The meeting will be held in the Board Room on the sixth floor of the FDIC Building located at 550—17th Street, NW., Washington, DC.

Requests for further information concerning the meeting may be directed to Mr. John M. Buckley, Jr., Executive Secretary of the Resolution Trust Corporation, at (202) 416–7282.

Dated: July 17, 1990.

Resolution Trust Corporation.

John M. Buckley, Jr.,

Executive Secretary.

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Friday,
July 20, 1990

Part II

Department of Labor

Occupational Safety and Health Administration

29 CFR Parts 1910 and 1926
Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Proposed Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Parts 1910 and 1926

[Docket Number H-033-e]

RIN 1218-AB25

Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite

AGENCY: Occupational Safety and Health Administration, Department of Labor.

ACTION: Notice of proposed rulemaking and notice of hearing.

SUMMARY: The Occupational Safety and Health Administration (OSHA) is conducting supplemental rulemaking on its standards issued June 17, 1986 (51 FR 22612, June 20, 1986) for occupational exposure to asbestos, tremolite, anthophyllite and actinolite in general industry, 29 CFR 1910.1001, and in the construction industry, 29 CFR 1926.58. These standards revised the 1972 asbestos standard, reduced the permissible exposure limit (PEL) from 2.0 to 0.2 fibers per cubic centimeter (f/cc) time-weighted average (TWA) and updated other requirements. On February 2, 1988 the United States Court of Appeals for the District of Columbia Circuit upheld most aspects of the standard but remanded the case to OSHA on several issues, *Building and Construction Trades Department* v. *Brock*, 838 F. 2d 1258, (DC Cir 1988). As a part of its response to this decision, on September 14, 1988, OSHA issued a short term excursion limit (STEL) for asbestos of 1.0 f/cc averaged over a 30 minute sampling period (53 FR 35610).

In June and July 1989, the Building and Construction Trades Department (BCTD) of the AFL-CIO and the AFL-CIO petitioned the Court to order OSHA to resolve all remand issues on the record of the 1986 rulemaking proceeding. The Court, on October 30, 1989, ordered OSHA to take action on three of the remand issues by December 14, 1989, three other issues by January 28, 1990, and the remaining issues by February 27, 1990. OSHA issued its response on the first three remand issues on December 14, 1989 (54 FR 52024, December 20, 1989). These included: Removing the ban on spraying of asbestos containing materials; changing the regulatory text to clarify when construction employers must resume periodic monitoring; and explaining that the clarification of the exemption for "small-scale, short-duration" operations in the construction industry will require OSHA to institute rulemaking.

OSHA published its resolution of three additional issues on February 5, 1990 (55 FR 3724). These included: Expanding its ban on workplace smoking and adding training requirements covering the availability of smoking control programs; explaining how and why OSHA's respiratory requirements will result in risk being reduced below that remaining at the PEL; adding a requirement that employers assure that employees working in or contiguous to regulated areas comprehend required warning signs and labels.

OSHA has determined that four remanded issues cannot be resolved on the existing record and that their resolution will require new rulemaking. These issues which are addressed in this proposal are: The establishment of operation-specific permissible exposure limits; the extension of reporting and information transfer requirements; the expansion of the competent person requirement to all workers engaged in any kind of construction work; and the clarification of the exemption for "small-scale, short duration operations" which was deferred from the Agency's December 20, 1989 response (54 FR 52024).

OSHA is proposing the following regulatory approaches to resolve these issues: Lowering the PEL to 0.1 f/cc for all employees, specifying work practices to reduce exposures in brake and clutch repair and service; requiring additional communication of asbestos hazards among building owners, employers and employees and requiring notification of OSHA prior to removal, demolition, or renovation operations; requiring oversight of all construction operations by a competent person and of small-scale, short duration operations by a specifically trained competent person; and more explicitly defining the small-scale, short duration and other exemptions from the negative-pressure enclosure requirement.

