) in the proposed regulations, which required regulatory authority permission to use combination surface-in-hole delay systems. In response to heavy comment objecting to this requirement, with which the Office concurs, it has been deleted. Thus, the University of Maryland study was not used to directly support any of the final rules.

#### § 816.61 Use of explosives: General requirements.

I. A few commenters proposed that over 50 safety-related items be included in Sections 816.61 and 816.65 as operating standards. These suggested additions would cover the transportation, storage, and use of explosives. A

study of these comments indicated that these items should not be included in the final rules.

Examination of the suggestions showed that they apply mostly to the safety of workers; commenters did not indicate how the inclusion of these provisions would increase the safety of the public. All but one of the proposed additions to the rules were either already adequately covered by the Office's rules or were covered by regulations of the U.S. Mine Safety and Health Administration (MSHA) or the Federal Bureau of Alcohol, Tobacco, & Firearms (ATF).

Because MSHA has primary responsibility for the safety of workers and ATF has primary responsibility for the storage of explosives to protect the public, inclusion of these provisions in the regulations would be an unnecessary duplication. The exception is the lack of a provision to regulate the use of two-way radios in the vicinity of explosives. MSHA has advised the Office that the use of two-way radios has never been known to cause an accident and that estimated costs of requiring those throughout the industry would be \$4,000,000, a cost that would appear not to be justified.

II. To avoid redundancy by Federal agencies in inspection and enforcement, and to stay within the authority of the Act, deletions were made from proposed Section 816.61(a). The proposed regulation required compliance with all applicable local, State and Federal laws and regulations and the requirements of Sections 816.61-816.68 in the storage, handling, preparation, and use of explosives. The section was changed to require compliance with all applicable State and Federal laws in the use of explosives. As compliance with all sections of the regulations is independently required, the reference to Sections 816.61-816.68 was deleted.

The Act in section 515(b)(15) requires the Office to "ensure that explosives are used only in accordance with existing State and Federal law and the regulations promulgated by the regulatory authority . . ." The Act does not mention local law. In many cases it will not be necessary for inspection personnel of the Office to determine all the laws which may be applicable in the numerous municipalities and counties within their assigned geographical areas, because those governmental bodies will enforce those provisions directly. Therefore, reference to local laws and regulations has been deleted.

Further, the Act mandates that the Office "ensure that explosives are used only in accordance with State and Federal law . . ." (emphasis supplied). Traditionally, the "use" of explosives has been differentiated in

State and Federal regulations from the processes of manufacture, transportation, and storage, such as is done in MSHA regulations. See 30 CFR 55.6-1, 55.6-40, 55.6-90, 77.1300, 77.1301, 77.1302, 77.1303. Inspection by personnel of the Office to ensure compliance with all Federal and State laws pertaining to storage, preparation, and handling of explosives is not required of the Office by the Act under Section 515(b)(15). These aspects are presently sufficiently regulated by other Federal and State agencies, such as ATF, MSHA, and the U.S. Department of Transportation. Therefore, the reference that appeared in the proposed regulations pertaining to the storage, handling, and preparation of explosives has been deleted.

III. Section 816.61(b).

A. Several individuals and groups objected to the use of "the equivalent of five pounds of TNT" in the proposed rules as being confusing, since no mining operation uses TNT, the limit was too low, or the regulation was ambiguous. Based on the comments received, the following alternatives were considered and alternatives (2) and (5) were adopted.

(1) Retain the specification "the equivalent of five pounds of TNT" as written in the proposed permanent rules.

(2) Substitute in Section 816.61(b) the phrase "five pounds of explosive or blasting agent."

(3) Increase the weight to "250 pounds of explosive or blasting agent."

(4) Define the term "explosives" in the regulations.

(5) Do not further define the term "explosives."

B. A few commenters felt that the specification in the proposed rule of "the equivalent of five pounds of TNT" was ambiguous and confusing. "TNT" is used for military operations, not industrial blasting. One of these commenters recommended that the Office define *explosives*. Another commenter asked for clarification as to whether OSM means five-pounds-per-blast or five-pounds-per-delay, and recommended specification of five-pounds-per-delay. Another commenter suggested that the minimum weight be increased to 250 pounds, and that a provision be made for exempting unscheduled detonations in case of misfire, wet holes, or other instances.

The comments on the ambiguity of the "TNT" specification are correct, so the Office has replaced the phrase "the equivalent of five pounds of TNT" by "five pounds of *explosives or blasting agents*." A similar change was also made in Section 816.64(a) of the final regulations. "Explosives or blasting agents" covers the range of products used for industrial blasting. Since both "explosives" and "blasting

agents" are widely accepted terms for many specific types of detonable materials, and the definitions are common knowledge to those engaged in surface mining activities, no specific definition in the regulations is necessary. Of course, State regulatory authorities may adopt specific definitions, if those definitions cover *all* types of detonable materials used for blasting in surface mining activities in the particular State.

C. As proposed, Section 816.61(b) clearly stated that the rules apply to "blasting operations that use more than five pounds. . ." However, to eliminate any possible confusion, the term "blasting operations" has been changed to "blasts." Therefore, all "explosives and blasting agents" used in a particular blast will be aggregated to determine if these regulations apply. The Office clearly does not mean that the regulations should be applicable on the basis of five pounds "per delay."

The recommendation to increase the minimum charge specifications to 250 pounds was not accepted. First, this comment merely asserts, without providing supporting data, that blasts containing up to 250 pounds of explosive can be conducted safely. Second, (Ref. 14) Bureau of Mines Bulletin 656, p. 66, Figure 5.1, shows that even 27 pounds of explosive fired unconfined at a distance of 900 ft. will yield an airblast with overpressure of approximately .08 pounds per square inch, or 150 decibels, an unacceptably high level far in excess of the maximum allowable levels for blasting needed to protect the public. (See Section 816.65(e) and the literature cited in this preamble to support the maximum decibel levels.) Thus, if blasts at 27 pounds can produce overpressure far in excess of allowable limits, the Office believes that establishing the minimum level for application of these regulations at five pounds is desirable to ensure that blasting is conducted, as required by the Act, to adequately protect the public. See Section 515(b)(15) of the Act.

D. Finally, the Office has also decided not to adopt a special exception from the blasting schedule warning requirements for misfires and for other reasons that lead to explosives failing to fully detonate. Such an exception is unnecessary, if the need for additional blasting to replace misfires and wet holes is accounted for and described with particularity in the original blasting schedule. For example, if the schedule describes that blasting will occur at 2-3 p.m. on X date, then re-blasting at 3 p.m. for misfires occurring at 2 p.m. will have been properly described in the schedule. It is noted, however, that re-blasting occurring at times or under conditions not specified

in the blasting schedule would not be allowed, because then the public will not have received the adequate warning required by Section 515(b)(15) of the Act.

IV. *Section 816.61(c)*. Several commenters questioned the specification in the proposed rules of persons requiring blaster certification and personal characteristics of persons handling explosives. As a result, the Office revised Section 816.61(c) to eliminate reference to personnel characteristics of persons handling explosives and to retain only the requirements that blasting operations be conducted by certified blasters.

Adequate requirements for certification of blasters will be provided in detail in 30 CFR Part 850. Therefore, it is redundant to specify other requirements for certification of blasters in Section 816.61(c). It is sufficient in this section to provide that all blasting operations be conducted by certified blasters. Several commenters stated that it is unreasonable to certify all persons using explosives. These comments will be considered in the revision of proposed 30 CFR 850.

**Section 816.62 Use of Explosives: Pre-blasting survey.**

*Section 816.62(a)*. (A) Numerous comments were received relative to when, where, how, and by whom the preblasting survey should be conducted. A review of the comments resulted in consideration of the alternatives listed below. Alternatives three and four were adopted by the Office.

1. Retain the section as it appeared in the proposed regulations.
2. Set a definite time limit for submission to the regulatory authority of the preblast survey report, when completed.
3. Amend the proposed regulation to require "prompt" responses to the request for the survey and submissions of the report to the requestor and the regulatory authority.
4. Amend the proposed regulation to add provision for a supplemental preblast survey, if there have been renovations or additions to a surveyed structure after the original preblast survey.
5. Amend the section to extend the area of preblast survey beyond one-half mile of the permit area.
6. Amend the section to require that the preblast survey state the causes of existing, preblasting structural damage.
7. Amend the section to require that requests for preblast surveys be made in writing.
8. Amend the section to require that the blast schedule providing notice of the right to a survey be mailed to all residents within one mile of the

permit area and include a map showing the permit area.

**B. *Analysis of Comments and Alternatives***

*Alternatives 2 and 3*. Numerous comments were received relative to setting a time limit on completion of the preblast survey and submission of the report. The Office rejected the alternative of setting a specific time limit, in days, for the initiation of a preblast survey report and, instead, adopted the alternative of requiring both "prompt" responses to the request for surveys and "prompt" submission of survey reports to the regulatory authority. This alternative will further the purposes and requirements of the Act to ensure that preblast surveys be completed in a reasonable time prior to blasting, at the same time leaving flexibility to the regulatory authority to administer preblast survey requirements to fit local needs and workloads.

*Alternative 4*. A few commenters recommended that provisions should be made for a supplementary preblast survey, where renovations or additions have been made to a structure after an initial preblast survey has been made. The Office accepted this recommendation. The Act, Section 515(b)(15)(E), mandates that, if requested, a preblast survey be conducted of any structures within one-half mile of the permit area. Additions to a structure after the survey become portions of the "structure" that have not been surveyed and, therefore, should be covered in a supplementary survey. Renovations of a structure can substantially change its features, so that a preblast survey conducted prior to the renovation will no longer be representative of the structure for the purposes of analyzing the effects of blasting on the structure.

*Alternative 5*. Several comments were received relative to extending the area for preblast surveys beyond one-half mile of the permit area. The Office considers the one-half mile zone required by the Act as adequate for most circumstances. At a 0.5 mile (2,640 feet) distance, based on the scaled distance formula presented in 30 CFR 816.65(m)-(1), more than 1,900 pounds of explosives can be detonated within any eight-millisecond time period, without the maximum peak-particle velocity of the ground vibration exceeding one inch per second. Similarly, at a distance of 0.6 mile (3,168 feet), over 2,700 pounds of explosives can be detonated without the peak-particle velocity exceeding one inch per second.

Therefore, at distances greater than one-half mile, a mining operator should not experience difficulty in designing blasts that will not exceed the quantities as allowed by the scaled distance formula. Furthermore, Gustafs-

son, p. 221 (Ref. 8), states that when ground vibration control is to be supplemented with preblast surveys, the extent of the area subjected to preblast inspection is usually within one-half mile of a blast site. The Office did not, therefore, extend the area of preblast surveys. However, under Sections 503, 504, and 505 of the Act and 30 CFR 700.3(c), 730 and 736, the regulatory authority may extend the area beyond one-half mile from the permit area, if local situations require.

*Alternative 6*. Several commenters recommended specifying that the preblast survey include analyses of the causes of existing preblast structural damage, while another commenter recommended that persons who conduct surveys make no comments either during the survey or within the survey report, concerning possible causes of any damage noted during the survey. The Office did not adopt either of these recommendations. The final regulations neither absolutely preclude nor require such information in the survey report.

In some cases the permittee may choose to have the causes of existing structural damage determined in a preblast survey. However, such determinations need not be made in all cases, because it would require detailed engineering analyses incompatible with the general purpose of the survey, which is to quickly document that damage exists and to compare that record as blasting proceeds.

The Office did not adopt the recommendation to prohibit the surveyor from making comments during the survey. This would be contrary to an objective of the preblast survey as stated in the preamble to the proposed regulations, to increase communication between the mining entity and the public about blasting operations. Further, the surveyor may in some cases be able to provide opinions or information which could be of value to the requestor, by explaining the cause of existing damage present at the time of the survey.

*Alternative 7*. A commenter recommended that requests for a preblast survey be made in writing and that the person making the request state the specific conditions of the structure to be surveyed. The Office did not adopt this recommendation, because the stated purpose of the recommendation, which was to limit the number of requests for the preblast survey, was contrary to the purposes of Section 515(b)(15)(E) of the Act. That provision broadly provides for surveys and for the surveyor, rather than the requestor, to evaluate existing conditions of structures. Moreover, requiring written requests would prejudice persons with limited writing abilities in invoking the protection of the Act.

Finally, a preblast survey is not an investigative or adjudicatory proceeding, requiring that written allegations be made to trigger the initiation of regulatory procedures.

*Alternative 3.* A commenter recommended that the blast schedule be mailed to all residents within one mile and that a map showing the permit area be included with the schedule. The Office did not adopt these recommendations, because a precise description of the permit area is already required to be published in local newspapers under 30 CFR 786.11, and residents beyond a distance of one-half mile from the permit area can reasonably be expected to have adequate notice of the blasting schedule by its publication in the local newspaper.

**II. Section 816.62(b) Survey Personnel.** A. Numerous comments were received relative to the personnel specifications in the proposed rules for conducting preblast surveys. A review of the comments resulted in consideration of the alternatives listed below. The Office adopted alternative 5.

1. Retain the section as it appeared in the proposed regulations.

2. Amend the regulation to give property owners and residents within one-half mile of the permit area the right to agree to the persons conducting the preblast surveys and/or the right to have their own candidates perform surveys.

3. Establish specific approval criteria for preblast surveyors and have the regulatory authority approve all those permitted to perform such surveys.

4. Establish only one criterion: preblast surveyors must not be employed by operator.

5. Delete requirement for regulatory authority's approval of persons conducting preblast surveys.

**B. Analyses of Comments and Alternatives**

*Alternative 2.* The Office did not adopt this recommendation as it would make it too difficult to conduct prompt surveys, contrary to the purposes of the Act. Also, it is in the permittee's interest to have a thorough survey performed when requested, as it will serve as a baseline of damage existing at the time of the survey. Furthermore, the public can retain its own consultants, if necessary, for conducting surveys.

*Alternatives 3, 4, and 5.* Several comments were received recommending against allowing the use of personnel employed by the mining industry to conduct preblast surveys, while several other commenters asserted that use of industry personnel should be allowed.

As stated in the preamble to the proposed regulations, one of the objectives of the survey is to increase communication between the mining entity and the public about blasting oper-

ations including discussions about how operations are conducted and how they may be modified, if necessary, to prevent damage. Use of personnel employed by the mining operators to conduct preblast surveys facilitate this objective.

The second objective of the preblast survey is to provide for the establishment of a preblasting record of the existing conditions of structures. The survey will provide a baseline record against which the effects of the mining-related blasting can be assessed. As it is to the operator's advantage to obtain a thorough preblast survey, it is not necessary to burden the regulatory authority and the industry with the requirement of approval of specific personnel conducting preblast surveys, because the operator is likely to use competent persons to conduct the survey. In addition, requiring prior approval of specific survey personnel would necessitate the establishment of comprehensive, job-related approval criteria, a scheme beyond the scope of this rulemaking.

The requirement in the proposed regulations for regulatory approval of personnel conducting the surveys was, therefore, deleted.

**III. Preblast Survey Methodology.** A. Recommendations as to the specific details of the conduct of preblast survey required by the rules were made by several commenters. Based upon a review of the comments, the alternatives listed below were considered. The Office adopted alternative 1. The Office may also prepare guidance manuals concerning the content of the preblast survey, if future experience indicates a need.

1. Retain the subject section as published in the proposed regulations.

2. Require that the subject of structural fatigue, due to blasting, be included as part of the preblast survey report.

3. Require that information be provided in the report on a specific minimum list of items.

4. Require that a photographic record, with copies of the photographs, be provided to the regulatory authority and to the survey requestor.

**B. Analyses of Comments and Alternatives**

*Alternative 2.* A commenter recommended that the subject of structural fatigue due to blasting be a required item to be considered in each preblast survey. The Office did not adopt this comment as the current state-of-the-art indicates that structural fatigue is not a factor in blast damage. (Mcdearis, Ref. 12, p. 84).

*Alternative 3.* A comment was made that information be required on specific minimum items such as cracks in foundations, water leaks, mortar cracks, loosened gutter nails, and col-

umns out of location. The Office did not adopt this recommendation, as it is in the self-interest of the mine operator that the preblast survey accurately reflect the condition of the structure at the time of the survey.

*Alternative 4.* Another commenter recommended that a photographic record of the structure be required as part of the survey report. The Office did not adopt the recommendation, because photography is not the only method of establishing the condition of structures. Verbal, textual descriptions are an acceptable alternative.

**IV. Section 816.62(c).** (A) Numerous comments were received on the requirements for a written report of the survey. A review of the comments resulted in consideration of the alternatives listed below. The Office adopted alternative 2.

1. Amend the proposed regulations to substitute the word "may" for "shall" in the requirement that "... the report shall include recommendations..."

2. A requestor of the preblast survey should be allowed to file objections to the report with the regulatory authority.

3. A requestor of the preblast survey should approve the survey or include comments on it, before the survey report is submitted to the regulatory authority.

4. Amend the section to require the regulatory authority to approve, disapprove, or modify any recommendations contained in the survey report regarding the blasting plan, within a specified time period.

**(B) Analyses of Comments and Alternatives**

*Alternative 1.* The Office did not adopt alternative one, because, as many commenters pointed out, the principal objective of the survey is to record existing levels of damage. The professionals who are competent to perform that work are not necessarily qualified to make recommendations concerning blasting itself.

Further, as was explained in the preamble to the proposed regulations, examination of relevant technology thus far has revealed no current, reliable methods for routinely determining the condition of structures in terms of resistance to vibration of structural and nonstructural elements, prior to blasting. Therefore, analyses regarding proposed blasting operations may not be possible in all cases, as part of the preblasting survey.

*Alternative 2.* Alternative two was adopted because the requestor of a survey should have the right to comment to the regulatory authority concerning specific objections to the report of the preblast survey, so that the regulatory authority's limited surveillance capabilities of surveys are

complemented and so that potential disputes between the permittee and the affected public may be resolved prior to blasting events. In that regard, the Office determined that the public would not be sufficiently protected by the right to file complaints under the inspection and enforcement provisions of Sections 517 and 521 of the Act and Subchapter L, because that process is intended to provide a remedy for problems that have already resulted, whereas the purpose of complaints on a preblasting survey is to prevent adverse effects prior to their occurrence.

*Alternative 3.* The Office did not adopt recommendations by commenters that the requestor of the survey must approve the survey report or include comments therein, before the survey report is submitted to the regulatory authority. Requiring approval of the report prior to its submittal to the regulatory authority would result in considerable delay of the report's submission. Further, it appears to the Office that approval of the report by the requestor might not serve a meaningful purpose, where the requestor was reviewing a report containing detailed technical information difficult for lay persons to understand. As an alternative, the Office has decided that the right of the requestor to comment on the report as provided for in alternative two will provide adequate protection, because the requestor will have had an opportunity to independently consult with appropriately qualified persons, if necessary, prior to filing objections.

*Alternative 4.* The Office did not adopt the recommendation of a few commenters that, within a specified time period, the regulatory authority shall in all cases approve, disapprove, or modify any recommendations regarding blasting that are contained in the survey report. It is the responsibility of the permittee, in the first instance, to conduct operations to avoid damaging property. Therefore, it is the permittee's primary responsibility to either implement or reject the recommendations. Requiring regulatory authority approval in all cases of recommendations in preblast survey reports would also be inconsistent with the purpose of the survey, which is to expeditiously provide a baseline reservoir of data on existing damages to structures.

Of course, there are instances where this consideration may be outweighed by the need for a regulatory authority to carefully scrutinize proposed blasting operations prior to blasting, such as where restrictions of Section 816.65(f) or where the peak-particle velocity limit needs to be set below one inch per second, to protect sensitive structures under Section 816.65(i). In

those instances, scrutiny of the preblast survey report, together with other relevant data, is needed because of the greater probability of adverse effects from blasting and also because, ordinarily, examination of those matters will not have occurred during the permit application review process, as is explained in the preamble to 30 CFR Section 780.13.

§ 816.64 Use of Explosives: Public notice of blasting schedule.

816.64(a)(1). *Blasting Schedule Publication*

A. Several commenters objected to the provisions in the proposed regulations requiring the mining operation to publish its blasting schedule in a local newspaper at least 10 days, but not more than 20 days, prior to blasting. A review of the comments resulted in consideration of the alternatives listed below. Alternative 1 was adopted by the Office.

1. Retain Section 816.64(a)(1) as proposed.
2. Allow publication of the blasting schedule at the same time that notification of the filing of the permit application is published.
3. Do not require public notification of the blasting schedule and delete Section 816.64(a)(1).
4. Delete the requirement for publishing the blasting schedule in a newspaper, but retain the requirement for notification by mail.
5. Require notification of the blasting schedule only in "heavily populated areas."

B. *Analyses of Comments and Alternatives.*

*Alternative 2.* One commenter stated that the permittee should be allowed to publish the blasting schedule at the same time as the notice of the filing of the permit application is published in a newspaper under Section 513(a) of the Act and 30 CFR 786.11. The commenter reasoned that, since it is impossible to predict when a permit to mine will be granted, rerunning the newspaper notice and performing the mailings within the proposed rule's prescribed time would be very difficult to predict.

If this comment were adopted, the schedule published at the time of the filing of the permit application would be likely impossible to predict since it would not be known when the permit would be granted and, therefore, the applicant could not publish with reasonable specificity the date when blasting was planned to start. Moreover, as is explained in detail in the preamble to 30 CFR 780.13, permit applications will ordinarily not contain detailed information on proposed blasting activities. Hence, the applicant will not have the data available at that point with which to sufficient-

ly warn the public. Alternatively, the operator can be specific, after the permit has been issued and before publishing the blasting schedule, so as to adequately warn the public of when blasting, in fact, will be conducted.

*Alternative 3.* It was asserted by a commenter that publication of the blasting schedule is unnecessary and dangerous to mine personnel who might rush operations to meet the schedule. Publication of the blasting schedule is required by Section 515(b)(A) of the Act and the schedule can be planned in accordance with Section 816.64(b) of the regulations so that it does not increase the danger to mine personnel, by selecting certain periods during several hours of the day for detonations of the blasts. If a case did occur that a blast was not ready to be detonated at the time originally anticipated, it could be detonated during the next scheduled detonation period.

Moreover, Section 816.65(a) of the final rules allows for detonations to be made in deviation from the schedule published in the newspaper, under carefully prescribed circumstances, to avoid a safety hazard to workers. Finally, Section 816.64(a)(1) does not prohibit loading of blasts at any time during the daylight hours; the schedule requirement refers only to periods of time when detonations are actually conducted.

*Alternative 4.* Another commenter agreed with the notification of the blasting schedule by mail, but objected to the requirement of publishing the notice in the newspaper. Section 515(b)(15)(A) of the Act, however, specifically requires publishing the schedule "in a newspaper of general circulation in the locality." Further, persons traveling through an area near blasting need to be aware of the times of blasting through newspaper notices, in addition to residents of those areas notified by mail.

*Alternative 5.* One commenter agreed with requiring public notice of the blasting schedule in heavily populated areas, but objected this was impractical in remote areas. The Office decided not to modify the regulation. Notification in remote areas will require considerably less effort to conform with the Act, due to the probability of fewer residents within one-half mile of the blasting site who require notification by mail. In any event, the Act requires notification without regard to the density of population in the areas involved.

Section 816.64(a)(2)

A. Many comments were received on details of the mailing of the blast schedule and notification of how to request a preblast survey to owners and residents within one-half mile of the

blast site. A review of the comments resulted in consideration of the alternatives listed below. Alternatives 3 and 4 were adopted by the Office.

1. Retain Section 816.64(a)(2) as proposed.

2. Change "permit area" to "blasting site."

3. Restrict the meaning of "permit area".

4. Add a provision to Section 816.64(c), eliminating the requirement for preblast survey information in change notices.

*B. Analyses of Comments and Alternatives.*

*Alternatives 2 and 3.* Several commenters pointed out that Section 515(b)(15)(a) of the Act provides that residents within a half mile of the "blasting site" will be notified by mail of the proposed blasting schedule. However, Section 515(b)(15)(E) of the Act provides that any resident or owner of a structure within one-half mile of the "permit area" is entitled to a preblast survey. The Office takes these areas to be essentially the same, when viewed over the total permit term of a mining operation, realizing that the actual location of each successive blast within a permit area will necessarily differ from the preceding blast at a given point. Changing "permit area" as in the proposed rule to "blasting site" would, therefore, not accord all persons entitled to the preblast survey notice of their rights established under Section 515(b)(15)(E).

However, there are certain types of support facilities used routinely in surface mining activities which do not require the use of blasting. Notification of proposed blasting need not ordinarily be given to persons who reside or own property adjacent to such areas. Thus, Section 816.64(a)(2) was modified in the final rule, to clarify the applicability of the notification requirement with respect to the permit area.

Several commenters also recommended deletion of notice of rights to request a preblasting survey in the copy of the schedule mailed to residences within one-half mile of the permit area, alleging that this is expensive and will generate frivolous survey requests. Another commenter suggested adding notice of the right to request a survey to the newspaper notice. The Office decided to reject both sets of comments. Section 515(b)(15)(E) of the Act provides a right for a preblast survey upon request. To implement that right and to ensure that the public is adequately informed (Section 102(i) of the Act) of its rights, the Office is requiring that notice of these rights be made by mail to the persons involved. Newspaper notice, on the other hand, would duplicate notice by mail and could gener-

ate survey requests by persons outside the one-half mile zone.

*Alternative 4.* One commenter pointed out that the requirement to publish changes in areas on schedules of blasting would also require renotification of all residents and owners within the area of a right to a preblast survey. Since the purpose of the preblast survey is to provide baseline data, additional surveys are unnecessary, unless the structures or facilities studied have changed. Section 816.64(c) was revised in the final rules to eliminate requiring information relative to preblast surveys to be included in mailed notices of changes in blasting schedules, when notices previously mailed to the owner or resident have already supplied that information.

*Other Comments.* A commenter recommended that the regulations be amended to provide that the blasting schedule be submitted to the regulatory authority. This comment was not adopted, however, because the schedule will have to be retained by the permittee and made available for inspection in order to know when republication is necessary. Of course, if individual States desire such information, such a requirement can be included in their regulations.

Another commenter felt that special notification conditions are necessary in Alaska. Section 708(d) of the Act and 30 CFR 731.13, 736.22(a), 741, allow for the regulations to be modified to fit the special conditions of Alaska. Such modifications are not, however, within the scope of the instant rulemaking.

*Section 816.64(a)(3).*

A. Several comments were received concerning the provision of the proposed regulations that required renotification by the permittee of its blasting schedule every three months. A review of the comments resulted in consideration of the 3 alternatives listed below; alternative 3 was adopted.

1. Delete the requirement for renotification.

2. Retain the provision as proposed.

3. Retain the requirement for renotification, but lengthen the time period beyond three months.

B. (1) Several commenters recommended deleting this subsection in its entirety, arguing that the Act does not explicitly require renotification of blasting schedules. These commenters alleged that renotification is an unnecessary cost, with one commenter citing \$1,890 as a median cost to prepare, copy, publish, and distribute the schedule. Another commenter recommended that the section be changed to provide for an original notification covering the expected life of the mining operation, and to republish

and redistribute the schedule only in the event that life of the operation is extended beyond that noted in the original schedule. Section 515(b)(15)(A) of the Act requires the regulatory authority to promulgate regulations that will include provisions:

... to provide *adequate advance-written notice* to local governments and residents who might be affected by the use of such explosive, 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 . . . prior to blasting. (*emphasis added*)

There will be persons who will begin to travel or work in or move into the area around permitted operations only after the original notification of the blasting schedule. Therefore, renotification of some frequency is needed so that those persons are given the "adequate advance written notice" required by the Act. Further, as the comments on the proposed blasting plan portions of the permit regulations (30 CFR 780.13) showed, highly detailed predictions of blasting operations cannot ordinarily be given several years in advance of conducting those operations. Thus, renotification of blasting schedules will be needed on, at least, approximately annual frequencies as detailed information on blasting becomes available to the permittee.

Renotification of the blasting schedule at least every 12 months can reasonably be expected to keep the populace adequately notified and aware of the blasting schedule and sufficiently reduce the expense that would have been needed to comply with the proposed regulations. By lengthening the maximum time period from three to 12 months, small mining operations, where necessary blasting can ordinarily be completed within 12 months, will be spared the expense of renotification of the blasting schedule, unless changes in operations are made during the 12-month period.

*Section 816.64(b)(2)(ii)*

A. Numerous comments were received relative to the provisions of the proposed regulations limiting blasting to periods not exceeding an aggregate of four hours in any one day. A review of the comments resulted in consideration of four alternatives; alternative 1 was adopted by the Office.

1. Retain "aggregate of four hours" as published in the proposed regulations;

2. Change to "aggregate of eight hours;"

3. Change to "between Sunrise and Sunset;"

4. Delete the last sentence of the section, i.e., allow blasting throughout the day, without limitation on the length of the time periods.

B. Numerous commenters objected to the aggregate of four hours as promoting unsafe operations, principally on the theory that blasters would be rushed to meet a certain specific time period, causing mistakes in detonation which would be dangerous. These comments, however, were based on misinterpretation of the regulations, which require only that "... such periods shall not exceed an aggregate of four hours in one day." (emphasis added) This would allow for blasting at more than one time period in one day, so long as the aggregate of total blasting time does not exceed the maximum of four hours. Thus, there should be no necessity for operations to "rush" to blast at one particular hour, as personnel engaged in blasting can detonate the round during any one of the scheduled periods in the daily aggregate of four hours.

Furthermore, as is explained in Section 816.65(a), blasting may be delayed and conducted at a previously unscheduled time under carefully prescribed conditions, if specified unavoidable hazardous conditions arise, in order to avoid safety hazards to workers.

(2) Many commenters stated that the four-hour limitation would unduly inhibit operations and was not authorized by the Act; several commenters objected that they could not sufficiently predict when blasting would be conducted. Some commenters also stated that the limitation would increase costs, but provided no supporting data. As previously discussed, however, the regulation allows for multiple blasting periods, aggregating to a daily total of four hours, giving a great deal of flexibility to an operator to fashion its own blasting schedule. Because the regulations only specify that detonation must be within the time frame, the operator can do all preparation for blasting during other times. In fact, several commenters stated that if it was clear that several different times aggregating to four hours was permitted, then the four-hour limitation would be acceptable.

Regardless of possible inhibition of operation and costs associated with these limitations, the Office must establish some time limitations on blasting under the Act. Section 515(b)(15)(A) of the Act requires that the person conducting surface mining activities "... provide adequate advance written notice to local governments and residents ... of the planned blasting schedule."

Thus, some limitation on the frequency of blasting must be imposed, to ensure that predictions are made by

the operator for the purpose of including in the schedule "adequate advance written notice." Secondly, Section 515(b)(15)(c) of the Act requires that blasting be limited with respect to the "timing and frequency of blasts..." Therefore, limitation on the total duration in which blasting may occur in any one daylight period is appropriate to implement this Section of the Act.

Given that the Act requires establishing limitations on the timing of blasting, the industry must develop the capability of planning its operation so as to be able to predict in advance, to a certain extent, the times in which blasting will occur. As noted above, some commenters indicated that this can be done under the "four-hour aggregate" system, which is what the Office requires.

(3) Comments that suggested limited blasting only to eight hours per day or "sunrise to sunset" would not meet the requirements of the Act. These limitations would not provide a schedule with sufficiently specific advance warning to inhabitants of areas around the minesite, persons traveling through these areas, and local governments so as to allow those persons and governments to regulate their daily activities around normal work or business hours when blasting would take place.

#### V. Section 816.64(c).

Additions were made to this Section from the proposed regulations, due to comments received and discussed under the preamble to Sections 816.64(a)(2) and 816.64(b)(2)(ii).

#### § 816.65 Use of explosives: Surface blasting requirements.

##### Section 816.65(a).

(A) A few commenters objected to allowing the regulatory authority to specify time periods for allowable blasting that are more restrictive than sunrise to sunset, while others recommended further restrictions on blasting between 5 p.m. to sunset. Some commenters objected to prohibiting blasting at night, alleging that it may be dangerous to hold undetonated charges overnight. Other comments proposed that the regulatory authority be allowed to grant exemptions for night blasting on a site-specific basis in remote areas; additional comments cited the special conditions in Alaska as an example where restrictions on night blasting are unreasonable. One commenter assumed a conflict between this section and MSHA's proposed blasting regulations. A review of these comments resulted in the Office's consideration of five major alternatives; alternatives 4 and 5 were adopted.

1. Retain the Section as proposed;

2. Allow blasting at night in "remote areas;"

3. Modify the Section to add further restrictions on blasting between 5:00 p.m. and sunset;

4. Modify Section 816.65(a) to be more specific as to the reasons the regulatory authority may use to specify more restrictive time periods on an *ad hoc* basis;

5. Modify Section 816.65(a), by adding a provision to allow for blasting at night on loaded charges that cannot be either detonated by sunset or delayed until sunrise of the following day for safety reasons. (This alternative included attaching conditions to the use of night blasting, to ensure that the public is still adequately warned and protected as required by the Act.)

(B) *Alternatives 3 and 4.* A few commenters objected to allowing the regulatory authority to prohibit or otherwise regulate blasting in time periods in addition to the sunset-to-sunrise restriction. These comments objected to the vagueness of the discretionary power which would have been granted the regulatory authority under the proposed rule. The Office agreed that more specificity is desirable. Accordingly, the regulations have been modified to clarify the conditions under which the regulatory authority has the power to further modify hours for blasting.

The regulatory authority will only be empowered under Paragraph (a) to impose more restrictive blasting time periods for the specific purpose of protecting the public from adverse noise. In some cases, protection against noise may warrant special precautions, particularly because it can be much more severe under certain atmospheric conditions (Ref. 25, p. 404 and Ref. 21, p. 15). The public is adequately protected from other effects of blasting, such as ground vibrations and flyrock, by Sections 816.65(g) and (1). A few commenters recommended that blasting should be further restricted, than in the proposed regulations, between 5:00 p.m. and sunset, because of noise caused by blasting that would occur during those hours when people relax at the end of the day. The Office did not accept this recommendation as it would be redundant. The regulatory authority may specify more restrictive time periods to protect from adverse noise under Section 816.65(a)(1).

(C) *Alternative 5.* Several commenters noted that it may be dangerous to hold explosive charges overnight which were loaded with the intention of detonation during the day, but through equipment failure or sudden adverse weather occurrences could not be detonated until after sunset. These comments asserted that, in the next day, the explosives could

react to detonation by blowing out and throwing rocks over the area, due to moisture accumulation in the charge holes, or could result in incomplete or no detonation at all. The threat of such contingencies was said to be safety problems to the workers, such as in digging out undetonated explosives. Some of these comments recommended modifying the regulations to allow for blasting at night to prevent these safety problems.

Although not fully explained by the comments, throwing of rocks could possibly result from leaving undetonated charges held overnight. Due to the deteriorating effect of moisture in the blast hole on some types of explosives or blasting agents, some of the charged blast holes in a blast may not have the power necessary to fragment surrounding rock as originally planned. Under these circumstances, it is probable that some charged holes would lose their potential power to a greater degree than others, due to having been in the ground for a greater number of hours or being subjected to more moisture. Where charges that retain a considerable portion of their original power were adjacent to more severely weakened charges, a situation could be created that would result in excess rock being thrown in the air. This could be caused by the failure of some weakened charges to move the rock burden in a lateral direction as planned, with the more powerful charges only moving rock in a vertical direction.

As a result, the Office decided that a change in the regulation should be made to allow blasting at night, when it is necessary to prevent creating a hazardous condition, while maintaining controls to prevent abuse of the provision. These controls are imposed to ensure that the public is adequately warned of an emergency blast and that records are made and reported to the regulatory authority to ensure that the provision is not used except in unavoidable hazardous situations.

The Office notes that, while MSHA currently does not prohibit all surface blasting at night, a proposed revision to MSHA's regulations (33 CFR 477.1308(j)) would create such a blanket prohibition. The Office will, however, ensure that its regulations are closely coordinated with MSHA's final rule and expects that, given the safety problems discussed above, MSHA will appropriately modify its proposed regulation when adopted in final form.

(D) *Alternative 2.* One commenter proposed that the regulatory authority be allowed to create exemptions for blasting at night, on a site-specific basis, for surface mines in "remote areas." This comment was rejected. The Act requires that blasting be appropriately restricted as to times with-

out regard to the density of population in surrounding areas. Indeed, the Act requires protection of even a few persons (i.e., "the public") in areas located near to the permit area. Furthermore, the use of the "remote area" concept would be very difficult to enforce, because it would require extensive field investigations to determine the density of population in areas surrounding minesites, often in very difficult terrain, thereby utilizing enormous regulatory authority resources for the benefit of very few mine operations.

(E) A commenter from Alaska objected to the restriction on nighttime blasting due to portions of that State having up to 5½ months of completely daylight time and winters where daylight is only 2-3 hours a day in areas where coal is actively produced. This was decided to be outside the scope of this national rule-making and should be addressed, if valid, through appropriate special provisions for Alaska under Section 508 of the Act and 30 CFR 731.13, 736.22(a)(1), and/or 741, depending upon whether the State of Alaska seeks to implement its own State program.

(III) *Section 816.65(b).*

(A) MSHA commented that this section, as proposed, was unclear in two ways. First, unscheduled blasting was to be allowed only in "emergency conditions approved by the regulatory authority." The Section did not specify when or how these situations would be approved by the regulatory authority and left the implication that operators would have to contact the regulatory authority, after an emergency arose, to obtain permission to blast at unscheduled times.

The Office agreed with this comment and has reworded the Section to read, "previously approved by the regulatory authority in the mining plan." Though 30 CFR 780.13(f) requires that applicants for permits list such situations in the permit application, persons who are responsible for meeting the requirements of Section 816.65(b) could have misinterpreted the method and time of regulatory approval as the section was previously worded.

MSHA's is second concern was that the word *emergency*, along with the listing of "rain, lightning, other atmospheric conditions," was not consistent with MSHA terminology. MSHA considers rain and lightning to be expected and recurring hazardous events, not emergencies. MSHA labels such events as "hazardous situations," along with emergencies (totally unexpected events which are also hazardous, e.g., fires). The Office agreed to substitute MSHA's term, *hazardous*, for *emergency*, which makes terminology of the two agencies consistent and de-

scribes all situations which threaten operator or public safety. The Office has further limited approval of unscheduled blasting to those times of *unavoidable hazardous* situations, preventing approval of situations which could be created by the operator to justify deviation from the blasting schedule for convenience and not safety's sake.

Adoption of these changes in Section 816.65(b) also required changing the word *emergency* to *unavoidable hazardous* in Sections 816.64(b)(2)(v), 816.65(a)(2)(i), and 817.65(b)(2)(i), and adding it at Section 780.13(f), to maintain consistency of terminology throughout affected portions of the regulations.

(B) (1) Several other comments received on proposed Section 816.65(b) suggested that additional requirements be added, that the blasting schedule be eliminated, and asserted possible conflicts with MSHA regulations. Analysis of these comments led to consideration of three alternatives; alternative 1 was adopted.

1. Revise Section 816.65(b), only as per MSHA's comments.

2. Require a report to be submitted to the regulatory authority, within 10 days of any emergency blast.

3. Explain the definition of emergency condition in this section.

(2) *Alternative 2.* One commenter recommended that the emergency conditions and reasons for deviating from the blasting schedule be documented and reported to the regulatory authority within 10 days of the occurrence of the blast. The Office believes that the recording requirements of Section 816.68 are adequate to ensure that sufficient information about the blast is developed and maintained for scrutiny by the public and regulatory authority. Under Section 816.68, the permittee must record pertinent information about each blast contemporaneously with blasting and maintain that record for public and regulatory authority inspection. This should be adequate, on a national basis, for regulation of the wide variety of circumstances in which emergencies may occur.

That range is distinguishable, however, from the narrow type of circumstances when blasting at night would be authorized in Section 816.65(a). In the latter situation, reports should be filed with the regulatory authority much less frequently, and the regulatory authority needs to more closely scrutinize night blasting because of its high potential for causing adverse noise effects. The decision on Section 816.65(b), of course, will not preclude individual States from requiring the filing of such reports, if their needs require it.

(3) *Alternative 3.* Another commenter suggests that the conditions

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Justifying deviation from the schedule be expanded to specifically include "events beyond the operator's control." The Office feels that this is adequately provided for by substituting the adjectives *unavoidable* and *hazardous* to describe those situations which warrant unscheduled blasting.

(4) *Other Comments.* One commenter's objection, that the schedule, stating it is impractical to establish, was rejected. The Act in Section 515(b)(15)(A) requires a blasting schedule.

Another commenter suggested that there are some differences between Section 816.65(b) and MSHA's regulations, 30 CFR 77.1303(uu) and proposed Section 77.1305(g). MSHA's existing and proposed regulations call for suspension of operations and withdrawal to a safe location of all persons upon the approach of an electrical storm. The Office does not believe that these create a conflict with Section 816.65(b), as the withdrawal would constitute justification for deviation from the proposed schedule, if the operator's permit had provided for such conditions under Section 780.13(f). If delay because of storm conditions had not been approved by the regulatory authority in the permit, the operator would have to wait for the next scheduled time period to conduct blasting operations. In no event does Section 816.65(b) allow for blasting during an electrical storm.

### III. Section 816.65(c).

(A) A number of commenters objected to the requirement that warning and all-clear signals be given which are audible at a distance of one-half mile from the blast site. Other commenters felt that this provision is already covered by MSHA regulations, that particular items should be deleted, that additional sections should be added covering specific provisions on safety in the storage and use of explosives, that the signals should be audible "under normal weather conditions", that some wording was unnecessary, and that the section was inappropriate for the State of Alaska.

The Office's review of these comments led to the consideration of four major alternatives and the adoption of alternative 1.

(1) Do not revise this Section from the proposed rule;

(2) Reduce the audible limit to one-quarter mile or less;

(3) Delete the requirement for periodic notification and posting of signs;

(4) Specify the signal source and signal character.

(B) *Alternative 2.* Several commenters recommended that the audible distance requirement for signals be reduced to one-quarter mile or less.

Some of these commenters asserted that, to meet the requirement that the signal be audible for a distance of one-half mile, the noise level of the signal would be greater than allowed by MSHA. Although the particular regulation was not specified by the commenters, 30 CFR 70.510(b)(3) of MSHA's regulations lists a table of permissible noise exposure levels as follows:

Duration per days (hours)	Noise level (dBA)
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
¾	107
½	110
¼ or less	115

(Figure 1)

These do not substantiate the commenters' assertion that the requirement for warning signals audible to one-half mile from the blast would require a sound source that would exceed MSHA's allowable noise levels at the mine. First, several warning signal devices can be appropriately positioned at strategic locations within the one-half mile area and the sounding of the several devices coordinated electronically or by some other means. The noise levels from the individual devices would be considerably less than for a single device used to notify the entire one-half mile area. The Office's regulations do not specify that a single signal device has to be audible for one-half mile. Rather it requires that signals that are audible within a range of one-half mile shall be given.

Second, as provided in MSHA's Section 70.510(b)(3), a sound level of 115 dBA is an allowable level for up to 15 minutes per day. Adequate warning signals under the Office's regulations can be conducted to aggregate less than 15 minutes per day, particularly considering that blasting may only be conducted within a total aggregate of four one-hour periods. Thus, warning and all-clear signals may be divided into eight segments of one minute each, far less than the 15-minute limit imposed by MSHA's regulations.

Third, calculations made by the Office and contained in its administrative record indicate that a warning signal sounded at 115 dBA (MSHA's maximum in Table 1) or less can be audible at a distance of one-half mile.

(C) *Coverage by MSHA.* Several commenters stated that the provisions of this Section are already adequately addressed under MSHA's regulations. MSHA has only one proposed signal warning regulation (30 USC 77.1308h), and it merely provides that "ample warning shall be given . . ." However, Section 515(b)(15)(A) of the Act re-

quires that daily notice be given to residents/occupiers in the area that are within one-half mile of the blast site. Therefore, the Office decided not to alter the regulation, because the provisions of this section will fulfill the Act's requirement for daily notification of the public, in a manner that is satisfactory, appears to be most practical, and does not duplicate MSHA's proposed general requirement.

(D) *Alternative 4.* A few commenters recommended that additional provisions be added to Section 816.65(b), to specify rules on handling explosives, and that this paragraph be modified to specify the actual signal type and the signal source. The material that was recommended to be inserted is covered in MSHA's rules, 30 CFR Part 77. Addition of those rules would be mere duplication of MSHA, as opposed to the requirements for when signals are to be given and at what distances they must be audible, and would not provide any greater protection to the public or environment. If conditions in particular States require specific signals or signaling devices, these can be adopted in that State's regulations.

(D) *Alternative 3.* Several commenters recommended deletion of the provisions for periodic notification or communication of the meaning of signals and maintenance signs. Commenters felt that miners and visitors are warned and instructed when entering the property. That, in itself, would not, however, provide warning instructions for residents within one-half mile, if they are not employees of the mine. Therefore, the comments were not accepted.

(E) *Other comments.* (1) One commenter recommended that the section should be changed to "audible, under normal weather conditions, within a range of one-half mile." The Office did not feel that this modification would improve the regulations, as the phrase "normal weather conditions" would be subject to highly variable, and the statute requires adequate warnings without regard to the type of weather conditions. Indeed, severe weather is the time when warnings are most necessary, because of the increased danger of airblast and reduced visibility for persons traveling near the permit area.

(2) A commenter stated that the phrase, "through appropriate instructions," should be deleted as unnecessary additional wording. This wording specifies how the information shall be communicated and the Office, therefore, decided it should be retained to ensure that the Act is fully implemented.

(3) Another commenter alleged that there are significant differences between most mining to be covered by

this Section and conditions of mining in the State of Alaska. This comment was believed to be outside the scope of this national rule-making and can be more appropriately resolved when a particular permanent regulatory program is approved for Alaska under Subchapter C and D.

(4) Several commenters alleged that the blasting schedule provision is redundant, because audible warnings required prior to a blast under Section 816.65(c) would be sufficient. Audible warnings alone, however, are not sufficient. The Act specifically requires publishing of blasting schedules in advance. Furthermore, audible warnings will not provide adequate advance notice either to persons inside buildings in the area around the minesite (and thus cut off from the signals), or to persons who travel through the blast area between the signal and the blast.

(5) Several comments cited Gustafsson (page 256, ref. 8) on the effects of atmospheric conditions on the propagation of blast noise, as justification for eliminating the four-hour time aggregate. Gustafsson correctly points out that—

“... wind direction, wind velocity, air temperature, and air pressure have a very great effect on the propagation of pressure waves. Even the type of weather, for example cloudy or almost clear, should be taken into consideration when estimating the propagation of pressure waves. . . .”

However, the multiple time frames allowed by the “four-hour aggregate” rule of Section 816.65(b)(2)(ii) and the emergency blasting provisions of Section 816.65(a) and (b) provide a degree of flexibility such that the requirement for a blasting schedule need not be the cause of blasting at times when atmospheric conditions may cause propagation of blast noise. If the blast cannot be detonated during any of the scheduled blasting periods because of adverse atmospheric conditions, the blast can be detonated when necessary in accordance with Section 816.65(a) and (b).

(6) One commenter stated that the “four-hour limit is meaningless,” asserting that operator will be able to blast for 10 minutes in any hour and thus blast every half-hour throughout the day. The regulations, however, do not allow this to occur. Section 816.64(b)(1) states that “a blasting schedule shall not be so general as to cover all working hours. . . .” Section 816.64(b)(2)(ii) states that “such periods shall not exceed an aggregate of four hours.” (Emphasis added.) These sections of the regulations limit blasting operations to not more than four specific hours. Thus, blasting could occur during the hours of 9 a.m.-10 a.m., 11 a.m.-12 p.m., 1 p.m.-2 p.m., 3

p.m.-4 p.m., but not in 10-minute increments of each of the hours 9:00 a.m., 10:00 a.m., 11:00 a.m., 12:00 p.m., 1:00 p.m., 2:00 p.m., 3:00 p.m., 4:00 p.m., 5:00 p.m., 6:00 p.m., 7:00 p.m. To further ensure that this system is not abused and provides for protection against the hypothetical situation raised by commenters, a provision was added to Section 816.64(c) to allow the regulatory authority to require republishing and redistribution of the blasting schedule, if there is a substantial pattern of non-adherence to the original schedule as evidenced by the absence of blasting during scheduled periods.

IV. Section 816.65(d).

(A) A few commenters pointed out that some confusion could result from the wording of the proposed rules as to the limit of the “blasting area” to be protected from entry. Objections were also received on the time limit for guarding and on the protection of livestock. Based on these comments, the final rule was reworded to clarify the area to be regulated and to eliminate the requirements of prohibiting access to the area for a specific time prior to the blast.

(B) Several commenters stated that use of the term “blasting area” would result in confusion as to the actual extent of the area to be regulated under this section. The term “blasting area” was used in proposed Sections 816.65(d) and 817.65(e), to mean the area possibly subject to flyrock from blasting. However, one commenter stated that MSHA presently interprets “blasting area” to be confined to the blast hole pattern.

Another commenter expressed the fear that the Office's proposed rule would be interpreted to allow unauthorized persons to enter the blast-hole pattern area at any time until 10 minutes prior to detonation of the blast. Such an interpretation is unwarranted and would be unacceptable to both MSHA and the Office. Further, by deleting the words “blasting area” and substituting “an area possibly subject to flyrock from blasting,” the confusion of terms will be eliminated.

(C) One of the commenters also pointed out that, where it is necessary to stop traffic during blasting near public roads, the 10-minute minimum control limit will cause extra inconvenience to the traveling public. The Office feels that it is not necessary to specify a particular time limit prior to the blast for which access to the flyrock area should be controlled.

The purpose of the rule is to assure that the public or livestock will not enter an area where they could be endangered by flyrock during blasting and that access to the area after a blast will not be permitted, until an in-

spection by the mining personnel indicates it is safe to do so. To accomplish this may require that access to the area be regulated more or less than 10 minutes prior to the blast. Thus, if the section were not reworded, there would be confusion about the area to be guarded and in some instances the public would be subject to unnecessary inconvenience due to the specified time limit of control prior to the blast.

(D) One commenter also objected to the inclusion of livestock in the regulation on the grounds that all States have livestock fencing laws and therefore the inclusion of livestock was redundant. Livestock constitutes “property” protected by the Act. Fencing may not be successful in all cases, or fences may be too far apart to preclude widespread movement of animals into close proximity of blasting. Therefore, the Office decided not to delete livestock from the section.

V. Section 816.65(e).

Although several commenters supported the proposed version of this section, other comments suggested that either it be deleted, or the wording changed to agree with relevant MSHA regulations. Several commenters recommended deletion on the grounds that the guarding of charged holes is already covered by MSHA and that an additional rule covering the same item is merely duplicative. MSHA does, in fact, cover the protection of charged holes under 30 CFR 77.1303(g), which provides: “Areas in which charged holes are awaiting firing shall be guarded or barricaded and posted or flagged against unauthorized entry.” The Office believes that the MSHA rule is adequate, so that the Office's proposed rule was redundant. MSHA's regulation will apply to surface coal mining operations throughout the active phase of mining. Blasting is not ordinarily conducted at other times in the surface mining of coal, and the flagging/guarding of holes is related solely to worker protection, not those outside the mine-site.

Section 816.65(f)—Airblast Standards

(A) Numerous comments were received on a variety of aspects of the airblast standard, including recommendations for both higher and lower permissible noise levels, changes in frequency specifications in Hertz (Hz.), and exemption of certain structures from protection by the standards. A review of the comments resulted in the consideration of the following alternatives. Alternatives 10, 11 and 12 have been adopted.

- (1) Retain the rules as proposed;
- (2) Increase the permissible airblast level;

(3) Decrease the permissible airblast noise level standards;

(4) Permit a percentage of the blasts to exceed the noise level standards;

(5) Delete the airblast noise level standards entirely;

(6) Change the Hz ( $\pm 3$ dB) in the table in Section 816.65(e)(1) to Hz ( $-3$ dB);

(7) Delete the C-weighted noise level standards;

(8) Replace the numerical airblast noise level standards with a stemming requirement;

(9) Use only one frequency specification, instead of multiple specifications;

(10) Delete the reference to the permit area in Section 816.65(e)(1) and allow a waiver from persons leasing structures from the operators;

(11) Add a provision enabling the regulatory authority to require monitoring of blasts;

(12) In Section 816.65(e)(2) change the upper limit of frequency from 500Hz to 200Hz and specify "Type 1" sound level meters for C-slow measurements.

#### II. Analysis of Comments and Alternatives

A. *Introduction.*—MSHA health standards in 30 CFR, Parts 70 and 71, protect only mine workers from hearing loss caused by *continuous* noise, such as that emitted by trucks, shovels, car shutters, and crushers. However, impulsive noise, such as airblast resulting from the detonation of explosives is not similarly regulated by MSHA. Because impulsive airblast can cause property damage (Ref. 21, pp 2,3,15; Ref. 25, p.400), the Office has adopted standards to prevent damage to structures and to protect the public from noise resulting from airblast.

*Alternatives 2, 3, and 5.* Reference 21 was written in 1974 and was based on 26 quarry blasts and an analysis of the results of a great deal of previous work by other researchers. This reference recommended a 136 dB linear peak value (equivalent to the 130 peak measured at six Hz or lower peak response) as a minimum allowable level for airblast, based on damage probabilities. This data was further supported by more recent work.

The airblast noise level standards of the regulations are based largely on a special study conducted by the Bureau of Mines (Ref. 22). The time histories of hundreds of cases of ground vibration, airblast, and structural response to ground vibration and airblast were plotted and analyzed. Using the observed structural response to ground vibration and airblast and observed damage to the structures, an appropriate airblast/ground vibration equivalence, consistent with the latest data on structure response, damage, and tolerable levels was derived.

The noise level limitations specified in the table in Section 816.65(e)(1) represent the conclusion of the Bureau of Mines study, the latest state-of-the-art in understanding coal mine blasting airblast on structures and methods of measurement of that airblast. To increase reliability, two independent approaches were used to derive the values specified in the regulation.

(1) The first analysis involved determination of the structural response associated with a one-inch-per-second ground vibration. Plots were made of the previously described data organized into four classes: one-story homes, two-story homes, corner responses (structural), and mid-wall responses (non-structural).

The airblast response data were then similarly analyzed, except that the above four categories were each examined for six types of airblast descriptors. The results of this series of comparisons correlated very closely, probably because the natural frequencies of structures are within a narrow range (Ref. 12, pp. 6&7).

Based on the first method of analysis, it was decided that the amplitude of mid-wall and corner motions of structures could be limited to levels below those causing damage, by limiting the amplitude of airblast from 135 to 137dB,<sup>2</sup> when measured on a blast meter (Ref. 20, pp 20-23 and 21, p. 14) that measures the peak amplitude and has a flat frequency response of 0.1 to 200 Hz (135 dBL (0.1Hz), or when the amplitude of airblast is limited to 109-112 dB when measured with a "type 1" sound-level meter that will hold the peak reading and uses the C-weighting, slow response described in ANSI Standards S1.4-1971 (dBC-slow).

Limiting airblast to 137 dBL (0.1Hz) would protect structures from structural damage, when the most disadvantageous combination of structure response to ground vibrations and structure response to airblast is considered (Ref. 22). Consequently, the use of 135 dBL (0.1 Hz) provides a slight safety factor to preclude damage to structures. This factor was also needed to try to reduce human annoyance factors from mid-wall structure motions and associated rattling (Ref. 21, pp. 15 and 16). C-weighted-slow responses were similarly analyzed, with the value of 109 dB C-slow recommended as being equivalent to the 135 dBL (0.1 Hz) level.

<sup>1</sup>As used in Ref. 22, the natural frequency of the structure is that frequency at which the structure tends to vibrate when excited by an impulsive loading such as airblast or ground vibration from blasting.

<sup>2</sup>As used in Ref. 22, the dB (decibel) is a measurement of sound pressure and is defined as 20 times the logarithm to the base 10 of the ratio of the measured pressure to a reference pressure of 20 micro newtons per square meter.

(2) A second independent technique was used to analyze the airblast response data, involving displacement produced strain which is related to cracking in interior walls (Ref. 22, p. 4), according to the following method:

*Method No. 2: (Displacement-produced strain method)*

lowest observed damage level

0.016 in maximum wall displacement

using lowest natural frequencies

compute theoretical associated airblast

Method No. 2 was used because displacement, or the distance a particle moves, is not, by itself, a good damage predictor, since displacement is frequency dependent. Thus, both displacement and frequency should be specified. (Peak-particle velocity does not have this disadvantage, because it is not frequency dependent). However, structure walls and corners have definite frequency ranges (Ref. 22, p. 4).

An analysis was performed to determine the airblast levels associated with the lowest damage case in the available data of 0.016 inches maximum wall displacement. For both mid-walls and gross-structure motions (corners), the most strict values were derived by taking the lowest natural frequencies typically encountered, 12 Hz for mid-walls and six Hz for corners. In all cases, the associated airblast level for both one- and two-story homes equaled or exceeded the 135 dBL (0.1Hz) peak linear and 109 dB C-slow, with most values within a few dB of these limits, further indicating that the 135 dBL (0.1 Hz) and 109 dB(C-slow) limits are necessary to protect from structural damage.

(3) The use of C-slow measurements has been recommended in the Committee on Hearing Bioacoustic (CHABA) Working Group 69 report to the EPA. (Ref. 5, pp. V-1-V-5). The Office is not convinced that this method is superior to peak-linear; however, C-slow is included as an alternative, based on CHABA's recommendation, to provide for the use of another class of monitoring instruments which will give equivalent indications of potentially damaging airblast to the other types of instruments allowed under the regulations.

(4) Some commenters suggested lower noise decibel standards, based on arguments that human annoyance is caused at levels of noise below the proposed standards. Some commenters dispute this, arguing that prevention of human annoyance goes beyond the requirements of the Act. The latter commenters felt that the 135 decibel (0.1 Hz or lower) specification was unreasonable, because it provides an additional safety factor (Ref. 22, pp. 3-5) to prevent human annoyance, as com-

pared with the one-inch-per-second peak-particle velocity limitation, and should be raised to 137 decibels.

A State agency submitted comprehensive testimony on the annoying effects to humans of airblast at coal mine blasting. Two commenters documented the relationship between sonic boom and surface mine airblasts. Based on a large volume of data, the commenters recommended changing the table values of 135dB, 132dB, 130dB and 109dB, to 128dB, 125dB, 123dB and 98dB, respectively. These data lend support to 135dB, rather than 137dB as a reasonable level. **Mid-wall motions and associated rattling caused by airblast** (Ref. 22, pp. 1-5) cause not only human annoyance, but can also cause minor damage such as falling bric-a-brac and dislodgement of items from shelves. Furthermore, the Act requires preventing harm to public health and safety, which includes prevention of severe annoyance to people (see Section 515(b)(15)).

The two adverse effects from airblast that were emphasized in the argument for lower airblast levels were loss of sleep and a startle effect. The regulations already are believed to alleviate **loss-of-sleep** problems, by prohibiting night-time blasting, except in the case of a documented safety hazard under Section 816.65(a). Such a safety hazard, where documented to the satisfaction of the regulatory authority, should reasonably take priority over loss of sleep. It will be the responsibility of the regulatory authority to assure that the night blasting waiver provision is not abused. Therefore, the Office decided not to adopt more stringent noise standards in response to the loss-of-sleep comments.

The **"startle effect"** cited by a commenter is based on studies of sonic booms, which are similar to airblast from blasting. However, sonic booms are normally unpredicted events. Because of the blasting schedule provision of Section 816.64 and prohibiting of blasting outside normal daylight hours, Section 816.65(a), the public will have reasonable notice of when to expect blasting, thereby alleviating the startle effect. Also, the Office notes that a warning signal is required to alert the public before blasting, Section 816.65(c).

Furthermore, it is important to note that, because the decibel scale is logarithmic, a 7 decibel (db) reduction from the proposed standard amounts to a reduction of about 55 percent in the sound pressure. (For instance, 132dB=1.69 psi, 125dB=.75 psi.) Based on typical airblast levels (Ref. 21, p. 12 and Ref. 19, pp. 12 and 13), this would be a very difficult reduction to achieve as an absolute limitation. Since Sections 816.64 and 816.65(a) already substantially alleviate the two objections

of "loss of sleep" and "startle effect," the proposed airblast standards have not been lowered.

(5) Some commenters stated that meeting the one-inch-per-second peak-velocity limitation will automatically control airblast damage. This is not true. In addition to the charge weight per delay and distance from the blast, which do control both airblast noise and ground vibrations, damage from airblast is independently a function of the type of burden being blasted, type and amount of stemming being used (Ref. 25, p. 403), improper or lack of covering of surface detonating cord, and lack of attention to rock structural weaknesses and weather conditions (Ref. 21, p. 15, Ref. 8, p. 220, and Ref. 13, p. 15). Thus, **control of ground vibrations alone will not prevent airblast damage**, and the specifications of Section 816.65(e) are necessary for limiting airblast.

(6) A few commenters stated that the airblast standards are based merely on preventing crack extensions in walls of structures and, therefore, distort the purposes of the Act. However, Section 515(b)(15) of the Act requires prevention of damage to structures. **Propagation of an existing crack is a reasonable definition of damage**, and the prevention of such events is not an unreasonable restriction. Of course, airblast can also cause initiation of new cracks, also considered "damage" by the Office. As discussed above, the airblast standard will also help to reduce human annoyance, independent of structural damage.

(7) Without giving reasons, several commenters asserted that the study of Reference 22 cannot be defended. Some commenters (again without a rationale) felt that the airblast standard is inappropriately tied to the one-inch-per-second peak-particle velocity limitation. The study in Reference 22 was based on hundreds of structure response, ground vibration, and airblast time histories. These data were obtained from field studies involving surface mine production blasts and onsite field measurements. **The Bureau of Mines has been the nation's leading research organization in the field of blast vibrations for over 20 years. The researcher who conducted the study on which the airblast standard is based is a recognized authority in the field of airblast and ground vibrations.** The large volume of data contributing to the study, the reputation of the organization conducting the study, and the qualifications of the investigator lend strong credibility to the study.

None of the commenters stating that the study cannot be defended have given any compelling rebuttal to the study. None of the commenters gave substantial data which would establish that noise levels significantly greater

than those to be allowed under the regulations could preclude damage to structures. Rather, they mainly argued that the specified limits cannot be met 100 percent of the time. As explained below, airblast can and should be adequately controlled to meet the regulation without a variability provision.

Further, damage to structures is created through structural vibrations from both ground vibrations and airblast. **Through analysis of hundreds of vibration records from production blasts, the Bureau of Mines established a reliable equivalence between the response of a structure to a one-inch-per-second peak-particle velocity and the airblast levels specified in the tables.** (Ref. 22, pp. 1-5). The validity of the one-inch-per-second peak-particle velocity ground vibration damage-prevention criterion is established in the preamble discussion of Section 816.65(f).

Therefore, the validity of the airblast table values for preventing damage has been adequately established by correlation between ground vibration-produced damage and airblast noise levels. The inappropriateness of tying the airblast criterion to the one-inch-per-second peak-velocity limitation was only alleged by the commenters, but no justification was offered. Therefore, the Office believes it entirely correct to establish the noise level standards in the manner selected.

(C) *Alternative 4.* Several commenters stated that the table standards cannot be met consistently because of variations in rock subjected to blasting and weather conditions. Some commenters recommended that the operator be permitted to exceed the standard 20 percent of the time.

Historically, airblast from coal mining has not been pervasively regulated in this country. Therefore, it has not been necessary for all mine operators to systematically design blasts to limit airblast, except where specific complaints arose. Commenters' requests that the limitation be met only 80 percent of the time appear to be based on the range of airblast occurring under current practice, rather than what the industry is, in fact, capable of achieving. Reference 25, pages 403 to 405, describes blast design techniques such as stemming and proper burden which will reduce airblast to a level meeting the standards. (See also Ref. 21, pp. 3 and 15). The necessity to consider weather conditions in reducing the propagation of airblast is discussed in Reference 25, p. 404; Ref. 3, p. 15, and Ref. 21, p. 15. The Office, therefore, believes that the operator will be able to meet the standard. **If adverse weather problems develop, such as a strong wind blowing**

in the direction of nearby structures from the blast operation or a strong temperature inversion (Ref. 25, p. 404 and Ref. 21, p. 15), it may be necessary to reschedule blasting until adverse conditions subside.<sup>3</sup>

Further, a standard requiring compliance only 80 percent of the time could subject the public to potentially damaging airblast for 20 percent of all shots. Such a standard would not fulfill the provision of Section 816.65(f)(1)(C) of the Act, which requires prevention of damage to property outside the permit area by limiting the duration and frequency of blasting. Furthermore, allowance for the standards to be violated 20 percent of the time is particularly inappropriate where, as here, the Office finds that the factors leading to exceedances are within the industry's ability to avoid violation of the standard. Finally, because blasting is a non-continuous, essentially non-regularized activity, a compliance standard allowing for 20 percent of violations of a standard would be virtually impossible to enforce consistently through field surveillance. Such a standard would require very heavy commitment of regulatory authority resources to monitor for unpredictable periods of time in amassing and analyzing data until sufficient data were obtained to calculate a 20 percent deviation figure.

(D) *Alternative 6.* One commenter suggested a specification of (-3dB) only, rather than ( $\pm 3$ dB) in Section 816.65(f)(1). A second commenter felt that ( $\pm 3$ dB) allows too much tolerance. No rationale or justification was given for the change from ( $\pm 3$ dB) to (-3dB), and the Office did not adopt the first comment. The ( $\pm 3$ dB) defines the frequency response limit of the measuring instruments and not the accuracy of the measuring system (Ref. 21, pp. 4 and 5). It is not a tolerance allowed to the operator in meeting the standard, but rather an instrument calibration specification.<sup>4</sup> The ( $\pm 3$ dB) was determined to be a proper specification. The rule has not been changed in that regard.

(E) *Alternative 7.* Commenters stated that the C-weighted standard is not valid, because it is alleged not to respond to a great deal of low frequency energy associated with blasting. However, Reference 22, pp. 1-5, established the equivalence of the C-

weighted standard to the other airblast damage standards, in terms of its effect on structures and use in precluding damage, thereby indicating its utility even in low frequency situations. The Committee on Hearing and Bioacoustics has supported the C-weighted measurements to the EPA (Ref. 5, pp. V-1-V-5). A state agency, in its comments on this section, also presented a proposed C-weighted specification but made no comment as to its validity. Therefore, the Office decided to retain the C-weighted standard.

(F) *Alternative 8.* One commenter felt that a stemming requirement should be specified, rather than an airblast limitation, and another commenter supported the Office's proposal not to include a stemming limitation. Stemming is insert material placed in the top of the blast hole above the explosive charge. Proper stemming alone will not control airblast. Proper blast design (Ref. 1, pp. 373-396) and attention to weather conditions (Ref. 21, p. 15, Ref. 25 p. 404) are also important in controlling airblast. Thus, the suggestion to replace the airblast noise levels limitation with a stemming requirement was rejected.

(G) *Alternative 9.* Some commenters felt that four different frequency specifications would be difficult to enforce and recommended that only one be selected. All of these commenters recommended their own airblast criteria, each based on four frequency response spectra, which is also the basis for the Office's standard. The Office's multiple frequency standard was selected, because a wide variety of airblast monitoring equipment is available with a wide variety of frequency response. Since a reliable comparability of the frequency responses was established in Ref. 22, pp. 1-5, the multiple standard was adopted to avoid unduly limiting the use of various types of monitoring equipment, all of which are capable of reliably detecting damaging levels of airblast. Because the four different frequency specifications amount to essentially the same level of noise control, the Office has decided to retain the four specification standards to allow for the use of a wider variety of testing equipment.

(H) *Alternative 10.* Some commenters suggested deleting the limitation on the exemption of property owned by the permittee and exempt from the airblast standard only that property in a permit area. Another commenter suggested deleting this limitation on the assumption that the permittee's property not be leased to any other person. The first suggestion was accepted, because the Office believed it unreasonable to require a person to protect his own property

from airblast whether or not it is within the permit area. In response to the second comment, the regulation was modified to allow a person leasing a structure from the permittee to sign a waiver relieving the operator from meeting the airblast limitation, with respect to that structure.

(I) *Alternative 11.* The proposed rules on airblast made no provision for requiring airblast monitoring, where violation of the standard is suspected. The ground vibration Section 816.67(c), has such a provision. To enable the regulatory authority to properly enforce the airblast provisions, wording has been added at Section 816.65(e)(4).

(J) *Alternative 12.* One commenter correctly stated that, since the major part of sound energy is in frequencies below 200 Hz, specifying a blast meter with at least 500 Hz is unnecessary and would eliminate the use of satisfactory instruments that are presently available. The Office agreed with this analysis and has changed the regulations to reduce the frequency response specification to 200 Hz.

(K) *Other Comments.* One commenter felt that the specification in the regulation for the frequency limit of the noise measuring system should be flat or calibrated.<sup>5</sup> However, the commenter did not provide evidence of a comprehensive data base suggesting that such equivalencies can be routinely made on a national basis. The regulation has not been changed, as requiring a flat response assures that adequate monitoring instruments will be used. Further, use of calibrated systems on a routine basis would cause doubt as to the accuracy of data collection.

Another commenter felt that adverse weather conditions should be used by the regulatory authority to determine extenuating circumstances in any decision on penalties assessed for violation. This suggestion was not accepted. As discussed more fully above, it is the operator's responsibility to take weather conditions into account when firing a blast. The operator should not create a situation damaging to a private structure, regardless of weather conditions, because the operator can delay blasting until after weather returns to normal.

Some commenters correctly stated that three types of sound level meters are described in ANSI-S1. 4-1971. As pointed out in Ref. 12, p. 22, a large amount of the energy in airblast and ground vibration is contained in frequencies below 20Hz. This is reflected

<sup>3</sup> A temperature inversion is a condition in which the temperature decreases, then increases with altitude, rather than decreasing with altitude, causing sound waves to be refracted back to the earth. (Ref. 25, pp. 404-405) (Knowledge of the existence of a temperature inversion can be obtained from local weather bureaus).

<sup>4</sup> The limit of the frequency of a given instrument is that frequency at which the instrument fails to respond to three decibels or more of the actual noise present.

<sup>5</sup> A specification that an instrument's response is flat means that the response to the frequencies within its range is constant to within less than one dB. Calibration attempts to establish an equivalence between an instrument without a flat response and one with a flat response.

in the different sound levels specified when using different blast meters. Because Types two and three sound level meters described in SI. 4-1971 have frequency cutoffs at 20Hz and Type one meters have a frequency response down to 10Hz, it is evident that Type two and Type three meters would not give as good an indication of the potential damage as a Type one meter. The final regulations reflect this by requiring that only Type one meters be used for the C-weighted, slow response values.

VII. Sections 816.65(f).

A. Substantial comment was received on proposed Section 816.65(g). Most of the comments requested that the 1,000-foot limitation in subsection (1) be reduced to some lower limit, on the theory that this limitation was arbitrary and had no statutory basis. Several commenters also suggested that the 500-foot limitations in subsection (2)-(3) be deleted. Several commenters felt the 1,000-foot limit was acceptable, assuming that specific waiver provisions are available. Other commenters argued that the paragraph should be entirely deleted, because other provisions of Section 816.65 assertedly adequately protect the public, making distance limitations unnecessary. A few comments stated that the phrase "other appropriate investigation" should be deleted, and a few requested that a provision be added that the distances not be decreased if there was a probability that airblast or ground vibration would be increased. A few comments stated that, either the entire section, or the reference to dwellings should be deleted. Several commenters stated that the 1,000-foot limitation would impose unwarranted costs on the industry. Review of the comments indicated that the following alternative should be considered and that alternative 3 should be adopted.

- (1) Retain Section 816.65(f), as in proposed Section 816.65(g);
- (2) Change the distance limitations from 1,000'/500'/500'/ to 300'/300'/500', or to ¼ mile /500'/500'
- (3) Add the term "seismic investigations" to Section 816.65(f), retain Sections 816.65(f)(1) and 816.65(f)(2) as unchanged and delete 816.65(f)(3).

B. Analysis of Comments and Alternatives.

(1) *Legal Authority.* Several commenters stated that the 1,000-foot distance limitation requiring regulatory authority approval for its waiver was arbitrary and lacked statutory authority. This argument has been rejected in the U.S. District Court for the District of Columbia *In Re Surface Mining Regulation Litigation* 452 F. Supp. 327, 345-349, (1973). The Court held that the Office does have authority to establish a 1,000-foot distance

limit on blasting in its regulations under Section 515(b)(15) of the Act, where those regulations do not absolutely prevent mining. Rather, blasting operations may be regulated, if allowed within the specified limits, upon approval of the regulatory authority.

(2) *Alternative 2.* A commenter stated that no blasting should be allowed within ¼ mile of a residence under any conditions, but provided no evidence to justify this position. Therefore, the Office declined to accept it.

Several commenters recommended distance limitations for Section 816.65(f)(1) of less than 1,000 feet. Some comments suggested 500 feet, two recommended 300 feet, one recommended 800 feet, and five simply stated that 1,000 feet was too great a distance. Most of these commenters based their recommendations on the incorrect belief that the Office did not have statutory authority to set such a limit.

Several others stated that blasting is done safely at distances closer than 1,000 feet, and, therefore, should be allowed. The fact that blasting can be done safely at distances less than 1,000 feet from a structure does not justify eliminating the 1,000-foot limitation. Because blasting can adversely impact public property and safety at distances up to 1,000 feet, if not properly controlled, there is a substantial need for close scrutiny by the regulatory authority of blasting operations within this distance.

Flyrock and noise are particular problems caused by blasting within 1,000 feet of dwellings. In Perry County, Kentucky, flyrock from surface mine blasting several hundred feet away severely injured a four-year-old standing in the doorway of his home and damaged three homes and four automobiles. (*Surface Mining Control and Reclamation Act of 1977: Hearings on H.R.2. before the Subcommittee on Energy and Environment of the House Committee on Interior and Insular Affairs, 95th. Congress, First Session, Part II, p. 313 (1977)*) ("House Hearings"). In Dante, Virginia, a 200-pound rock was thrown over 2,000 feet from the blasting site (House Hearings, Part II, p. 313). The State of Alabama, recognizing the problem of flyrock and noise, specifies a distance limitation on blasting of 800 feet, within which special precautions must be taken by covering all detonating cord to minimize airblast and posting of guards to protect against flyrock. (House Hearings, SUPRA Part I, p. 138). Cases have been revealed where blocks of rock up to one-half cubic meter have been thrown hundreds of meters. (Gustafsson, Ref. 8, p. 86).

Blasting is also a problem with respect to excessive ground vibrations

within 1,000 feet of dwellings. To comply with the scaled distance formula of 60 at 1,000 feet, the maximum charge weight per delay is 278 pounds, as shown in the table in Section 816.65(i)(2). For ammonium nitrate fuel oil at a specific gravity of 0.8 gm/cc, this amounts to a seven-foot charge length placed in a 12-inch diameter blasthole and a 12.5-foot charge length in a nine-inch diameter blasthole.<sup>6</sup> Since single charges of these lengths would be unacceptable (Ref. 1 pp. 383-390) for blasting in a typical surface mine with bench heights of 50 to 100 feet, the operator would have to take alternative action such as monitoring all shots, using a modified scale-distance formula as allowed in Section 816.65(b), using multiple-delay deck charges within the blasthole, or drilling smaller diameter blastholes. To assure compliance with the one-inch-per-second peak-particle velocity limitation in such a close-in situation, it is important that the operator make his contingency plans known to the regulatory authority and have them approved so that compliance can be properly monitored.

In those situations where the operator is not using scaled distances but is monitoring each blast, special precautions are also necessary, such as those described by a commenter. That comment stated that, historically, an operator's charge weights were 400-1,000 pounds. Assuming that 1,000 pounds is a common charge, this would represent charge lengths of 25.5 feet in a 12-inch diameter blasthole and 45.4 feet in a nine-inch blasthole.<sup>7</sup> These would be acceptable charge lengths under many conditions (Ref. 1, pp. 383-395). Additional precautions to meet the one-inch-per-second peak-particle velocity limit may be needed as shown by the considerable variability to be expected from use of the scaled distance formula.

Medearis (Ref. 12, p. 44), has plotted predicted peak-particle ground vibration velocity against distance for a 1,000-pound charge. The curve of the plotted data passes through the one-inch-per-second peak-particle velocity line at a distance slightly greater than 600 feet. Because geological conditions can effect the propagation of ground motion, as has been indicated in Gustafsson (Ref. 8, p. 217), some scatter of data around the curve of predicted ve-

<sup>6</sup>Calculations: ANFO specific gravity (density)=0.8 gm/cc gm/cc×62.4=16/cu. ft. (standard conversion factor)  
 $\pi r^2 \times h = \text{volume of a cylinder. Therefore:}$   
 $0.8 \times 62.4 \times 0 = \pi (.5)^2 (7.1) = 278.41b$   
 $0.8 \times 62.4 \times \pi (.375)^2 (12.6) = 277.91b.$

<sup>7</sup>ANFO specific gravity (density)=0.8 gm/cc gm/cc×62.4 (Standard Conversion Factor)=lb./cu.ft. (Standard Conversion Table)  $\pi r^2 \times h = \text{volume of a cylinder. Therefore:}$   
 $.8 \times 62.4 \times \pi (.5)^2 (25.5) = 1,000 \text{ lb.}$   
 $.8 \times 62.4 \times \pi (.375)^2 (45.4) = 1,000 \text{ lb.}$

locity can be expected, indicating that the one-inch-per-second limit may be exceeded or reached at distances close to 1,000 ft., if blast design is not employed. The 1,000 ft. distance limitation thus provides a safety factor to account for this scatter and to alert the operator that special precautions must be taken to prevent structural damage.

(3) *Waivers.* Several commenters stated that the 1,000 foot distance was acceptable, providing that the regulations specified the written waivers by occupants or owners of any structures within 1,000 feet of the blast site could be used to justify the lesser distances, instead of compliance with the rest of Section 816.65. Such waivers do not assure the regulatory authority that the operator will take the necessary special precautions to protect the public from the danger of flyrock and to protect the structures involved from possible damage caused by excessive ground motion or airblast. Therefore, this suggestion was not accepted.

(4) *Redundancy.* Other comments stated that the other provisions of the blasting performance standards, such as Sections 816.65(g), 816.65(f), and 816.65(h), adequately protected structures and the public, making the 1,000-foot/500-foot limitations unnecessary. The Office has carefully considered whether Section 816.65(f)(1)-(2) are merely redundant to other sections and has concluded that, to the contrary, these provisions are essential to a rational regulatory scheme for blasting. Section 816.65(f) establishes requirements for advance approval by the regulatory authority of particular blasting events by the operator, that paragraphs (c)(g) & (i), which are generally self-executing, do not ordinarily require. This advance approval requirement is important when blasting is conducted in close proximities to the types of structures and facilities involved.

Numerous comments to the Office indicated that, ordinarily, permit applicants cannot be expected to present detailed information on the frequency, quantities, and location of blasting in the appropriate portion of the application (30 CFR 780.13). The Office agreed that it may be impossible to accurately establish this level of detail until shortly before mining operations actually commence in the field. In addition, preblast surveys of structures in the area around the mine will not ordinarily be performed until after a permit is issued, so data on conditions of those structures suggesting the need for special precautions in the course of implementing the blasting performance standards will not be available in the initial stage of the permit process.

The Act, however, requires that mining operations not be conducted until the operator has borne the burden of proving ability to comply with applicable performance standards. (Sections 102, 508(a), 507(b), 508(a), 510(a)-(b) of the Act). As the operator will not be able to provide such a demonstration, in detail, during the formal permit application process, it is essential that regulatory authority scrutiny of blasting operations take place at some later point, prior to the conduct of blasting in relatively close proximity to those structures and facilities where the risk of harm is substantial. Thus, Section 816.65(f) is an important alternative to close scrutiny of proposed blasting operations during the permit application review/approval stage.

(5) *Basis for regulatory authority approval.* A few comments suggested removing the phrase "other appropriate investigations," from the rule, implying that a preblast survey under Section 816.62 is sufficient data for the regulatory authority to authorize a waiver of the distance limits of Section 816.65(f). Preblast surveys will not necessarily provide sufficient data, however, to determine whether the distance limitation should be reduced. First, preblast surveys are not necessarily required to assess existing physical conditions of structures. Survey reports may, but are not required to, specify how the operator intends to blast. Second, seismic or geologic investigations may be necessary or considered appropriate by the regulatory authority to indicate special conditions existing in the area around the blast site warranting special operational precautions. Third, to determine if airblast noise limits will be complied with, it may be necessary to develop information on weather conditions and proposed blasting procedures. All of these are elements, in addition to a preblast survey report, that may be needed by the regulatory authority before approval is granted under Section 816.65(f). Therefore, the phrase "other appropriate investigations" has not been deleted.

A few commenters suggested that a provision should be added that in no case should the distance be reduced if there was a probability that the ground vibrations or airblast noise would be increased by blasting authorized under Section 816.65(f). Such an addition would be redundant, however, as Paragraphs (c) and (i) already specify the maximum allowable peak-particle velocities and airblast noise levels. Authority to blast under Section 816.65(f) will not change these ground motion and airblast limits provisions and will not allow for less stringent ground motion and airblast limits to be followed.

(6) *Costs.* Some commenters said that the 1,000-foot distance limitation would impose unwarranted costs on the industry. A few commenters related the additional costs to the cases where land companies lease houses near mines, with provisions that the occupants must vacate within a 30-day notice. These commenters reasoned that, in these cases, the operator or land company would be forced to issue eviction notices to prevent complaints. The Office does not consider this to be a valid argument for eliminating this regulation. First, the commenters did not show that ordinarily structures and facilities within the distance limits will be owned by the operator. Thus, the distance limit is still important for those persons occupying or using structures or facilities not under the control of the operator within the specified limits. Second, to the extent that the commenters are correct (i.e., in order to comply with the blasting performance standards, persons inhabiting structures in close proximity to the permit area must be physically relocated), the regulations still should be retained so that the health and safety of those persons is protected. Third, the Office does not expect that such removal will ordinarily be required, because the industry should be able to obtain approval of the regulatory authority through establishing that blasting within the specified distances can be done in compliance with the peak particle velocity, air blast, and flyrock performance standards.

The remainder of the commenters predict that, because of doubt as to whether a permit to mine closer than 1,000-feet would be granted, operators will encounter difficulty in obtaining financing or will have to pay higher interest rates. This difficulty should be minimized, however, because the specific focus on the blasting performance standards will ordinarily occur after permits are issued and operators are about to start. Because the 1,000-foot limitation is intended as a distance at which the regulatory authority is to ensure compliance with the other provisions of the blast performance standards, the Office does not expect the permission to mine will be difficult to obtain. It is indeed expected that approvals will be granted in many, if not most, cases. Therefore, this should not be a substantial deterrent in obtaining financing for mining operations.

(7) *Blasting near deep mines.* Several commenters suggested that Section 816.65(g)(3) in the proposed rules be deleted, as unnecessary in view of the provisions of Section 816.79. The Office agreed that Section 816.65(g)(3) was redundant, given Section 816.79, and has, therefore, deleted the provision.

(8) *Seismic investigations.* The term seismic investigations has been added to Sections 816.65(f) and 816.65(g) in the proposed rules for clarification, since seismic investigations are an acceptable means of proving that an operator can comply with the blasting performance standards within a distance of 1,000 feet, as regards the peak-particle velocity limits of Sections 816.65(i) and 816.65(j). (See preamble to Section 816.67).

VIII. Section 816(g) (816.65(h) (in proposed rule).

A. In comments on the proposed regulations, several persons felt that flyrock restrictions are unnecessary. Some commenters felt that the restriction on casting flyrock to one-half the distance to the nearest structure illegally preempts operators' property rights. One commenter recommended a variable flyrock distance standard, based on the slope of the terrain around the blasting location. Some commenters suggested a stemming specification, rather than a flyrock restriction. Many commenters suggested the need for major revisions to this section for clarity and to eliminate redundancy. Based on comments, the following alternatives on Section 816.65(g) were considered, and alternative 1 adopted—

1. Rewrite the section for conciseness and clarity, eliminating the restriction on throwing rock more than half the distance to roads and railroads;
2. Delete or modify the restriction on throwing rock more than half the distance to the nearest structure;
3. Specify blast design requirements, rather than flyrock distance limits;
4. Permit exemptions from the distance provisions;
5. Delete the provision entirely.

B. *Analysis of comments and alternatives.*

(1) *Introduction.* Flyrock represents a catastrophic potential for harm to the public from blasting. (House Committee Hearings—*supra*. Part II, p. 283). Flyrock falling through the roofs of structures, cited in those hearings, has the potential to cause death and injury, in addition to structural damage.

(2) *Alternative 1.* Several commenters felt that portions of Paragraphs (1), (2), and (3) in proposed Section 816.65(h) were redundant. The Office agreed. The Section has been rewritten as one paragraph to enhance its clarity and eliminate unnecessary repetition of the phrase "no flyrock shall be cast" and the specific types of structures protected by this section.

In response to one commenter's suggestion, the reference to roads and railroads in the "one-half the distance" limitation has been deleted. If

access to these areas is adequately guarded, as is to be required under Section 816.65(d), no danger from flyrock should occur.

(3) *Alternatives 2 and 5.* A commenter's suggestion for a graduated flyrock limitation based on the slope of the terrain surrounding the blast site was not accepted. A property owner needs the same degree of protection, in the form of a buffer zone, regardless of the terrain slope. Since airborne and groundborne flyrock are treated the same in this Section, the "one-half distance" requirement gives equal and adequate protection to all.

Flyrock is more difficult to predict than other blast effects. Limiting flyrock casting to within one-half the distance to the nearest occupied structures provides a necessary safety factor for people living at a mine permit perimeter. If a person lives 50 feet from the mine perimeter, and a blast is 1,000 feet from that perimeter, simply stating that the flyrock may not go past the perimeter would provide inadequate protection from both flyrock that initially lands near the perimeter and then rolls towards nearby structures, and from concussion and debris generated by landing flyrock.

Some commenters felt that it is impossible to control flyrock. This is not true. Flyrock controls, using the basic recommendations from Ref. 1, pp. 373-396, are common practices in the industry. (This reference covers, in detail, proper design for blasts.) If the burden is less than 25 times the blasthole diameter, the shot may become violent and excessive, and flyrock can occur. If the stemming distance is less than 0.7 times the burden an imbalance of forces can occur, resulting in excessive flyrock. Where midseams, voids or other zones of weakness occur in the burden, the blast energy will be released violently through these zones, creating concussion and flyrock. Stemming, rather than explosive, should be loaded in these zones to prevent flyrock. If a blast causes flyrock to be thrown closer than one-half the distance to a structure, the operator should be able to solve the problem, by increasing burden and stemming distances and paying close attention to zones of weakness in the burden.

A comment by a vibrations consultant that uncontrolled flyrock will occasionally occur was not accepted. Using design techniques spelled out in Ref. 1, pp. 382-395, and Ref. 8, pp. 83, 88, the operator can use sufficiently conservative designs to adhere to the provisions of Section 816.65(h). When blasting near residences, it will be incumbent on the blaster to exercise close control over blast design and pay

close attention to the rock structure being blasted to reduce flyrock spread.

(4) *Alternative 3.* Some commenters suggested that blast design specifications be substituted for flyrock limitations, based on books identifying items of preferred blast design. However, detailed specifications for blast design to limit flyrock in all cases would be an excessive burden to many operators, because of the extreme variation in rock density, competence, and geology encountered on a national basis, and the lack of substantial data to show a high degree of correlation between each variable of blast design and a specific flyrock distance limit. Given this variation and lack of existing data base, the Office feels that it is preferable to specify required results and leave the method of compliance with the standard to the industry, based upon a choice among variables identified above as controlling flyrock.

(5) *Alternative 4.* Some commenters suggested that a provision be made for exemptions to the flyrock limitation, but gave no basis for this suggestion. Substantial exemptions to the limitation would present a hazard to the public. The regulatory authority will not be expected to know the specific structural aspects of the rock to be blasted when receiving permit applications, given the final rules' version of Section 780.13, in response to comments. Because the specific sizes and distances of flyrock will not be known, in detail, the regulatory authority would not be able to routinely make the analysis necessary for approval of exemptions. Further, such an exemption would constitute a total variance from this performance standard, contrary to the limit of Office authority provided by Congress. (See *In re Surface Mining Litigation*, 452 F. Supp. 327, 338-339 (D.D.C. 1978)).

*Other Comments.*

(1) One commenter felt the rock traveling along the ground should not be considered flyrock. Since rolling rock can be as hazardous as rock falling upon persons or structures, the provision for rock traveling along the ground was retained.

(2) On the question of pre-emption of the operator's rights, the Act does not allow a person conducting mining to operate within the confines of the permit area so as to cause damage or injury to persons in nearby areas. Sections 102 and 515(b)(15), of the Act.

(3) A commenter suggested changing "area of regulated access" to "safety perimeter." This was not adopted, because "area of regulated access" is a more specific term as it is tied to specification of "access areas" in Section 816.65(d).

IX. Section 816.65(h) (Section 816.65(i) in the proposed rules).

A comment was received recommending deletion of Section 816.65(i) from the regulations as unnecessary, alleging that "actual disruption and fracturing of the rock only takes place very close to a blasthole." This is certainly not true in the case of flyrock, which is documented in the legislative history, as described in the preamble to Section 816.65(f). Excessive flyrock could change the course of a small stream by creating barriers to the original flow of water in the stream and by initiation of rock slides in unstable pit slopes adjacent to streams. Moreover, the text of Section 816.65(i) comes directly from Section 515(b)(15)(C) of the Act, and clearly reflects the intent of Congress.

**X. Section 816.65(i), (Section 816.65(j) in proposed rule) Peak-Particle Velocity Limits.**

A. A large number of commenters objected to the one-inch-per-second limit for peak-particle velocity of ground motion. The majority of these comments recommended that the limit be placed at two inches per second, although others recommended levels as low as 0.2 inch per second. Other comments indicated that the proposed rule was ambiguous as to how compliance with the particle velocity standard was to be measured in the field. Some commenters recommended that this section be revised to specify the conditions under which the regulatory authority would monitor ground motion and the equipment to be used. Study of the comments received led to the consideration of the following alternatives:

(1) Retain this section as proposed without change;

(2) Specify that the maximum peak-particle velocity shall be as measured in any of three mutually perpendicular directions, or specify that the maximum peak-particle velocity is the maximum of resultant of three components which are measured in three mutually perpendicular directions;<sup>9</sup>

(3) Retain the limit of one-inch-per-second peak-particle velocity vs. specifying a limit of up to two-inches-per-second peak-particle velocity vs. a limit as low as 0.2 inches per second;

(4) Eliminate any specific maximum peak-particle velocity and use an equivalent scaled distance (explosive weight/delay vs. distance to structure) only.

(5) Replace the maximum peak-particle velocity standard with a "structural response" criterion; and

<sup>9</sup>A component is a velocity measurement taken on a pre-determined orientation. The three common components are vertical (v), taken in true vertical orientation; radial (r), taken on the line from the blast to the measurement point; and transverse (t), taken on the horizontal line perpendicular to (r). The resultant is the vector sum of v, r, and t, and is equal to  $\sqrt{v^2 + r^2 + t^2}$ .

(6) Require the regulatory authority to monitor blasts at a mine without notifying the mine, to use certain specified monitoring equipment, and to require that the operator use trained monitoring personnel versus not providing for such requirements on monitoring.

After consideration of these alternatives, the Office decided to retain the one-inch-per-second peak-particle velocity, specify that this limitation is to be measured in any of three mutually perpendicular directions, and to reject other alternatives.

**B. Analysis of Comments and Alternatives.**

(1) Some of the comments received reflected confusion as to the fundamental purpose of this section. These commenters appeared to criticize the one-inch-per-second standard on the theory that the adoption of this standard is an attempt to protect against not only property damages caused by blast ground vibrations, but also against causing any annoyance to people by emotional distress.

As later discussion will explain, the one-inch-per-second standard is based principally on protecting property from damage, although it should also reduce the level of human emotional distress caused by ground vibrations. Bulletin 656 (Ref. 14, pg. 28), based on the Salmon nuclear event, states that an estimated 35 percent of all families will complain when exposed to ground vibrations of two-inches-per-second, and 18 percent will complain at one-inch-per-second. Although frequencies and durations for nuclear blasts are different than for conventional blasts, some similar complaint reduction should be expected in coal mining. Therefore, the standard being adopted is anticipated to reduce emotional distress somewhat, although not completely prevent it.

(2) *Alternative 2*—One commenter approved of selecting the "resultant" form of measurement of peak-particle velocity for ground vibration. As the Office does not intend that the resultant method of measuring the minimum peak-particle velocity be required, Section 816.65(i) was modified to clarify the method of measurement.

The Office has decided that the resultant method should not be used, principally because that method has not been used in collection and analysis of the data in the literature upon which peak-particle velocity standards for mine blasting have been based. All peak-particle velocity data presented in Bureau of Mines Bulletin 656, (Ref. 14, pp. 93-103), was measured as the maximum in any of three mutually perpendicular directions. Therefore, most of the work correlating peak-particle velocity from blasting in mining with structural damage has been done

with the velocity determined by measuring the greatest velocity in any of three mutually perpendicular directions, without use of the resultant method.

Investigators working on a relationship between blasting ground vibrations and structural damage continue to determine maximum recommended peak-particle velocity as that measured from any of three mutually perpendicular directions (Ref. 19, pp. 12-13). The historical data pool on ground vibrations and related damage is all based on measurements taken in three mutually perpendicular directions, as opposed to vector sum measurements. Therefore, the three-component system is the only one on which a vibration regulation can logically be based.

(3) *Alternative 3*—The Office received a wide range of comments as to the level at which the peak-particle velocity standard should be set. Many commenters argued for a level above one-inch-per-second, most of these recommending two-inches-per-second, which was the prevailing industry standard prior to promulgation of the Office's interim regulations in December, 1977. Some commenters urged that the standard be set below one-inch-per-second, arguing that structural damage and/or emotional distress cannot be eliminated, unless peak-particle velocity is reduced to a level as low as 0.2 inch per second.

(a) Some commenters suggested that the two-inch-per-second standard be adopted, alleging that an operator would subject blasting personnel to a great hazard with the one-inch-per-second standard because blasting would have to be conducted more often in order to break up the same amount of overburden. Analysis of this claim does not reveal that it is substantial.

The primary method for reducing ground motion from mine blasting is to reduce the charge weight of explosives per delay (Ref. 7 at 93; Ref. 14, p. 73; Ref. 13, pp. 8-9). In most instances, the same amount of rock can be broken in a single blast by increasing the number of delays used in a round of blasting. Commercial delays, in conjunction with sequential timers, provide between 100 and 200 delay intervals per blast round. (Ref. 17, pp. 1-2). Readily available sales literature indicates that cap manufacturers market 20 different delay periods. Furthermore, detonating cord delay-connectors can be used in series to provide an essentially unlimited number of delay periods per blast. Delay blasting switches (sequential timers) can be used to increase the number of delay periods available when using electric controls (Ref. 12, p. 9).

A few commenters alleged, however, that increasing the number of delays requires reducing drill patterns, thereby reducing the size of individual blasts and requiring more total number of blasts. Ref. 1, pp. 373-397, however, makes no provision for needing to reduce blast patterns because of an increased number of delays. (See also, Ref. 7 at 93-97 and Ref. 12 and 17, *supra*. Moreover, the extent that the commenter's assertion might be true, the Act requires precluding damage from ground vibrations.

One commenter also stated, without providing demonstration, that by increasing the number of delays, there is an increased chance of propagation between charges which could lead to damage at closely adjacent buildings. (Propagation is the initiation of a charge by means of an earthborne or airborne shock wave radiating from a nearby detonation.) The blasting agents used in surface mining today are, however, very insensitive to accidental initiation and not subject to charge-to-charge propagation in surface blast designs. (See, e.g., Ref. 7 at 95).

(b) Some commenters that recommend the two-inch-per-second level relied on technical literature or their own experiences to argue that a two-inch-per-second standard is "adequate" for protection of structures against blast damage. However, none of the commenters who cited their own experiences submitted detailed data showing comparisons between damage and peak-particle velocity from blasting in representative sets of mining blasting situations. Without those data, the Office could not evaluate the claims of those commenters who cited personal experiences, which in any event, appear contrary to the weight of data available in the relevant literature.

Technical literature cited by commenters urging the two-inch-per-second standard was primarily Bulletin 656 (ref. 14), Medearis (ref. 12) and Laadegard-Pederson (ref. 10). Bulletin 656, however, states that the two-inch-per-second standard will protect structures from damage only 95 percent of the time. (Ref. 14, p. 73). This is not an adequate standard, because the Section 515(b)(15)(C) of the Act requires prevention of damages. Medearis does not support the two-inch-per-second criterion, but a complex structural response criterion, discussed later. Ref. 10 is a review of various other papers and presents no new data.

One other commenter recommended eight additional publications for study of the peak-particle velocity limitation. Four of these involved only nuclear explosion data, not coal mining, and are not sufficient for establish-

ment of a coal mining standards on a national basis.

The fifth article cited by the commenter was Bulletin 656, (ref. 14) which has already been discussed. The sixth was Bulletin 442, the data from which form part of the analysis in Bulletin 656. The other two suggestions were references 23 and six, both of which are addressed elsewhere and which support the one-inch-per-second standard.

Another commenter suggested that Wiss and Nicholls, ASCE, 1974, supports a two-inch-per-second standard. However, this publication concerns a very limited test, performed with only a few blasts near one house in a hard-rock mining district, and thus is not a sufficiently comprehensive piece of work on which to base a national surface coal mine blasting standard, because of the limited scope of the study and the difference in rock type; i.e., hard rock versus the soft sedimentary rocks associated with coal mining.

Another commenter suggested using Bureau of Mines RI 8163, by Siskind, Stachura and Radcliffe. However, this publication does not deal with structural damage criteria of any type from ground vibration.

(c) When published in 1971, Bulletin 656 was the most comprehensive and best information available on the peak-particle velocity limit. Bulletin 656 recognized (at p. 73) that the probability of damage for a two-inch-per-second vibration would be about five percent. Commenters pointed out that this probability estimate was based on four instances ("points") where damage could be shown at levels below two-inches-per-second and that these points had the greatest standard deviations.

However, none of the literature cited by the commenters established that no damage will occur at the two-inch-per-second level. Medearis (ref. 12) feels that peak-particle velocity in itself is not a good criterion, although he is the only published authority in our records who takes this specific position. Further, on page 87 of Ref. 12, Meaderis states that his criterion would be more strict than current practice with regard to one-story structures.

Another commenter said that repeated blasting will not cause fatigue damage. The Office has never contended that this was a factor. The damage from repeated vibration discussed in the preamble to the proposed final rules refers to induced settling through compaction of material on which a house is built. Vibration is a standard civil engineering technique for compaction of material. Vibration damage data typically are of a single event type and thus do not consider accumulated effects from multiple

blasts. One of these effects could be induced settlement. This is a contributing factor, although not a major one to lowering the limitation from two-to one-inch-per-second, i.e., several small vibrations may do as much damage as one larger one.

(d) One of the commenters who criticized the one-inch-per-second standard recognized that the two-inch-per-second standard is not really adequate to preclude damage. A careful review of the technical literature, as a whole, shows that the one-inch-per-second limit is what is necessary to preclude damage to buildings from blasting. The best available information clearly shows that damage to property may result from blasting vibrations below two-inches-per-second. Indeed, this literature recognizes that even a limit of one-inch-per-second may not absolutely protect structures from minor damage.

Integration of data from Dvorak (Ref. 6) yields 32 points of damage below two-inches-per-second. Gustafsson (Ref. 8, pp. 207-210), using information developed from over 100,000 blasts, recommended a safe level for peak-particle velocity down to 0.7 in-per-second, depending on geologic conditions, and a threshold of damage as low as 1.2 inch-per-second. This is a very impressive volume of actual blast data, and, by its very number, encompasses a wide variety of conditions similar to that present in coal mining across the U.S. Tynan (Ref. 23, p. 19) recommends a peak-particle velocity of 0.75 inch-per-second. These sources thus indicate that a particle velocity specification below two-inch-per-second is necessary in order to protect the majority of structures from damage, and that one-inch-per-second is a reasonable criterion.

(e) Some commenters alleged that the use of the one-inch-per-second limit would be burdensome on operators. Costs will probably be increased, in some cases, because of additional delays required and a small amount of additional loading time. Based on a comparison of use of a scaled-distance formula of 50 (to achieve two-inch-per-second) to use of a scaled-distance formula of 60 (to achieve one-inch-per-second), the charge weight per delay will have to be reduced about 30 percent.<sup>9</sup>

$$\begin{array}{ll} 60 = 1,000/\sqrt{W} & 50 = 1,000/\sqrt{W} \\ \sqrt{W} = 1,000/60 & \sqrt{W} = 1,000/50 \\ \sqrt{W} = 16.667 & \sqrt{W} = 20 \\ \sqrt{W} = 278 \text{ lb/delay} & \\ \sqrt{W} = 400 \text{ lb/delay} & \\ 278/400 = 70\% & \end{array}$$

If an operator is currently blasting at or near two-inches-per-second, he

<sup>9</sup> Calculated by comparing the two scaled distance equations: SD = distance/Charge weight.

Example: Calculation comparing scaled distances of 50 to 60 using an absolute distance of 1,000 feet.

would have to use approximately 40 percent more delay intervals to achieve the one-inch-per-second based on use of the scaled-distance data in Ref. 14, p. 17. Delay intervals, however, are not a major component of the total costs associated with blasting.<sup>10</sup> These additional costs will, however, be offset by reduced damage to structures and reduced human annoyance. Further, some additional cost is not a valid reason for allowing for blasting with a significantly greater probability of structural damage and human distress, since Section 515(b)(15) of the Act requires that blasting be conducted so as to "prevent" damage and injury. Moreover, no commenter indicated that surface mining would have to cease in any locations because of increased cost associated with the Office's blasting regulations.

One commenter complained that a large coal company had recently purchased a new drill to acquire capability of drilling smaller holes to meet the one-inch-per-second standard and the entire cost of \$250,000 for the drill was an expense in imposing this standard. However, that drill will replace drilling time for older, larger drills and thus the older drills will last longer. Also, the company will have more operational flexibility, by the ability to drill more types of holes. Moreover, there was no way for the Office to calculate accurately how much the drill purchase cost the company in the long run. When lower maintenance (resulting from a newer drill), increased operational flexibility (resulting from an extra drill), fewer complaints and damages (resulting from lower ground vibrations), and better fragmentation (resulting from smaller holes with closer spacings) are considered, the company could even conceivably have saved money by making this purchase. (See, e.g., Ref. 7 at 95-97.)

(f) A few commenters recommended lowering the allowable vibration level to below 1 inch/second. In most of these comments, reliance was put on information developed by a State

<sup>10</sup>No additional detonating cord would be required to meet the one-inch-per-second standard since the hook-up of explosives would be the same. Some additional delays would be interposed on the surface, but these are less than \$1.00 each. In the case where the operator is already using in-hole delays, no additional delays would be needed, only a wider variety. No additional loading time would be required because the same powder loads would be used. There might be a slight insignificant increase in time due to delay pattern design, care in proper loading, etc., if an operator chose to load different delayed charges within a borehole to reduce the charge weight per delay, this would take a little extra time. The increased time, even with an extremely complex blast, should amount to less than 5 percent; increased cost of materials (delays, cord, etc.) would be almost nil.

agency and the recommendations contained in Appendix C of the Committee on Bioacoustics and Biomechanics Report (Ref. 5). As was pointed out in comments by an industry commenter, Appendix C was not an actual recommendation made by the CHABA working group, but was included as background information. The material quoted in Appendix C of the report was a summary of the 1976 draft standard, International Standards Organization, Technical Committee 108, Standards Committee 2, Working Group 3. The actual recommendation of the CHABA report was that since structural damage had been observed to levels as low as one-inch-per-second, even that level should be regarded as one of potentially adverse exposure.

(g) A few comments stated that the one-inch-per-second standard was arbitrary or discriminatory against coal mining as compared to other methods of mining. The above material demonstrates that the standard is not arbitrary. Nor is it unduly discriminatory, since the Act requires establishing a standard to prevent property damage and injury from surface coal mine blasting.

(4) *Alternative 4, Use of Scaled-Distance Formula Only.*

One commenter proposed that the ground vibration criterion be eliminated completely, appearing to recommend that all reliance be placed on explosive charge weights and distance formula. Although charge weight-distance formula is one method of protecting structures from ground vibrations (Ref. 14, pp. 70-74 and Ref. 13, pp. 8-9), use of seismographs to predict adequate charge weights is also acceptable. Section 816.67(b) provides that a different charge weight-distance formula can be used, if it can be shown that the maximum peak-particle velocity is not being exceeded. Thus, the Office decided not to accept this comment.

(5) One commenter objected to the provision in Section 816.65(i) that the maximum allowed peak-particle velocity is to be lowered below one-inch-per-second, if required by population density, age of structures, geology, hydrology, or frequency of blasts. The commenter did not feel that a relationship between those elements and ground vibration had been demonstrated.

Gustafsson (Ref. 8, p. 208) found that older structures cannot withstand ground vibrations as well as newer structures. Some evidence does exist that the frequency of blasting does have an effect on structures (Ref. 8, p. 209). Density of population may require a lowering of the ground vibration limitation because of the possibility of increased human distress. Ref. 14, p. 28, shows that the percentage of

persons affected by distress is a function of the level of ground vibrations. In high density population areas, a larger number of persons will be distressed, since the number of persons affected is determined by multiplying the percentage of persons expected to be affected by the number of persons in a given area.

In some cases, geologic structure may cause vibrations to propagate more efficiently through the ground and cause more complaints or damage than normal. With regard to effects on hydrology and water supplies, it is clear that blasting can adversely affect ground waters by rock fracturing. (Ref. 7, at p. 2; Ref. 26 at p. 25; Ref. 27, Vol. 1, at p. 120). The regulatory authority, therefore, needs to be provided with authority to specify a lower peak-particle velocity, where use of one-inch-per-second is insufficient.

(6) One commenter objected to the one-inch-per-second standard, saying that mine-caused blasting damage is due to poor enforcement of the two-inch standard, rather than to actual ground vibration levels at two-inch-per-second. The data cited in this discussion, particularly Dvorak (Ref. 6) Gustafsson (Ref. 8) and Tynan (Ref. 23) show, however, that because damage and distress can occur below two-inches-per-second, one-inch-per-second is needed.

(7) *Alternative 5.* The Office received a number of comments which objected to the adoption of a peak-particle velocity standard which is based upon the assumption that all structures respond in the same manner to a given ground vibration, as opposed to a standard which is derived from analyses leading to a "structural response criterion." These comments urged the latter criterion be used, based on the work of Medearis (Ref. 12) to determine allowable maximum vibration levels.

Medearis' work involves the determination of how a structure will respond to a ground vibration. This response will vary with the frequency of the ground vibrations, the height of a building, the type of ground on which the structure is built, and the type of construction and age of the structure.

Medearis' system requires that the natural frequency of structures be determined by test blasting, along with spectral response curves showing the response of the structure when excited by different frequencies and amplitudes of ground vibrations. The predominant frequencies of the ground vibration, which will vary with the distance from the blast, must also be determined.

It is important to note, too, the Medearis' studies were not performed at actual blast sites. Medearis' studies involved records of 74 blasts provided by

Vibra-Tech Engineers (Ref. 12, p. 20) and simulated structural vibrations induced by "slamming doors or bumping appropriate structural components." (Ref. 12, p. 4). The structures studied were not those involved in the blasts. His simulated vibrations are not truly representative of blasting events because they excite only selected portions of the structure whereas blast vibrations excite the entire structure. To fully develop the Medearis' system, actual field blasts with associated ground vibration and structural vibration measurements are needed.

As Medearis states (Ref. 12, p. 87) this technique is based on a limited amount of data and requires further research. In contrast, the one-inch-per-second criterion used by the Office is based on a large volume of published data (ref. 6, 8, and 17) and Bureau of Mines unpublished data which correlate damage directly with ground vibration data, and do not take structural response into account.

Further, some commenters indicated that computer analysis is necessary for using the structural response system in each particular situation, making this a cumbersome and costly procedure, in comparison to the peak-particle velocity limitation, which uses the scaled distance formula or seismographic readings for implementation and compliance purposes. Moreover, given that detailed blasting plans cannot be provided at the permit application stage, there would be no necessary point in the regulatory process where the regulatory authority would have time to conduct an in-depth review of the computer analysis results.

The Office, instead, has decided to use a system involving the alternatives of scaled-distance or seismographic readings, which has been widely used throughout the industry for many years and can continue to be applied under the regulations without the necessity of Medearis' system for gathering site-specific structural data and engaging in computer modeling.

(7) *Alternative 6.* Finally, it was also argued that the Section should be amended to provide that the regulatory authority should not notify the mine when ground vibrations are being monitored, that the regulatory authority use only certain equipment and trained personnel, and that the latest equipment should be required for use by well-trained personnel. The Office, however, prefers to leave these enforcement particulars to the regulatory authority in individual cases, based on a case-by-case use of the best testing methodologies and whether notice to the operator may be needed. It was not felt that further modification of this paragraph was warranted.

XI. Section 816.65(j) (Section 816.65(k) in proposed rules).

(A) Several commenters requested that this provision be modified to afford additional relief from the one-inch-per-second peak-particle velocity limitation at certain structures. Several commenters suggested allowing for waiver of the peak-particle velocity limits at any location under control of the operator or at any property of any other person willing to grant a waiver of the peak-particle velocity limit. Section 515(b)(15)(C), of the Act however, requires that blasting be limited to preclude dangers to underground mines and to surface or underground waters. Thus, allowing for waiver of the peak-particle velocity merely at a particular location would not satisfy the requirements of the Act (See Refs. 26,27), because:

1. An underground mine might be located at or under the surface location of the person agreeing to the waiver, and

2. A spring or stream used by downstream or downgradient persons might pass through or under location of a person agreeing to the waiver for structures on adjacent property overlying surface or groundwaters.

Therefore, the Office decided it could not authorize waivers of the maximum peak-particle velocity limit, without preserving restrictions to protect underground mines and surface and ground waters. As a result, any waivers must be appropriately based on pre-conditions, as specified in Section 816.65(i).

B. Some commenters felt that an operator should not be required to protect his or her own structure from vibrations merely because the structure was leased to another party. If the requirement protecting a lessee were dropped completely, a lessee of the property owned by the operator would lose the right under the Act to protection from discomfort and damage from ground vibrations caused by blasting. Thus, the waiver provision in the final rule was adopted to protect the lessee's rights and still permit the operator to seek relief from the basic requirement of the regulation.

C. Some commenters felt that a structure owned by the operator, even though it is off the permit area, should be exempt from the one-inch-per-second limitation. The Office agrees that the location of the property with respect to the permit area should not be a determinant in authorizing waivers to the permittee. The final rule reflects this.

D. Several commenters felt that the one-inch-per-second limitation should be subject to waiver by a private homeowner or lessee thereof, in addition to structures owned by the permittee. Allowance for these types of

waivers, however, can easily subject homeowners and their lessees to undue coercion by the mine operator. Additionally, homeowners may waive rights to protection of their property without realizing the significance of this action. The average lay person is not likely to have adequate technical knowledge for intelligent selection of an alternative peak-particle velocity ground vibration level under a waiver. In comparison, the permittee should have employed competent experts to conduct blasting and upon whom the permittee can rely for advice in deciding whether to use the waiver of the one-inch-per-second limit. Thus, the Office feels that a provision for a waiver from private homeowners or their lessees, other than the permittee, is unjustified.

XI. Section 816.65(k) and (l) (Sections 816.65(1), (m) of proposed rules).

A. Several comments were received on the use of a scaled-distance formula of 60 as an acceptable means of compliance with the one-inch-per-second peak-particle velocity limitation of Section 816.65(i). As a result of the comments, the following alternatives were considered, and alternative 1 was adopted.

(1) Retain the text of the proposed rules;

(2) Reduce the scaled distance equation to 50;

(3) Use a scaled distance greater than 60.

B. (1) Scaled distance is an expression which relates the absolute distance from a blast to a structure to the square root of the charge weight of explosive per delay. Although vibration data tend to have considerable scatter, equivalent scaled distances tend to give similar vibrations. The scaled distance equation is as follows:

$$SD = R/\sqrt{W}$$

Where R is the distance from the blast to the structure in feet, and W is the charge weight per delay. The following examples will illustrate this. Given distances of 1,000 feet and 5,000 feet, what is the maximum charge weight per delay that can be used in complying with a scaled distance of 60? A scaled distance of 50?

	1000 ft.	5009 ft.
	$60 = 1000/\sqrt{W}$	$60 = 5000/\sqrt{W}$
SD = 60	$\sqrt{W} = 1000/60$	$\sqrt{W} = 5000/60$
	$W = 16.667$	$W = 83.333$
	$W = 273 \text{ lb}$	$W = 6944 \text{ lb}$
SD = 50	$50 = 1000/\sqrt{W}$	$50 = 5000/\sqrt{W}$
	$\sqrt{W} = 20$	$\sqrt{W} = 100$
	$W = 400 \text{ lb}$	$W = 10,000 \text{ lb}$

(2) *Analysis of Comments and Alternatives*

(a) *Alternative 2.* Several commenters stated that a scaled distance of 50 should be adopted, based either on ref. 14 or on the commenter's practices. Ref. 14 discussed use of 50 as a

basis for meeting a peak-particle velocity standard of two-inches-per-second, and it was the information in that bulletin that set the established practice.

Because the particle velocity limitation is being reduced to one-inch-per-second, a higher scaled distance was required for compliance with this lower limitation. The scaled distance of 60 was derived from the combined velocity data, p. 71, Ref. 14. The Office recognizes that the 60 scaled distance is an empirically derived number with a built-in safety factor, and therefore, permits the operator to seek relief by deriving a site-specific scaled distance factor, based on seismographic data from a particular blast site, subject to approval by the regulatory authority. (Section 816.67(b)).

(b) A few commenters stated that a scaled distance of 50 will keep vibrations in the 0.5 inch per second range. The data on page 71 of ref. 14 refute this assertion. In any event, if the operator has a property at which the scaled distance of 60 is unduly restrictive, he may seek relief under Section 816.67(b), by use of site-specific seismograph data.

(c) Several commenters argued that the scaled distance of 60, when compared with the scaled distance of 50, results in a reduction by 30 percent of the weight of explosives to be detonated at one time. This is true, but the fact remains that the scaled distance of 60 is necessary to keep vibrations below one-inch-per-second, unless the operator seeks relief under Section 816.67(b) or meets the higher scaled distance by employing more delays in the blast.

(d) *Alternative 3.* A State environmental agency recommended that the scaled distance should be 100 for compatibility with one inch per second, but provided no detailed data to substantiate this. The combined data on page 71 of ref. 14, furthermore, based on recordings of 159 blasts in 24 operations, refutes this contention.

(e) *Other comments.*

(1) A commenter stated that no scaled distance is adequate to protect against a specific level of ground vibrations because of variations in blasting-cap firing times. (Ref. 23, pp. 17, 21, 24 and 27). Manufacturers and the industry have been aware of this firing time scatter since the development of delay caps. However, the data enumerated above, from which the 60 scaled distance was derived, are empirical data obtained from blasts using detonators with assumed scatter in firing times. Thus the cap scatter is automatically incorporated and accounted for by the results of the data analysis supporting the 60 scaled distance.

(2) One commenter recommended that the specification that the scaled distance be determined by reference to

the distance to the nearest structure should be clarified, to be the "shortest distance that seismic waves would propagate through the earth or along the surface of the earth," because the current wording is believed to be too conservative, in some cases, for complex terrain. However, the scaled distance has historically been measured on a horizontal plane analogous to land surveying techniques. (Ref. 25, pp. 405-408; Ref. 13, p. 7; Ref. 14, pp. 70-72) If the scaled distance of 60 is too conservative in certain instances in complex terrain, relief is available through Section 816.67(b).

(3) Several commenters suggested rewording from "within any eight-millisecond period" to "with at least eight milliseconds' separation in time from all other detonations." The Office rejected this suggestion because it would unduly restrict an operator's options in blast design. The premise of the use of delay intervals (Ref. 13, pp. 8, 9 and Ref. 14, pp. 40, 70, 71) is that any amount of explosive detonated within an individual interval may act as a single charge in terms of producing vibrations. For an efficient blast design, an operator may want to use delay intervals of less than eight milliseconds. This is permissible under the scaled distance concept, as long as the maximum weight of explosive fired within any eight-millisecond period is used in the scaled distance calculation.

(4) A few commenters argued that the eight-milliseconds figure is not specified in Bulletin 656. This is true, but the data used in calculating the eight-millisecond specification are accounted for and used in calculations of the scaled distance formula in Bulletin 656.

XIII. *Proposed Section 816.65(n).*

A few commenters requested that the provision in the proposed regulations for limiting the duration of ground vibrations be deleted. Based on the review of the comments, the Office decided to accept this recommendation.

The commenters recommended deletion of this section on the grounds that it is unnecessary, confusing, and simple to circumvent. The Office agrees that the Section is unnecessary. The Office's rationale for proposing this Section was that ground vibrations of one-second duration constitute steady-state conditions. This contention cannot, however, be supported. This Section was adopted from a State regulation. Subsequent comments from that State revealed, however, that the rule is not based on sufficiently accurate and available data. Many delay systems designed to have vibration durations of longer than one second have been in use for years with no reported problems, as the com-

menters noted. Spreading vibrations over a longer time period is one of industry's most effective ways of reducing peak vibrations, and thus this Section would be counter-productive to insuring that peak vibrations be minimized under other paragraphs of these Sections.

XIV. *Proposed Section 816.65(o).*

Numerous commenters felt that the requirement for regulatory approval of the use of delay systems combining surface and in-hole delays, as specified in the proposed rules, should be deleted. Based on rationale provided with these comments, the Office decided to delete this provision.

Most of the commenters stated that combination surface/in-hole delay systems have become common practice for reducing blast vibrations. They felt that the scaled distance formula in Section 816.65(m) and the one-inch-per-second peak-particle velocity limitation in Section 816.65(j), is adequate, so that a requirement for specific regulatory authority approval to use combination surface/in-hole delays is an unnecessary burden. Several commenters felt that the Office is needlessly specifying to industry how to achieve the required results, instead of simply specifying the required results.

A few commenters felt that an additional time delay criterion/or continuous monitoring requirement should be added. However, according to Ref. 17, pp. 1, 2, these combination systems have been widely used, with excellent results, to control ground vibrations. Placing additional restrictions on their use will discourage operators from using the latest available technology to control vibrations. The Office argues that the public is adequately protected by Sections 816.65(l) and 816.65(i) and that approval of combination delay systems by the regulatory authority is a significant burden, without benefit.

§ 816.67 Use of explosives: Seismograph measurement.

(A). A number of individuals or organizations submitted comments in this section objecting to various provisions. A few of these stated that the frequency response of structures and the conditions of structure should be considered to allow for variances for use of the prescribed charge weights of the scaled distance (requirements of Section 816.65(i) and (k)). Some commenters stated that Section 816.67(c) should be deleted and one commenter stated that the provisions of Section 816.67(c) should be used only if a complaint has been made by a citizen. One commenter felt that significant economic risk should be considered in deciding when a waiver of the scaled dis-

tance formula is allowed. One commenter stated that the "remoteness of an area" should also be a consideration for allowing for waiver of the scaled distance formula, and another felt that because seismograph monitoring may be required, a scaled distance of 50 should be used. One commenter wanted this Section's specification of a peak-particle velocity of one inch-per-second replaced by two-inches-per-second.

Consideration of the comments led to the following alternatives, and alternative 1 was chosen.

(1) Clarify Section 816.67(c) to provide that when the regulatory authority requires the collection and recording of seismograph data, it also has the authority to specify the monitoring location. Leave other provisions unchanged.

(2) Allow structural response, economic risk, or "remoteness" to be used as additional factors to authorize waivers of the scaled distance formula under Section 816.67(a).

(3) Delete the authorization to the regulatory authority to require seismographic readings or limits its application.

(B). (1). Several commenters stated that the frequency response of structures (Ref. 12) and the condition of structures should be considered when allowing for waivers of the scaled distance tables based on seismographic measurements. The above discussion on the one-inch-per-second peak-particle velocity limitation Section 816.65(i) provided detailed reasons for not adopting a system of limiting ground vibrations from blasting, based upon the Medearis theory of structure response. It is not adequately developed for use at this time, is very complex, and requires costly, time-consuming analyses. Condition of a structure is not grounds for changing the allowable peak-particle velocity. Section 816.65 (j) and (k) provide that the one-inch-per-second particle velocity may not be exceeded at any structure not owned or leased by the permittee.

(2). A few commenters stated that Paragraph 816.67(c) of these Sections should be deleted because it confers too much discretion on the regulatory authority to require seismographic readings by permittees. However, to provide a mechanism for enforcing the one-inch-per-second velocity limit, it is essential that the regulatory authority have the option to require seismograph measurements, where questions arise as to the operator's compliance with the limit by use of the scaled distance formula. It is not expected that the regulatory authority will use its discretion arbitrarily.

(3). One commenter stated that Section 816.67(c) should be used only when there has been a complaint

made to the regulatory authority about a permittee's blasting. No reason was given by the commenter for this. It is anticipated that this provision will be applied mostly where there have been complaints. However, where blasting records or inspectors' observations cast doubt as to the operator's compliance with the one-inch limit by use of the scaled distance formula, the regulatory authority needs the option to require measurements because use of the scaled distance formula is not considered to provide absolute protection against exceeding a specific ground vibration level. (Ref. 14.)

(4). One commenter felt that Section 816.67(c) should be employed only where there is significant economic risk. A determination of economic significance would provide a vague standard which would be difficult to administer, particularly in the field. Detailed economic data, including property valuation materials, would be required. This data would be costly to assemble and access. Further, Sections 515(b)(15)(C) of the Act requires the prevention of damage to property whether or not based on a "significant economic risk."

(5). One commenter felt that operators in remote areas should be permitted to use a scaled distance formula larger than that required to protect against one-inch-per-second. Remoteness, however, has no bearing on structures, since all structures must be protected. In fact, operators in remote areas should have the least difficulty in complying with the scaled distance requirements and the one-inch-per-second velocity limitation. Structures in remote areas tend to be located further from blasting, thereby allowing more explosives to be used before exceeding the one-inch-per-second velocity limitation at those structures.

(6). One commenter stated that, since we have provided in Section 816.67(c) for the regulatory authority to require monitoring of all shots, the scaled distance of 50 should be adequate. The use of seismic monitoring and the use of the scaled distance equation are two separate options for compliance under Section 816.65. As is explained in the preamble to Paragraphs 816.65(k)-(l), the scaled distance of 60 is necessary to meet the one inch per second peak-particle velocity limit, if seismographic data is not obtained.

(7). One commenter wanted the one-inch-per-second specification of Section 816.67 replaced by two-inches-per-second. For consistency between the standards of Section 816.65 and 816.67, the one-inch-per-second must be retained.

(8). A few commenters had no criticisms of Section 816.67 but suggested

clarification. In order to clarify the provisions of Section 816.67, Paragraph (c) has been revised to reflect that when the regulatory authority requires that a semismograph record be made, it will also have the authority to specify appropriate data collection locations, if necessary.

§ 816.68 Use of explosives: Records of blasting operations.

(A). Numerous commenters suggested various changes in the information required in the blasting record in the proposed regulations. A review of the comments resulted in consideration of the following alternatives. Alternatives 4 through 8 were adopted.

(1) Retain the text of the proposed rule;

(2) Establish a minimum distance specification for documenting particulars about the nearest structures (Paragraph 816.68(d));

(3) Change the wording of Section 816.68(k) concerning the charge weight within any millisecond period;

(4) Add temperature, wind direction, and approximate wind velocity as data requirements to Paragraph 816.68(e);

(5) Add a requirement for making a sketch of the delay pattern used;

(6) Change the wording of Paragraph (m) for clarity.

(7) Replace "person" with "operator" in Section 816.68(a);

(8) Add a requirement to record the number of persons used in the blasting crew.

(B). (1). Several commenters suggested that documentation of the nearest structure be limited to structures within one-half mile and one commenter suggested a distance of 10,000 feet. The rationale given for the ½ mile distance was "to be consistent with the Act." However, the Act clearly intends that all structures be protected, regardless of the distance from the blast. The distance to the nearest structure, whatever the actual distance, is necessary to assume that the structure is adequately protected, by either the scaled distance factor or a seismograph record.

(2). A few commenters suggested changing the wording of Section 816.68(k) to "explosives detonated with at least eight milliseconds' separation in time from other detonations." Based on the detailed rationale discussion in the preamble under Section 816.65 (k) and (1), the Office has decided not to make this change, because delay intervals of less than eight milliseconds are permissible under the scaled distance concept, as long as the maximum weight of explosive fired within any eight-millisecond period is used in the scaled distance calculation.

(3). One commenter suggested that temperature be added as a specific requirement in Section 816.68(e). Ref.

14, p. 65, and Ref. 13, p. 11, state that airblast propagation is influenced by temperature and wind. So that the blast record will be useful in determining possible causes for high airblast noise levels, the wording "including temperature, wind direction, and approximate velocity" has been added to Section 816.68(e).

(4). Section 515(b)(15)(B) of the Act requires that the blast record contain "the order and length of delay in the blasts." The simplest and clearest way to accomplish this is through a sketch of the delay pattern. Therefore, a provision for this has been added to the blast record requirements.

(5). For clarification and consistency, Paragraph (m) now reads "initiation system" and the word "person" is replaced with "operator" in Paragraph (a). The name of the blaster-in-charge is already required in Paragraph (c). To check compliance with 30 CFR Part 850, which specifies the allowable maximum number of persons on individual blasting crews, a requirement has been added to record the number of persons in the blasting crew.

(6). One commenter felt that having a blast record open for public inspection is undesirable because it would be misunderstood and misinterpreted. Section 515(b)(15)(B) of the Act specifically requires maintaining the availability of records for public inspection.

#### §§ 816.71-816.74 Disposal of excess spoil.

30 CFR 816.71-816.74, along with the definitions of "head-of-hollow" and "valley fills" in Section 701.5, regulate excess spoil. Section 816.71 lists general requirements that apply to all fills, including those dealt with in Sections 816.72-816.74. These requirements are basically safety and environmental protection standards which the engineer designing the disposal area must satisfy. If the particular spoil disposal area does not fall within the definitions of head-of-hollow or valley fill, the requirements of Section 816.71 are the governing regulations. If the spoil disposal area falls within the definition of valley fill, then in addition to the more general requirements of Section 816.71, the valley fill must also meet the requirements of Section 816.72. If the particular spoil disposal area falls within the definition of head-of-hollow fill, then in addition to the more general requirements of Section 816.71 and 816.72 the fill must comply with Section 816.73. Section 816.74 provides an alternative method of constructing a head-of-hollow or valley fill.

These different approaches were adopted to allow increased flexibility for the operators and the State regulatory authorities while maintaining the

public safety and environmental protection that Congress mandated.

The flatter fill areas are covered by the more general requirements of Section 816.71 since the risk of failure or pollution of ground or surface water may be less than in steeper areas. Both Sections 816.72 valley fills and Section 816.73 head-of-hollow fills are defined in Section 701.5 of the final regulations.

For valley fills, Section 816.72 provides for a fill with a rock underdrain constructed with diversion ditches that carry surface water away from and around the fill. The engineered rock underdrain and diversion ditch system are necessary because valley fills block a path of water flow from a watershed above the valley fill. If the fill is a head-of-hollow fill, then there will be a smaller watershed, in which case Section 816.73 provides that the fill may be constructed with a rock chimney drain and water may be diverted toward the rock chimney. Section 816.74 governs a special type of either head-of-hollow or valley fill that is made up of at least 80 percent by volume of sandstone, limestone, or other durable rocks that do not slake in water. In such fills, internal drainage is more free and failure because of saturation is much less of a risk, and erosion should be minimal. Therefore, special methods of construction are allowed.

Spoil disposal practices in mining operations have had a major impact on the environment and, in some cases, represented a significant hazard to life and property. The requirements outlined in these Sections of the final regulations provide positive measures to protect life, property, and the environment by establishing criteria for the disposal of excess spoil materials while achieving adequate drainage control and long-term stability. For reference to the potential environmental impacts of excess spoil disposal see: "Final Environmental Impact Statement OSM-EIS-1," pp. III-13-15.

If excess materials are improperly placed across drainage channels and provide inadequate drainage and stability, disturbance to the hydrologic balance and impact on safety could be profound. (Comptroller General of the U.S., 1977, pp. 1-2; Coalgate and others, 1973, pp. 93-94; Hopkins and others, 1975, p. 9; Taylor, 1948, pp. 406-407). The purpose of detailed construction standards for disposal of excess spoil is to construct fills which will not require maintenance over the life of the fill. Fills constructed for highways, railroads and buildings are not only carefully engineered, but also monitored and maintained for their lifetime. In contrast, excess spoil fills are ultimately the responsibility of the surface landowner who is likely not to

have the capital or equipment for long-term maintenance or remedial action. Therefore, it is essential to design and construct excess spoil fills properly.

Major issues which have been identified based on public comments were separated into five areas:

- (1) Semantic interpretations of the terms "haul or convey" versus "transport and placed";
- (2) durability requirements for rock used in underdrains;
- (3) Lift thicknesses for excess spoil placement;
- (4) Allowance of alternative spoil disposal methods; and
- (5) Provisions for the disposal of coal processing waste in excess spoil fills.

Each of the principal issues, as well as additional comments, are addressed below.

The authority for these proposed Sections is found in Sections 102, 201, 501, 503, 504, 507, 508, 510, and 515 of the Act. The rationale for selecting the final regulations in lieu of the alternatives analyzed in the Regulatory Analysis is found in the context of this general preamble discussion, the disposition of submitted comments related to the proposed regulations, and the preamble to the proposed regulations for these Sections.

Technical literature used in the preparation of these Sections is listed in the preamble discussion for Section 816.91-816.93 in addition to the following:

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Curtis, W. R. 1971a. Strip-mining, erosion and sedimentation. American Society of Agricultural Engineers Transactions. Vol. 14, no. 3, pp. 434-436.

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Franklin, J. A., and Chandra, R. 1972. The slake-durability test. Pergamon Press, *International Journal of Rock Mechanics and Mining Sciences*. Vol. 9, No. 3, pp. 325-341.

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Lutton, Richard J. 1977. Design and Construction of Compacted Shale Embankments, Volume Three: Slaking Indices for Design. FHW-77-1, 83 pp.

Mason, Brian, 1966. Principles of geochemistry. Third edition. John Wiley and Sons, Inc., New York, 329 pp.

NCA/AMC Joint Committee, Comments received proposing addition of 816.74. Submitted to OSM, November 27, 1978. pps. S-190 through S-194.

Plass, W. T. 1967. Land disturbances from strip mining in eastern Kentucky. U.S. Forest Service Research Notes NE-52 (7 pp.), NE-68 (6 pp.), NE-69 (7 pp.), and NE-71 (7 pp.).

Shamburger, J. H., Patrick, D. M., and Lutton, Richard J. 1975. Design and Construction of Compacted Shale Embankments, Volume One: Survey of Problem Areas in Current Practices, 288 pp. FHW-75-61.

Underwood, Lloyd B. 1967s. Classification and identification of shales. *Journal of the Soil Mechanics and Foundation Division, ASCE* vol. 93, No. SM6, pp. 97-116.

U.S. Congress: H. Rept. 218, 95th Congress, 1st sess. p. 126 (1977).

U.S. Department of Energy, 1978. Comments in a document to OSM, November 24, 1978, Section on Excess Spoil Disposal, pp. 1-15.

U.S. Environmental Protection Agency. 1976b. Erosion and sediment control—Surface mining in the eastern

United States; Vol. 1, Planning; Vol. 2, Design. U.S. Environmental Protection Agency Technology Transfer Seminar Publication EPA-625/3-76-006. Vol. 1, 102 pp; Vol. 2, 137 pp. (Available from U.S. Department of Commerce, NTIS PB-261 353).

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U.S. 95th Congress. 1977a. Surface Mining Control and Reclamation Act of 1977. Pub. L. 95-87. 91 Stat. 445-532.

Weigle. 1966. Spoil bank stability in eastern Kentucky. *Mining Congress Journal*, April 1966, pp. 67-68 and 73.

Young, Stephen G. "Comments on Substance of CEA's Contacts Relating to OSM's Proposed Nationwide Permanent Program for the Regulation of Surface and Underground Mining," dated January 12, 1979. Letter of 2 pages with attachment 113 pp. and 6 Appendices, dated December 15, 1978.

§ 816.71 Disposal of excess spoil: General requirements.

Section 816.71 requires controlled placement utilizing current engineering practices common in embankment construction for all types of permanent fills. This Section implements the general requirements outlined in the Act and is applicable to all excess spoil disposal areas. For definition of the different types of fill see 30 CFR 701.5.

Disposal of excess spoil in designated offsite storage areas such as pre-existing mined benches is presently practiced in several States. In some areas, disposal of excess spoil has occurred without benefit of permits, sufficient bonding, or minimal provisions for environmental control. Under the proposed permanent regulations, Section 816.71(a), disposal of excess spoil was to be permitted in areas only "other than mine workings or excavations." The Office recognizes the constructive and beneficial results for disposal of excess spoil in such workings or excavations, and strongly encourages this practice which is feasible and consistent with both the Act and the permanent performance standards. As a result, the wording of Section 816.71(a) has been modified to clarify the language.

Commenters said the first cut or box cut spoils should not adhere to the same requirements as excess spoil. The commenters said Section 515(d) of the Act separates the requirements of steep versus flat slope areas regarding spoil disposal. The legislative history and the Act in Section 515(b)(22) do not indicate that excess spoil regula-

tions should be divided based upon mining terrain slopes. Therefore where box cut or first cut spoils are not required to achieve approximate original contour or cannot be handled in accordance with Section 816.101, they should be treated as any excess spoil and comply with the requirements of Sections 816.71-816.74.

Commenters objected to the use of the phrase "haul or convey" since Section 515(b)(22)(A) of the Act uses the language "transported and placed." The legislative history shows that "standards require controlled placement of spoil. Spoil must be transported-hauled by truck or other vehicle-placed and compacted. . . ." (123 Cong. Rec. H-7582, July 21, 1977). The intent of the recommended change was to allow uncontrolled end-dumping soil as an acceptable method of spoil placement. This recommendation is rejected.

One commenter noted that the use of the word "replaced" in Section 816.71(c) regarding topsoil appeared to be an error. He suggested use of the term "placed" as an alternative. This comment was rejected, as "replaced" is consistent with Section 816.22.

A commenter suggested that removal of topsoil, vegetative, and organic material was not necessary "in the nonstructural portion of the fill to insure stability." The Act, however, requires removal of topsoil in Section 515(b)(5); therefore, this comment is considered non-substantive and cannot be accepted.

Some commenters contended that all topsoil should be removed from the entire disposal area before any spoil is placed on it. This is not implied by the regulation. OSM recognizes that the entire removal of topsoil before spoil is placed in the area is undesirable. Concurrent removal of topsoil is accepted and desirable and minimizes the disturbances at the disposal site.

A commenter suggested that moderate slopes are not always stable because the parent bedrock which produces moderate slopes usually results in deeply weathered soils. He suggested that foundation investigations be required prior to fill placement. This comment was rejected, as placing this requirement in Section 816.71(e) would be redundant because Section 816.71(n) requires foundation investigations.

Commenters proposed a variance allowing small depressions or impoundments on the crest of fills, if demonstrated to be consistent with the post-mining land use and stability of the fill. Commenters said that such impoundments would enhance post-mining land uses, such as grazing. It is a commonly accepted engineering and construction practice to minimize infiltration of surface water into the fill

is reopened for mining to recover the remaining coal.

The authority for this Section is found in Sections 102, 201, 501, 503, 504, 510, and 516 of the Act.

Discussion of specific language and alternative language to require fixed percentages of coal recovery are in the preamble discussion of Section 816.59 to which the reader is referred for a discussion of issues relevant to this Section.

One comment was received suggesting that specific percentages of coal recovery be required. This comment was rejected for the reasons explained in the preamble to Section 816.59.

One commenter suggested that OSM should not promulgate a standard for coal recovery of underground mining, on the grounds that the Act did not authorize Federal coal recovery standards for deep mines, citing Section 517(a) of the Act limiting inspections to strip mines. OSM has rejected this suggestion on the basis that Section 515(b)(1) itself, and as applied through Section 516(b)(10), requires coal recovery standards for deep mines. Moreover, OSM feels that Section 517(a) of the Act authorizes inspections of underground mines. Section 517(a) authorizes inspection of "surface coal mining and reclamation operations." This phrase is defined by Section 701(28) of the Act and Section 700.5 of these regulations to include the surface effects of underground mining. The amount of coal recovered has an effect on the surface in that maximum recovery can preclude the need to re-disturb the surface at a future date, a primary objective of this Section of the regulations. Maximum recovery from an underground mine may be a smaller percentage of the total coal than would be recovered using surface mining methods if such methods were feasible for the specific site.

It is understood that the operator must strike a balance between this requirement to maximize coal recovery and the requirements of Sections 817.121-126 dealing with subsidence control. Both the coal recovery plan and subsidence damage control plan must be approved by the regulatory authority.

§ 817.61-817.68 Use of explosives.

These Sections are promulgated under the authority of Sections 102, 201, 501, 503, 504, 507, 510, 515, 516, and 719 of the Act. Most of the provisions of these regulations are substantially identical to the blasting performance standards regulations for surface mining activities (Sections 816.61-816.68). To that extent, the reader is referred to the appropriate portions of the preamble for Part 816, which contains the rationale, in general, for parts of Sections 817.61-817.68

which are not specifically discussed in the preamble to Part 817.

§ 817.61 Use of explosives: General requirements.

Numerous comments were received which pertained specifically to Section 817.61. As a result of these comments, the following alternatives were considered and alternatives two, three and four were adopted by the Office.

1. Retain the wording of Section 817.61(a) as proposed.

2. Revise Section 817.61 to restrict Section 817.61-817.68 to only surface blasting activities incident to underground mining, including construction of initial rounds of slopes and shafts. As a result of such an addition, portions of Section 817.65(a) of the proposed regulations would become unnecessary.

3. Delete reference in Section 817.61(a) to Sections 816.61-816.68.

4. Delete Section 817.61 of the proposed regulations, which required a blasting schedule for surface blasting incident to underground mining.

*Alternative 2*—Numerous commenters have pointed out an obvious ambiguity in the proposed blasting regulations for underground mining. Although proposed Section 817.65(a) stated that the provisions of that Section applied only to blasting conducted on the surface, that distinction was not made for the rest of Sections 817.61-817.68. Adoption of alternative two clarified the Office's intent not to regulate blasting performed underground, because this activity is adequately controlled by MSHA. By adding Section 817.61(a) to the final rules, proposed Section 817.65(a) was made unnecessary and was changed in the final rules.

*Alternative 3*—In response to comments that underground mining activities should not be subject to all requirements of Sections 816.61-816.68, the Office revised Section 817.61(a) so that the final rules require underground mining activities to comply only with Sections 817.61-817.68, which have been appropriately tailored solely for those activities.

*Alternative 4*—Several commenters objected to the requirement of the proposed rules for a blasting schedule for surface blasting incident to underground mining. The Office agrees because it was not the intent of Congress to require a blasting schedule for this type of blasting. Section 817.65(a), requiring a 24 hour notification for blasts of this type, is adequate protection for the public, given the limited frequency and duration of surface blasting associated with underground mining activities.

One commenter pointed out that MSHA's proposed rule, Section 77.1308(i), will allow blasting at night

in slopes and shafts at underground operations except for the initial rounds on the surface. The Office finds no conflict with MSHA's proposed rule, as the Office does not regulate blasting under Part 817 inside underground mine workings. Initial rounds of slopes and shafts have been provided for in final Section 817.61(a) which regulates surface blasting for underground mining.

§ 817.62 Use of explosives: Preblasting survey.

A few commenters recommended limiting the area in which preblast surveys are required for surface blasting associated with underground mining to a one-half mile radius from the blasting activities, as provided for in Section 515(b)(15) of the Act. The Office accepted these comments, because there was no apparent basis to expand the area for mandatory preblast surveys from surface mining (one-half mile) for underground mines (any portion of the mine).

§ 817.65 Use of explosives: Surface blasting requirements.

(1) Several comments were received concerning the 24 hour notice required for surface blasting in support of underground mining in the proposed rules. As a result of these comments the following alternatives were considered and alternative 2 was adopted—

1. Retain the wording as published in the proposed regulations.

2. Modify Section 817.65(b) by inserting "approximately" in front of "24 hours" and inserting "surface" in front of "blasting event."

3. Change the Section to require a notice at least 10 days, but not more than 20 days, prior to blasting.

4. Delete the Section.

*Alternative 2*. One commenter objected that the notice of blasting was required to be given exactly 24 hours prior to blasting. As this would not be necessary or practical if there are a large number of surrounding residents to be notified, the word "approximately" has been added to qualify the advance notice requirement.

*Alternative 4*. The same commenter also questioned the Office's authority to promulgate blasting regulations for underground mines, because blasting is not one of the subjects listed in Section 516(d) of the Act. However, Section 516(b)(10) of the Act makes all of the performance standards of Section 515 of the Act applicable to "other surface impacts" not specified in Section 516(b) of the Act, thereby incorporating, by reference, Section 515(b)(15) of the Act. Further, Section 516(d) of the Act makes the permit application requirements of Title V of the Act applicable to underground mining. Under the permit application

requirements at Section 507(g) of the Act, there is a requirement that the applicant establish how the blasting provision of 515(b)(15) of the Act will be met. Therefore, the Office does have the authority to promulgate rules for surface blasting at underground coal mines that are in accordance with Section 515(b)(15), as modified so as to accommodate any distinct difference between surface and underground coal mining.

Surface blasting associated with underground coal mining, as compared to surface mines, commonly involves a lesser quantity of explosives and is not of such a continuing nature as for surface mining activities, because smaller surface areas of overburden removal are involved. However, underground mining activities do involve substantial blasting for road or facilities construction, "facing-up" operations for installation of adits, and initial blasts for slopes and shafts. The environmental impact of these generally smaller blasts, conducted for a shorter time period, is less severe than the legislative history indicates for surface mining blasts. Therefore, the provisions of Section 515(b)(15)(A) of the Act required modification as applied to underground mining activities. In the Office's judgment, a notification of blasting approximately 24 hours in advance of the blast will provide adequate notification for the infrequent type of blasting involved.

*Alternative 3.* One commenter recommended that notifying residents within ½ mile at least 10 days, but not more than 20 days, prior to any blasting event be required only for "facing-up operations," on the theory that this modification would conform Part 817 to proposed Section 816.64(a). Section 816.64, however, requires publishing a blasting schedule in the local newspaper for *all* types of blasting. Because there was no basis shown by the commenter to distinguish among the types of blasting in surface work in underground mining, the Office rejected the comment.

(2) § 817.65(d). One commenter requested clarification as to which underground mining activities require maintenance of signs under Section 817.11(f). In response, the Office has clarified the wording of this Section to specify persons who conduct surface blasting incident to underground mining. The commenter correctly noted that, as proposed Section 817.65(d) would have required any person conducting underground mining activities to comply with all of the provisions of Section 817.11(f).

§ 817.68 1. Use of explosives: Record of blasting operations.

1. A few comments specifically directed to the blasting record require-

ments of proposed Section 817.68 were received. Some commenters felt that it was unclear whether Section 817.68 applied to blasts fired underground. However, the wording of Section 817.61(a) in the final rules makes it clear that only blasts fired on the surface and initial rounds in construction of shafts and adits are subject to the provisions of Section 817.68.

(2). One commenter suggested that a threshold size of blast be specified below which a blasting record is not required. The Office rejected this suggestion. As is discussed in detail in the preamble to Section 816.61, blasting involving the use of more than five pounds of explosives needs to be closely regulated, because of the potential for damage and harm to the public. In order that the regulatory authority can properly evaluate whether the requirements of the regulations specifying procedures and standards for blasting of over five pounds are being complied with, it is necessary that the identity, location, duration, types, and amounts of explosives used be recorded. These items will establish whether the operator, is, in fact, blasting with more or less than five pounds. Furthermore, the number and types of holes and description of delays used are appropriate means for cross-checking the claims of the operator in the total weight of explosives used per blast. Finally, other data required by Section 816.68 are useful to establish a historical data base by which the operator can predict how to conduct blasting over time.

§ 817.71-817.74 Disposal of underground development waste and excess spoil.

Authority for these Sections is found in Sections 102, 201, 501, 503, 507, 508, 510, 515, and 516 of the Act.

The basis and purpose of these Sections are the same as for Sections 816.71-816.74 of this Subchapter. All public comments discussed in the portion of the preamble relating to Sections 816.71-816.74 were considered and similarly disposed of with respect to Sections 817.71-817.74, because the Office believes that the differences between underground and surface mining do not justify differences in the coal development waste and excess spoil disposal requirements between structures associated with surface mining and those associated with underground mining. In effect, the Office believes that disposal of underground development wastes pursuant to these Sections will provide, and is necessary to insure, the same level of protection for the environment and public health and safety as is required for the disposal of excess spoil associated with surface mining.

The reader is referred to Sections 816.71-816.74 for a discussion of com-

ments and issues relative to Sections 817.71-817.74.

§ 817.81-89 Coal processing waste banks and disposal of non-coal waste.

Authority for these Sections is found in Sections 102, 201, 501, 503, 504, 507, 508, 510, 515, and 517 of the Act.

The basis and purpose of these Sections are the same as for Sections 816.81-816.89 of this Subchapter. All public comments discussed in the portion of the preamble relating to Sections 816.81-816.89 were considered and similarly disposed of with respect to Sections 817.81-817.89, because OSM believes that the differences between surface and underground mining do not justify differences in the waste disposal requirements between structures associated with surface mining and those associated with underground mining.

The reader is referred to Sections 816.81-816.89 of the preamble for a discussion of comments and issues relative to Sections 817.81-817.89.

§ 817.91-817.93 Coal processing waste: Dams and embankments.

The authority for these Sections is found in Section 516 of the Act, in addition to Sections of the Act cited in the preamble discussion of Sections 816.91-816.93.

The basis and purpose of these Sections are the same as for Sections 816.91-816.93 of this Subchapter. All public comments discussed in the preamble relating to Sections 816.91-816.93 were considered and similarly disposed of, with respect to Sections 817.91-817.93, because OSM believes that the differences between surface and underground mining do not justify differences in the coal processing waste dam requirements between structures associated with surface mining and those associated with underground mining.

§ 817.95 Air resources protection.

The basis and purpose of this Section are the same as for Section 816.95 of this Subchapter. All public comments discussed in the preamble to Section 816.95 were considered and similarly disposed of with respect to Section 817.95. The statutory authority for this Section is the same as that for 816.95 with the addition of Section 516 of the Act. Consideration of whether underground mines should be regulated differently than surface mines with respect to air pollution control is discussed in the preamble to 30 CFR 784.26. Fugitive dust control techniques are the same whether the dust originates from surface or underground mines and therefore Section 817.95 is identical to Section 816.95.

#### § 780.4 Responsibilities.

(a) It is the responsibility of the applicant to provide to the regulatory authority all of the information required by this Part, except where specifically exempted in this Part.

(b) It is the responsibility of State and Federal governmental agencies to provide information to the regulatory authority where specifically required in this Part.

#### § 780.11 Operation plan: General requirements.

Each application shall contain a description of the mining operations proposed to be conducted during the life of the mine within the proposed mine plan area, including, at a minimum, the following:

(a) A narrative description of the type and method of coal mining procedures and proposed engineering techniques, anticipated annual and total production of coal, by tonnage, and the major equipment to be used for all aspects of those operations; and

(b) A narrative explaining the construction, modification, use, maintenance, and removal of the following facilities (unless retention of such facilities is necessary for postmining land use as specified in Section 816.133):

- (1) Dams, embankments, and other impoundments;
- (2) Overburden and topsoil handling and storage areas and structures;
- (3) Coal removal, handling, storage, cleaning, and transportation areas and structures;
- (4) Spoil, coal processing waste, and non-coal waste removal, handling, storage, transportation, and disposal areas and structures;
- (5) Mine facilities; and
- (6) Water and air pollution control facilities.

#### § 780.12 Operation plan: Existing structures.

(a) Each application shall contain a description of each existing structure proposed to be used in connection with or to facilitate the surface coal mining and reclamation operation. The description shall include—

- (1) Location;
- (2) Plans of the structure which describe its current condition;
- (3) Approximate dates on which construction of the existing structure was begun and completed; and
- (4) A showing, including relevant monitoring data or other evidence, whether the structure meets the performance standards of Subchapter K (Permanent Program Standards) of this Chapter or, if the structure does not meet the performance standards of Subchapter K of this Chapter, a showing whether the structure meets the performance standards of Sub-

chapter B (Interim Program Standards) of this Chapter.

(b) Each application shall contain a compliance plan for each existing structure proposed to be modified or reconstructed for use in connection with or to facilitate the surface coal mining and reclamation operation. The compliance plan shall include—

(1) Design specifications for the modification or reconstruction of the structure to meet the design and performance standards of Subchapter K of this Chapter;

(2) A construction schedule which shows dates for beginning and completing interim steps and final reconstruction;

(3) Provisions for monitoring the structure during and after modification or reconstruction to ensure that the performance standards of Subchapter K of this Chapter are met; and

(4) A showing that the risk of harm to the environment or to public health or safety is not significant during the period of modification or reconstruction.

#### § 780.13 Operation plan: Blasting.

Each application shall contain a blasting plan for the proposed permit area, explaining how the applicant intends to comply with the requirements of 30 CFR 816.61-816.68 and including the following:

(a) Types and approximate amounts of explosives to be used for each type of blasting operation to be conducted;

(b) Description of procedures and plans for recording and retention of information on the following during blasting—

- (1) Drilling patterns, including size, number, depths, and spacing of holes;
- (2) Charge and packing of holes;
- (3) Types of fuses and detonation controls; and
- (4) Sequence and timing of firing holes.

(c) Description of blasting warning and site access control equipment and procedures;

(d) Description of types, capabilities, sensitivities, and locations of use of any blast monitoring equipment and procedures proposed to be used;

(e) Description of plans for recording and reporting to the regulatory authority the results of preblasting surveys, if required; and

(f) Description of unavoidable hazardous conditions for which deviations from the blasting schedule will be needed under 30 CFR 816.65(b).

#### § 780.14 Operation plan: Maps and plans.

Each application shall contain maps and plans of the proposed mine plan and adjacent areas as follows—

(a) The maps and plans shall show the lands proposed to be affected

throughout the operation and any change in a facility or feature to be caused by the proposed operations, if the facility or feature was shown under 30 CFR 779.24-779.25.

(b) The following shall be shown for the proposed permit area unless specifically required for the mine plan area or adjacent area by the requirements of this Section:

(1) Buildings, utility corridors and facilities to be used;

(2) The area of land to be affected within the proposed mine plan area, according to the sequence of mining and reclamation;

(3) Each area of land for which a performance bond or other equivalent guarantee will be posted under Subchapter J of this Chapter;

(4) Each coal storage, cleaning and loading area;

(5) Each topsoil, spoil, coal waste, and non-coal waste storage area;

(6) Each water diversion, collection, conveyance, treatment, storage, and discharge facility to be used;

(7) Each air pollution collection and control facility;

(8) Each source of waste and each waste disposal facility relating to coal processing or pollution control;

(9) Each facility to be used to protect and enhance fish and wildlife and related environmental values;

(10) Each explosive storage and handling facility; and

(11) Location of each sedimentation pond, permanent water impoundment, coal processing waste bank, and coal processing waste dam and embankment, in accordance with 30 CFR 780.25, and fill area for the disposal of excess spoil in accordance 30 CFR 780.35.

(c) Maps, plans, and cross-sections required under Paragraphs (b)(4), (5), (10), and (11) of this Section shall be prepared by, or under the direction of and certified by a qualified registered professional engineer, or professional geologist, with assistance from experts in related fields such as land surveying and landscape architecture, except that—

(1) Maps, plans and cross-sections for sedimentation ponds may only be prepared by a qualified registered professional engineer; and

(2) Spoil disposal facilities, maps, plans, and cross-sections may only be prepared by a qualified registered professional engineer.

#### § 780.15 Air pollution control plan.

(a) For all surface mining activities with projected production rates exceeding 1,000,000 tons of coal per year and located west of the 100th meridian west longitude, the application shall contain an air pollution control plan which includes the following:

dwelling as required in 30 CFR 761.12(e).

§ 782.17 Permit term information.

(a) Each application shall state the anticipated or actual starting and termination date of each phase of the underground mining activities and the anticipated number of acres of surface lands to be affected, and the horizontal and vertical extent of proposed underground mine workings, for each phase of mining and over the total life of the permit.

(b) If the applicant proposes to conduct the underground mining activities in excess of 5 years, the application shall contain the information needed for the showing required under 30 CFR 786.25(a).

§ 782.18 Personal injury and property damage insurance information.

Each application shall contain either a certificate of liability insurance or evidence that the self-insurance requirements in 30 CFR 806.14 are satisfied.

§ 782.19 Identification of other licenses and permits.

Each application shall contain a list of all other licenses and permits needed by the applicant to conduct the proposed underground mining activities. This list shall identify each license and permit by—

- (a) Type of permit or license;
- (b) Name and address of issuing authority;
- (c) Identification numbers of applications for those permits or licenses or, if issued, the identification numbers of the permits or licenses; and
- (d) If a decision has been made, the date of approval or disapproval by each issuing authority.

§ 782.20 Identification of location of public office for filing of application.

Each application shall identify, by name and address, the public office where the applicant will simultaneously file a copy of the application for public inspection under 30 CFR 786.11(d).

§ 782.21 Newspaper advertisement and proof of publication.

A copy of the newspaper advertisement of the application and proof of publication of the advertisement shall be filed with the regulatory authority and made a part of the complete application not later than 4 weeks after the last date of publication required under 30 CFR 786.11(a).

**PART 783—UNDERGROUND MINING PERMIT APPLICATIONS—MINIMUM REQUIREMENTS FOR INFORMATION ON ENVIRONMENTAL RESOURCES**

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- 783.27 Prime farmland investigation.

**AUTHORITY:** Secs. 102, 201, 501, 503, 504, 506, 507, 508, 509, 510, 511, 513, 514, 515, 516, 517, and 522, Pub. L. 95-87, 91 Stat. 445. (30 U.S.C. 1201, 1211, 1251, 1253, 1254, 1256, 1257, 1258, 1259, 1260, 1261, 1263, 1264, 1265, 1266, 1267, and 1272).

§ 783.1 Scope.

This Part establishes the minimum requirements for the Secretary's approval of regulatory program provisions for the environmental resources contents of applications for permits for underground mining activities.

§ 783.2 Objectives.

The objectives of this Part are to ensure that each application provides to the regulatory authority a complete and accurate description of the environmental resources that may be impacted or affected by proposed underground mining activities.

§ 783.4 Responsibilities.

(a) It is the responsibility of the applicant to provide, except where specifically exempted in this Part, all information required by this Part in the application.

(b) It is the responsibility of State and Federal Government agencies to provide information for applications as specifically required by this Part.

§ 783.11 General requirements.

Each permit application shall include a description of the existing, premining environmental resources within the proposed mine plan area and adjacent areas that may be affected or impacted by the proposed underground mining activities.

§ 783.12 General environmental resources information.

Each application shall describe and identify—

(a) The size, sequence, and timing of the subareas of the mine plan area for which it is anticipated that individual permits for mining will be requested over the estimated total life of the proposed underground mining activities; and

(b) The nature of cultural and historic resources listed or eligible for listing on the National Register of Historic Places and known archeological sites within the proposed mine plan and adjacent areas. The description shall be based on all available information, including, but not limited to, data of State and local archeological, historic, and cultural preservation agencies.

§ 783.13 Description of hydrology and geology: General requirements.

(a) Each application shall contain a description of the geology, hydrology, and water quality and quantity of all lands within the proposed mine plan area, the adjacent area, and the general area. The description shall include information on the characteristics of all surface and ground waters within the general area, and any water which will flow into or receive discharges of water from the general area. The description shall be prepared according to Sections 783.13-783.16 and conform to the following:

(1) Information on hydrology, water quality and quantity, and geology related to hydrology of areas outside the proposed mine plan area and within the general area shall be provided by the regulatory authority, to the extent that this data is available from an appropriate Federal or State agency.

(2) If this information is not available from those agencies, the applicant may gather and submit this information to the regulatory authority as part of the permit application.

(3) The permit shall not be approved by the regulatory authority until this information is made available in the application.

(b) The use of modeling techniques may be included as part of the permit application, but the same surface and ground water information may be required for each site as when models are not used.

§ 783.14 Geology description.

(a) The description shall include a general statement of the geology within the proposed mine plan area, down to and including the first aquifer to be affected below the lowest coal seam to be mined. The geology for areas proposed to be affected by surface operations and facilities, those surface lands overlying coal to be

that re-affecting the land in the future through surface coal mining operations is minimized.

**§ 816.61 Use of explosives: General requirements.**

(a) Each person who conducts surface mining activities shall comply with all applicable State and Federal laws in the use of explosives.

(b) Blasts that use more than 5 pounds of explosive or blasting agent shall be conducted according to the schedule required by Section 816.64.

(c) All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved. Each person responsible for blasting operations shall possess a valid certification as required by 30 CFR 850.

**§ 816.62 Use of explosives: Pre-blasting survey.**

(a) On the request to the regulatory authority by a resident or owner of a dwelling or structure that is located within one-half mile of any part of the permit area, the person who conducts the surface mining activities shall promptly conduct a pre-blasting survey of the dwelling or structure and promptly submit a report of the survey to the regulatory authority and to the person requesting the survey. If a structure is renovated or added to, subsequent to a pre-blast survey, then upon request to the regulatory authority a survey of such additions and renovations shall be performed in accordance with this Section.

(b) The survey shall determine the condition of the dwelling or structure and document any pre-blasting damage and other physical factors that could reasonably be affected by the blasting. Assessments of structures such as pipes, cables, transmission lines, and wells and other water systems shall be limited to surface condition and readily available data. Special attention shall be given to the pre-blasting condition of wells and other water systems used for human, animal, or agricultural purposes and to the quantity and quality of the water.

(c) A written report of the survey shall be prepared and signed by the person who conducted the survey. The report may include recommendations of any special conditions or proposed adjustments to the blasting procedure which should be incorporated into the blasting plan to prevent damage. Copies of the report shall be provided to the person requesting the survey and to the regulatory authority. If the person requesting the survey disagrees with the results of the survey, he or she may notify, in writing, both the permittee and the regulatory authority

of the specific areas of disagreement.

**§ 816.64 Use of explosives: Public notice of blasting schedule.**

*(a) Blasting schedule publication.*

(1) Each person who conducts surface mining activities shall publish a blasting schedule at least 10 days, but not more than 20 days, before beginning a blasting program in which blasts that use more than 5 pounds of explosive or blasting agent are detonated. The blasting schedule shall be published in a newspaper of general circulation in the locality of the blasting site.

(2) Copies of the schedule shall be distributed by mail to local governments and public utilities and by mail or delivered to each residence within one-half mile of the permit area described in the schedule. For the purposes of this Section, the permit area does not include haul or access roads, coal preparation and loading facilities, and transportation facilities between coal excavation areas and coal preparation or loading facilities, if blasting is not conducted in these areas. Copies sent to residences shall be accompanied by information advising the owner or resident how to request a pre-blasting survey.

(3) The person who conducts the surface mining activities shall republish and redistribute the schedule by mail at least every 12 months.

*(b) Blasting schedule contents.*

(1) A blasting schedule shall not be so general as to cover the entire permit area or all working hours, but shall identify as accurately as possible the location of the blasting sites and the time periods when blasting will occur.

(2) The blasting schedule shall contain at a minimum —

(i) Identification of the specific areas in which blasting will take place. Each specific blasting area described shall be reasonably compact and not larger than 300 acres;

(ii) Dates and time periods when explosives are to be detonated. These periods shall not exceed an aggregate of 4 hours in any one day;

(iii) Methods to be used to control access to the blasting area;

(iv) Types of audible warnings and all-clear signals to be used before and after blasting; and

(v) A description of unavoidable hazardous situations referred to in Section 816.65(b) which have been approved by the regulatory authority for blasting at times other than those described in the schedule.

*(c) Public notice of changes to blasting schedules.*

(1) Before blasting in areas or at times not in a previous schedule, the person who conducts the surface

mining activities shall prepare a revised blasting schedule according to the procedures in Paragraphs (a) and (b) of this Section. Where notice has previously been mailed to the owner or residents under Paragraph (a)(2) of this Section with advice on requesting a pre-blast survey, the notice of change need not include information regarding pre-blast surveys.

(2) If there is a substantial pattern of non-adherence to the published blasting schedule as evidenced by the absence of blasting during scheduled periods, the regulatory authority may require that the person who conducts the surface mining activities prepare a revised blasting schedule according to the procedures in Paragraph (c)(1) of this Section.

**§ 816.65 Use of explosives: Surface blasting requirements.**

(a) All blasting shall be conducted between sunrise and sunset.

(1) The regulatory authority may specify more restrictive time periods, based on public requests or other relevant information, according to the need to adequately protect the public from adverse noise.

(2) Blasting may, however, be conducted between sunset and sunrise if:

(i) a blast that has been prepared during the afternoon must be delayed due to the occurrence of an unavoidable hazardous condition and cannot be delayed until the next day because a potential safety hazard could result that cannot be adequately mitigated.

(ii) in addition to the required warning signals, oral notices are provided to persons within one-half mile of the blasting site; and

(iii) a complete written report of blasting at night is filed by the person conducting the surface mining activities with the regulatory authority not later than 3 days after the night blasting. The report shall include a description in detail of the reasons for the delay in blasting including why the blast could not be held over to the next day, when the blast was actually conducted, the warning notices given, and a copy of the blast report required by Section 816.68.

(b) Blasting shall be conducted at times announced in the blasting schedule, except in those unavoidable hazardous situations, previously approved by the regulatory authority in the permit application, where operator or public safety require unscheduled detonation.

(c) Warning and all-clear signals of different character that are audible within a range of one-half mile from the point of the blast shall be given. Each person within the permit area and each person who resides or regularly works within one-half mile of the permit area shall be notified of the

meaning of the signals through appropriate instructions. These instructions shall be periodically delivered or otherwise communicated in a manner which can be reasonably expected to inform such persons of the meaning of the signals. Each person who conducts surface mining activities shall maintain signs in accordance with Section 816.11(f).

(d) Access to an area possibly subject to flyrock from blasting shall be regulated to protect the public and livestock. Access to the area shall be controlled to prevent the presence of livestock or unauthorized personnel during blasting and until an authorized representative of the person who conducts the surface mining activities has reasonably determined—

(1) That no unusual circumstances, such as imminent slides or undetonated charges, exist; and

(2) That access to and travel in or through the area can be safely resumed

(e)(1) Airblast shall be controlled so that it does not exceed the values specified below at any dwelling, public building, school, church, or commercial or institutional structure, unless such structure is owned by the person who conducts the surface mining activities and is not leased to any other person. If a building owned by the person conducting surface mining activities is leased to another person, the lessee may sign a waiver relieving the operator from meeting the airblast limitations of this paragraph.

Lower frequency limit of measuring system, Hz (±3dB)	Maximum level in dB
0.1 Hz or lower — flat response.....	135 peak.
2 Hz or lower — flat response.....	132 peak.
6 Hz or lower — flat response.....	130 peak.
C-weighted, slow response .....	109 C.

(2) In all cases except the C-weighted, slow-response, the measuring systems used shall have a flat frequency response of at least 200 Hz at the upper end. The C-weighted shall be measured with a Type 1 sound level meter that meets the standard American National Standards Institute (ANSI) S1.4-1971 specifications. The ANSI S1.4-1971 is hereby incorporated by reference as it exists on the date of adoption of this Part. Notices of changes made to this publication will be periodically published by OSM in the FEDERAL REGISTER. ANSI S1.4-1971 is on file and available for inspection at the OSM Central Office, U.S. Department of the Interior, South Interior Building, Washington, D.C. 20240, at each OSM Regional Office, District Office, and Field Office and at the central office of any applicable State regulatory authority. Copies of this publication may also be obtained by

writing to the above locations. A copy of this publication will also be on file for public inspection at the FEDERAL REGISTER Library, 100 L Street N.W., Washington, D.C. Incorporation by reference provisions approved by the Director of the FEDERAL REGISTER February 7, 1979. The Director's approval of this incorporation by reference expires on February 7, 1980.

(3) The person who conducts blasting may satisfy the provisions of this Section by meeting any of the four specifications in the chart in paragraph (e)(1) of this Section.

(4) The regulatory authority may require an airblast measurement of any or all blasts, and may specify the location of such measurements.

(f) Except where lesser distances are approved by the regulatory authority, based upon a pre-blasting survey, seismic investigation, or other appropriate investigation, blasting shall not be conducted within—

(1) 1,000 feet of any building used as a dwelling, school, church, hospital, or nursing facility; and

(2) 500 feet of facilities including, but not limited to, disposal wells, petroleum or gas-storage facilities, municipal water-storage facilities, fluid-transmission pipelines, gas or oil-collection lines, or water and sewage lines.

(g) Flyrock, including blasted material traveling along the ground, shall not be cast from the blasting vicinity more than half the distance to the nearest dwelling or other occupied structure and in no case beyond the line of property owned or leased by the permittee, or beyond the area of regulated access required under paragraph (d) of this Section.

(h) 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 ground or surface waters outside the permit area.

(i) In all blasting operations, except as otherwise authorized in this Section, the maximum peak particle velocity shall not exceed 1 inch per second at the location of any dwelling, public building, school, church, or commercial or institutional building. Peak particle velocities shall be recorded in 3 mutually perpendicular directions. The maximum peak particle velocity shall be the largest of any of the three measurements. The regulatory authority may reduce the maximum peak particle velocity allowed, if it determines that a lower standard is required because of density of population or land use, age or type of structure, geology or hydrology of the area, frequency of blasts, or other factors.

(j) If blasting is conducted to prevent adverse impacts on any underground mine and changes in the course, channel, or availability of ground or surface water outside the permit area, then the maximum peak particle velocity limitation of paragraph (i) of this Section shall not apply at the following locations:

(1) At structures owned by the person conducting the mining activity, and not leased to another party; and

(2) At structures owned by the person conducting the mining activity, and leased to another party, if a written waiver by the lessee is submitted to the regulatory authority prior to blasting.

(k) An equation for determining the maximum weight of explosives that can be detonated within any 8-millisecond period is in Paragraph (1) of this Section. If the blasting is conducted in accordance with this equation, the peak particle velocity shall be deemed to be within the 1-inch-per-second limit.

(1) The maximum weight of explosives to be detonated within any 8-millisecond period may be determined by the formula  $W = (D/60)^2$  where  $W$  = the maximum weight of explosives, in pounds, that can be detonated in any 8-millisecond period, and  $D$  = the distance, in feet, from the blast to the nearest dwelling, school, church, or commercial or institutional building.

(2) For distances between 300 and 5,000 feet, solution of the equation results in the following maximum weight:

Distance, in feet (D)	Maximum weight in pounds (W)
300	25
350	34
400	44
500	69
600	100
700	136
800	178
900	225
1,000	278
1,100	336
1,200	400
1,300	469
1,400	544
1,500	625
1,600	711
1,700	803
1,800	900
1,900	1,002
2,000	1,111
2,500	1,736
3,000	2,500
3,500	3,403
4,000	4,444
4,500	5,625
5,000	6,944

§ 816.67 Use of explosives: Seismographic measurements.

(a) Where a seismograph is used to monitor the velocity of ground motion and the peak particle velocity limit of 1 inch per second is not exceeded, the

equation in Section 816.65(1) need not be used. If that equation is not used by the person conducting the surface mining activities, a seismograph record shall be obtained for each shot.

(b) The use of a modified equation to determine maximum weight of explosives per delay for blasting operations at a particular site, may be approved by the regulatory authority, on receipt of a petition accompanied by reports including seismograph records of test blasting on the site. In no case shall the regulatory authority approve the use of a modified equation where the peak particle velocity of 1 inch per second required in Section 816.65(i) would be exceeded.

(c) The regulatory authority may require a seismograph record of any or all blasts and may specify the location at which such measurements are taken.

**§ 816.68 Use of explosives: Records of blasting operations.**

A record of each blast, including seismograph reports, shall be retained for at least 3 years and shall be available for inspection by the regulatory authority and the public on request. The record shall contain the following data:

(a) Name of the operator conducting the blast.

(b) Location, date, and time of blast.

(c) Name, signature, and license number of blaster-in-charge.

(d) Direction and distance, in feet, to the nearest dwelling, school, church, or commercial or insitutional building either —

(1) Not located in the permit area; or

(2) Not owned nor leased by the person who conducts the surface mining activities.

(e) Weather conditions, including temperature, wind direction, and approximate velocity.

(f) Type of material blasted.

(g) Number of holes, burden, and spacing.

(h) Diameter and depth of holes.

(i) Types of explosives used.

(j) Total weight of explosives used.

(k) Maximum weight of explosives detonated within any 8-millisecond period.

(l) Maximum number of holes detonated within any 8-millisecond period.

(m) Initiation system.

(n) Type and length of stemming.

(o) Mats or other protections used.

(p) Type of delay detonator and delay periods used.

(q) Sketch of the delay pattern.

(r) Number of persons in the blasting crew.

(s) Seismographic records, where required, including the calibration signal of the gain setting and —

(1) Seismographic reading, including exact location of seismograph and its distance from the blast;

(2) Name of the person taking the seismograph reading; and

(3) Name of the person and firm analyzing the seismographic record.

**§ 816.71 Disposal of excess spoil: General requirements.**

(a) Spoil not required to achieve the approximate original contour within the area where overburden has been removed shall be hauled or conveyed to and placed in designated disposal areas within a permit area, if the disposal areas are authorized for such purposes in the approved permit application in accordance with Sections 816.71-816.74. The spoil shall be placed in a controlled manner to ensure—

(1) That leachate and surface runoff from the fill will not degrade surface or ground waters or exceed the effluent limitations of Section 816.42;

(2) Stability of the fill; and

(3) That the land mass designated as the disposal area is suitable for reclamation and revegetation compatible with the natural surroundings.

(b) The fill shall be designed using recognized professional standards, certified by a registered professional engineer, and approved by the regulatory authority.

(c) All vegetative and organic materials shall be removed from the disposal area and the topsoil shall be removed, segregated, and stored or replaced under Sections 816.21-816.25. If approved by the regulatory authority, organic material may be used as mulch or may be included in the topsoil to control erosion, promote growth of vegetation, or increase the moisture retention of the soil.

(d) Slope protection shall be provided to minimize surface erosion at the site. Diversion design shall conform with the requirements of Section 816.43. All disturbed areas, including diversion ditches that are not ripped, shall be vegetated upon completion of construction.

(e) The disposal areas shall be located on the most moderately sloping and naturally stable areas available as approved by the regulatory authority. If such placement provides additional stability and prevents mass movement, fill materials suitable for disposal shall be placed upon or above a natural terrace, bench, or berm.

(f) The spoil shall be hauled or conveyed and placed in horizontal lifts in a controlled manner, concurrently compacted as necessary to ensure mass stability and prevent mass movement, covered, and graded to allow surface and subsurface drainage to be compatible with the natural surroundings and ensure a long-term static safety factor of 1.5.

(g) The final configuration of the fill must be suitable for postmining land uses approved in accordance with Section 816.133, except that no depressions or impoundments shall be allowed on the completed fill.

(h) Terraces may be utilized to control erosion and enhance stability if approved by the regulatory authority and consistent with Section 816.102(b).

(i) Where the slope in the disposal area exceeds 1v:2.8h (36 percent), or such lesser slope as may be designated by the regulatory authority based on local conditions, keyway cuts (excavations to stable bedrock) or rock toe buttresses shall be constructed to stabilize the fill. Where the toe of the spoil rests on a downslope, stability analyses shall be performed in accordance with Section 780.35(c) to determine the size of rock toe buttresses and key way cuts.

(j) The fill shall be inspected for stability by a registered engineer or other qualified professional specialist experienced in the construction of earth and rockfill embankments at least quarterly throughout construction and during the following critical construction periods: (1) removal of all organic material and topsoil, (2) placement of underdrainage systems, (3) installation of surface drainage systems, (4) placement and compaction of fill materials, and (5) revegetation. The registered engineer or other qualified professional specialist shall provide to the regulatory authority a certified report within 2 weeks after each inspection that the fill has been constructed as specified in the design approved by the regulatory authority. A copy of the report shall be retained at the minesite.

(k) Coal processing wastes shall not be disposed of in head-of-hollow or valley fills, and may only be disposed of in other excess spoil fills, if such waste is —

(1) Placed in accordance with Section 816.85;

(2) Demonstrated to be nontoxic and nonacid forming; and

(3) Demonstrated to be consistent with the design stability of the fill.

(l) If the disposal area contains springs, natural or manmade watercourses, or wet-weather seeps, an underdrain system consisting of durable rock shall be constructed from the wet areas in a manner that prevents infiltration of the water into the spoil material. The underdrain system shall be protected by an adequate filter and shall be designed and constructed using standard geotechnical engineering methods.

(m) The foundation and abutments of the fill shall be stable under all conditions of construction and operation. Sufficient foundation investigation and laboratory testing of foundation

ity and quantity of runoff without treatment is consistent with the requirement of this Part to minimize disturbance to the prevailing hydrologic balance and to attain the approved postmining land use. These data may also provide a basis for approval by the regulatory authority for removal of water quality or flow control systems.

(3) Equipment, structures, and other devices necessary to measure and sample accurately the quality and quantity of surface water discharges from the surface disturbed area and from underground mine workings shall be properly installed, maintained, and operated and shall be removed when no longer required.

**§ 817.53 Hydrologic balance: Transfer of wells.**

(a) An exploratory or monitoring well may only be transferred by the person who conducts underground mining activities for further use as a water well with the prior approval of the regulatory authority. That person and the surface owner of the lands where the well is located shall jointly submit a written request to the regulatory authority for that approval.

(b) Upon an approved transfer of a well, the transferee shall—

(1) Assume primary liability for damages to persons or property from the well;

(2) Plug the well when necessary, but in no case later than abandonment of the well; and

(3) Assume primary responsibility for compliance with Sections 817.13-817.15 with respect to the well.

(c) Upon an approved transfer of a well, the transferor shall be secondarily liable for the transferee's obligations under Paragraph (b) of this Section, until release of the bond or other equivalent guarantee required by Subchapter J for the area in which the well is located.

**§ 817.54 Hydrologic balance: Water rights and replacement.**

Any person who conducts underground mining activities shall replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where the water supply has been affected by contamination, diminution, or interruption proximately resulting from the underground mining activities.

**§ 817.55 Hydrologic balance: Discharge of water into an underground mine.**

Water from the surface or from an underground mine shall not be diverted or discharged into other underground mine workings, unless the

person who conducts the underground mining activities demonstrates to the regulatory authority that the discharge will—

(a) Abate water pollution or otherwise eliminate public hazards resulting from underground mining activities;

(b) Be discharged as a controlled flow;

(c) Meets the effluent limitations of Section 817.42 for pH and total suspended solids, except that the pH and total suspended solid limitations may be exceeded, if approved by the regulatory authority and is limited to—

(1) Coal processing waste;

(2) Underground mine development waste;

(3) Fly ash from a coal-fired facility;

(4) Sludge from an acid mine drainage treatment facility;

(5) Flue gas desulfurization sludge; or

(6) Inert materials used for stabilizing underground mines;

(d) Continue as a controlled and identifiable flow and is ultimately treated by an existing treatment facility;

(e) In any event, the discharge from underground mines to surface waters will not cause, result in, or contribute to a violation of applicable water quality standards or effluent limitations;

(f) Minimizes disturbance to the hydrologic balance; and

(g) Meets with the approval of the Mine Safety and Health Administration.

**§ 817.56 Hydrologic balance: Postmining rehabilitation of sedimentation ponds, diversions, impoundments, and treatment facilities.**

Before abandoning the permit area, the person who conducts the underground mining activities shall renovate all permanent sedimentation ponds, diversions, impoundments and treatment facilities to meet criteria specified in the detailed design plan for the permanent structures and impoundments.

**§ 817.57 Hydrologic balance: Stream buffer zones.**

(a) No surface area within 100 feet of a perennial stream or a stream with a biological community determined according to Paragraph (c) below shall be disturbed by surface operations and facilities, except in accordance with Sections 817.43-817.44, unless the regulatory authority specifically authorizes underground mining activities closer to or through such a stream upon finding—

(1) That the original stream channel will be restored; and

(2) During and after the mining, the water quantity and quality from the stream section within 100 feet of the

underground mining activities shall not be adversely affected.

(b) The area not to be disturbed shall be designated a buffer zone and marked as specified in Section 817.11.

(c) A stream with a biological community shall be determined by the existence in the stream at any time of an assemblage of two or more species of arthropods or molluscan animals which are—

(1) Adapted to flowing water for all or part of their life cycle;

(2) Dependent upon a flowing water habitat;

(3) Reproducing or can reasonably be expected to reproduce in the water body where they are found; and

(4) Longer than 2 millimeters at some stage or part of their life cycle spent in the flowing water habitat.

**§ 817.59 Coal recovery.**

Underground mining activities shall be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best technology currently available to maintain environmental integrity, so that reffecting the land in the future through surface coal mining operations is minimized.

**§ 817.61 Use of explosives: General requirements.**

(a) Sections 817.61 through 817.68 apply only to surface blasting activities incident to underground mining, including, but not limited to, initial rounds of slopes and shafts.

(b) Each person who conducts underground mining activities shall comply with all applicable State and Federal laws and in the use of explosives.

(c) All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved. Each person responsible for blasting operations shall possess a valid certification as required by 30 CFR 850.

**§ 817.62 Use of explosives: Preblasting survey.**

(a) On the request to the regulatory authority by a resident or owner of a dwelling or structure that is located within one-half mile of any surface blasting activity covered by Sections 817.61-817.68, the person who conducts the underground mining activities shall promptly conduct a pre-blasting survey of the dwelling or structure and promptly submit a report of the survey to the regulatory authority and to the person requesting the survey. If a structure is renovated or added to, subsequent to a preblast survey, then upon request to the regulatory authority a survey of such additions and renovations shall be performed in accordance with this Section.

(b) The survey shall determine the condition of the dwelling or structure and document any preblasting damage and other physical factors that could reasonably be affected by the blasting. Assessments of structures such as pipes, cables, transmission lines, and wells and other water systems shall be limited to surface condition and readily available data. Special attention shall be given to the preblasting condition of wells and other water systems used for human, animal, or agricultural purposes and to the quantity and quality of the water.

(c) A written report of the survey shall be prepared and signed by the person who conducted the survey. The report may include recommendations of any special conditions or proposed adjustments to the blasting procedure which should be incorporated into the blasting plan to prevent damage. Copies of the report shall be provided to the person requesting the survey and to the regulatory authority. If the person requesting the survey disagrees with the results of the survey, he or she may notify, in writing, both the permittee and the regulatory authority of the specific areas of disagreement.

**§ 817.65 Use of explosives: Surface blasting requirements.**

(a) A resident or owner of a dwelling or structure that is located within one-half mile of any area affected by surface blasting activities shall be notified approximately 24 hours prior to any surface blasting event.

(b) All blasting shall be conducted between sunrise and sunset.

(1) The regulatory authority may specify more restrictive time periods, based on public requests or other relevant information according to the need to adequately protect the public from adverse noise.

(2) Blasting may, however, be conducted between sunset and sunrise if:

(i) a blast that has been prepared during the afternoon must be delayed due to the occurrence of an unavoidable hazardous condition and cannot be delayed until the next day because a potential safety hazard would result that cannot be adequately mitigated;

(ii) in addition to the required warning signals, oral notices are provided to persons within one-half mile of the blasting site; and

(iii) a complete written report of blasting at night is filed by the person conducting the surface blasting activities with the regulatory authority not later than 3 days after the night blasting. The report shall include a description in detail of the reason for the delay in blasting including why the blasting could not be held over to the next day, when the blast was actually conducted, the warning notices given,

and a copy of the blast report required by Section 817.68.

(c) Warning and all-clear signals of different character that are audible within a range of one-half mile from the point of the blast shall be given. Each person within the permit area and each person who resides or regularly works within one-half mile of the permit area shall be notified of the meaning of the signals through appropriate instructions. These instructions shall be periodically delivered or otherwise communicated in a manner which can reasonably be expected to inform such persons of the meaning of the signals. Each person who conducts surface blasting incident to underground mining activities shall maintain signs in accordance with Section 817.11(f).

(d) Access to an area possibly subject to flyrock from blasting shall be regulated to protect the public and livestock. Access to the area shall be controlled to prevent the presence of livestock or unauthorized personnel during blasting until an authorized representative of the person who conducts the underground mining activities has reasonably determined —

(1) That no unusual circumstances, such as imminent slides or undetonated charges, exist; and

(2) That access to and travel in or through the area can be safely resumed.

(e) (1) Airblast shall be controlled so that it does not exceed the values specified below at any dwelling, public building, school, church, or commercial or institutional building, unless such structure is owned or leased by the person who conducts the underground mining activities and is not leased to any other person. If a building owned by the person conducting the underground mining activities is leased to another person, the lessee may sign a waiver relieving the operator from meeting the airblast limitations of this paragraph.

Lower Frequency Limit of Measuring System, Hz (± 3 dB)	Maximum Level in dB
0.1 Hz or lower — flat response.....	135 peak.
2 Hz or lower — flat response.....	132 peak.
6 Hz or lower — flat response.....	130 peak.
C-weighted, slow response .....	109°C.

(2) In all cases except the C-weighted, slow response, the measuring systems used must have a flat frequency response of at least 200 Hz at the upper end. The C-weighted shall be measured with a Type 1 sound level meter that meets the standard ANSI S1.4-1971 specifications.

The ANSI S1.4-1971 is hereby incorporated by reference as it exists on the date of adoption of this Part. Notices of changes made to this publication will be periodically published by OSM in

the FEDERAL REGISTER. ANSI S1.4-1971 is on file and available for inspection at the OSM Central Office, U.S. Department of the Interior, South Interior Building, Washington, D.C. 20240, at each OSM Regional Office, District Office, and Field Office and at the central office of any applicable State regulatory authority. Copies of this publication may also be obtained by writing to the above locations. A copy of this publication will also be on file for public inspection at the FEDERAL REGISTER Library, 1100 'L' St., N.W., Washington, D.C. Incorporation by reference provisions approved by the FEDERAL REGISTER February 7, 1979. The Director's approval of this incorporation by reference expires on February 7, 1980.

(3) The person who conducts blasting may satisfy the provisions of this Section by meeting any one of the four specifications in the chart in paragraph (e)(1) of this Section.

(4) The regulatory authority may require an airblast measurement of any or all blasts, and may specify the location of such measurements.

(f) Except where lesser distances are approved by the regulatory authority based upon a preblasting survey, seismic investigations, or other appropriate investigations, blasting shall not be conducted within —

(1) 1,000 feet of any building used as a dwelling, school, church, hospital, or nursing facility; and

(2) 500 feet of facilities including, but not limited to, disposal wells, petroleum or gas-storage facilities, municipal water-storage facilities, fluid-transmission pipelines, gas or oil-collection lines, or water and sewage lines.

(g) Flyrock, including blasted material traveling along the ground, shall not be cast from the blasting vicinity more than half the distance to the nearest dwelling or other occupied structure and in no case beyond the line of property owned or leased by the permittee, or beyond the area of regulated access required under paragraph (d) of this Section.

(h) 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 ground or surface waters outside the permit area.

(i) In all blasting operations, except as otherwise authorized in this Section, the maximum peak particle velocity shall not exceed 1 inch per second at the location of any dwelling, public building, school, church, or commercial or institutional building. Peak particle velocities shall be recorded in 3 mutually perpendicular directions. The maximum peak particle

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velocity shall be the largest of any of the three measurements. The regulatory authority may reduce the maximum peak particle velocity allowed, if it determines that a lower standard is required because of density of population or land use, age or type of structure, geology or hydrology of the area, frequency of blasts, or other factors.

(j) If blasting is conducted to prevent adverse impacts on any underground mine and changes in the course, channel, or availability of ground or surface water outside the permit area, then the maximum peak particle velocity limitation of Paragraph (i) of this Section shall not apply at the following locations.

(1) At structures owned by the person conducting the mining activity, and not leased to another party.

(2) At structures owned by the person conducting the mining activity, and leased to another party, if a written waiver by the lessee is submitted to the regulatory authority prior to blasting.

(k) An equation for determining the maximum weight of explosives that can be detonated within any 8-millisecond period is in Paragraph (l) of this Section. If the blasting is conducted in accordance with this equation, the peak particle velocity shall be deemed to be within the 1-inch-per-second limit.

(l)(1) The maximum weight of explosives to be detonated within any 8-millisecond period may be determined by the formula  $W = (D/60)^2$  where  $W$  = the maximum weight of explosives, in pounds, that can be detonated in any 8-millisecond period, and  $D$  = the distance, in feet, from the blast to the nearest dwelling, school, church, or commercial or institutional building.

(2) For distances between 300 and 5,000 feet, solution of the equation results in the following maximum weight:

Distance, in feet (D):	Max. weight, in pounds (W)
300	25
350	34
400	44
500	69
600	100
700	136
800	178
900	225
1,000	278
1,100	336
1,200	400
1,300	469
1,400	544
1,500	625
1,600	711
1,700	803
1,800	900
1,900	1,002
2,000	1,111
2,500	1,736
3,000	2,500
3,500	3,403

Distance, in feet (D):	Max. weight, in pounds (W)
4,000	4,444
4,500	5,625
5,000	6,944

**§ 817.67 Use of explosives: Seismographic measurements.**

(a) Where a seismograph is used to monitor the velocity of ground motion and the peak particle velocity limit of 1 inch per second is not exceeded, the equation in Section 817.65(l) need not be used. If that equation is not used by the person conducting underground mining activities, a seismographic record shall be obtained for each shot.

(b) The use of a modified equation from that specified in Section 817.65(l), to determine maximum weight of explosives per delay for blasting operations at a particular site, may be approved by the regulatory authority, on receipt of a petition accompanied by reports including seismograph records of test blasting on the site. In no case shall the regulatory authority approve the use of a modified equation where the peak particle velocity of 1 inch per second required in Section 817.65(i) would be exceeded.

(c) The regulatory authority may require a seismograph record of any or all blasts and may specify the location at which such measurements are taken.

**§ 817.68 Use of explosives: Records of blasting operations.**

A record of each blast, including seismograph reports, shall be retained for at least 3 years and shall be available for inspection by the regulatory authority and the public on request. The record shall contain the following data:

(a) Name of the operator conducting the blast.

(b) Location, date, and time of blast.

(c) Name, signature, and license number of blaster-in-charge.

(d) Direction and distance, in feet, to the nearest dwelling, school, church, or commercial or institutional building either—

(1) Not located in the permit area; or

(2) Not owned nor leased by the person who conducts the underground mining activities.

(e) Weather conditions, including temperature, wind direction, and approximate velocity.

(f) Type of material blasted.

(g) Number of holes, burden, and spacing.

(h) Diameter and depth of holes.

(i) Types of explosives used.

(j) Total weight of explosives used.

(k) Maximum weight of explosives detonated within any 8-millisecond period.

(l) Maximum number of holes detonated within any 8-millisecond period.

(m) Initiation system.

(n) Type and length of stemming.

(o) Mats or other protections used.

(p) Type of delay detonator and delay periods used.

(q) Sketch of the delay pattern.

(r) Number of persons in the blasting crew.

(s) Seismographic records, where required, including the calibration signal of the gain setting and —

(1) Seismograph reading, including exact location of seismograph and its distance from the blast;

(2) Name of the person taking the seismograph reading; and

(3) Name of person and firm analyzing the seismograph record.

**§ 817.71 Disposal of underground development waste and excess spoil: General requirements.**

(a) Underground development waste and spoil not required to achieve the approximate original contour and which is not used as backfill shall be hauled or conveyed to and placed in designated disposal areas within a permit area if the disposal areas are authorized for such purposes in the approved permit application in accordance with Sections 817.71-817.74. The material shall be placed in a controlled manner to ensure—

(1) That leachate and surface runoff from the fill will not degrade surface or ground waters or exceed the effluent limitations of Section 817.42;

(2) Stability of the fill; and

(3) That the land mass designated as the disposal area is suitable for reclamation and revegetation compatible with the natural surroundings.

(b) The fill shall be designed using recognized professional standards, certified by a registered professional engineer, and approved by the regulatory authority.

(c) All vegetative and organic materials shall be removed from the disposal area and the topsoil shall be removed, segregated and stored or replaced in accordance with Sections 817.21-817.25. If approved by the regulatory authority, organic material may be used as mulch or may be included in the topsoil to control erosion, promote growth of vegetation, or increase the moisture retention of the soil.

(d) Slope protection shall be provided to minimize surface erosion at the site. Diversion design shall conform with the requirements of Section 816.43. All disturbed areas, including diversion ditches that are not ripped, shall be vegetated upon completion of construction.