DATES: Comments concerning this notice and notices of intention to appear at the public hearing must be postmarked on or before September 25, 1990. Parties requesting more than 10 minutes for their presentation at the hearing, and parties planning to present documentary evidence at the hearing must submit the full text of their testimony and all documentary evidence not later than September 25, 1990. The hearing will take place in Washington, DC and will begin at 9:30 a.m. on October 23, 1990.

ADDRESSES: Comments should be submitted in quadruplicate to the docket Officer, Docket H-033-e, Occupational Safety and Health Administration, 200 Constitution Avenue NW., room N2625, Washington, DC 20210; telephone (202)-523-7894.

Notices of intention to appear at the hearing, testimony, and documentary evidence should be submitted in quadruplicate to Mr. Tom Hall, Division of Consumer Affairs, Docket H-033-e, Occupational Safety and Health Administration, 200 Constitution Avenue NW., room N3647, Washington, DC 20210; telephone (202)-523-8615.

All written materials received and notices of intention to appear will be available for inspection and copying in the Docket Office, room N2625 at the above address.

The informal public hearing will begin at 9:30 a.m. on October 23, 1990 at the following location: Auditorium, U.S. Department of Labor, Frances Perkins Building, 200 Constitution Avenue NW., Washington, DC 20210.

Submission of Comments to the Docket: OSHA has established Docket H-033 for asbestos rulemaking evidence. Although the final decisions regarding the issues considered in this rulemaking will be based on the entire H-033 docket, OSHA has established a subcategory, H-033-e for purposes of referencing evidence specifically related to this proceeding on certain rulemaking issues remanded for reconsideration. The list of asbestos rulemaking subcategories is as follows:

H-033a	1972 Rulemaking
H-033b	1975 Rulemaking
H-033c	1986 Rulemaking
H-033d	Non-asbestiform minerals issues
H-033e	Court remand issues.

FOR FURTHER INFORMATION CONTACT: James F. Foster, Director of Information and Consumer Affairs, Occupational Safety and Health Administration, U.S. Department of Labor, room N3649, 200 Constitution Avenue, NW., Washington, DC 20210.

SUPPLEMENTARY INFORMATION:

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I. Regulatory History

On June 17, 1986, OSHA issued revised standards governing occupational exposure to asbestos,

tremolite, anthophyllite and actinolite for general industry and construction (51 FR 22612 et seq., June 20, 1986). Effective July 21, 1986, the revised standards amended OSHA's previous asbestos standard issued in 1972.

On October 17, 1986, OSHA published a partial stay of the revised standards insofar as they apply to occupational exposure to non-asbestiform tremolite, anthophyllite and actinolite (51 FR 37002), which were included in the scope of the 1986 standards. The stay has been extended to November 30, 1990 (see 54 FR 30704), to enable OSHA to complete rulemaking on these non-asbestiform minerals. The partial stay continues to apply to the 1986 standards and all amendments thereto, including the amendments proposed in this notice. On February 12, 1990 (55 FR 4938) OSHA published a Notice of Proposed Rulemaking in which OSHA proposed to delete non-asbestiform tremolite, anthophyllite and actinolite from the scope of the asbestos standard and is considering alternative approaches to regulation of these non-asbestiform minerals. OSHA is not considering in this proceeding the issues of economic and/or technical feasibility of these proposed revisions as they would apply to industries using non-asbestiform minerals. Extension of these revisions to non-asbestiform minerals would require determination of these issues in a further proceeding. Therefore OSHA does not intend to apply the proposed revisions to the asbestos standards to the regulation of the non-asbestiform minerals at the end of this proceeding.

In the proposed regulatory text to the asbestos standards, OSHA is treating the referencing of the non-asbestiform minerals in two ways. One, it is excluding them from the text of the provisions reducing the TWA PEL; and from new provisions for which there are not now counterparts, such as requiring notification to OSHA for large-scale construction projects, and mandatory work practices for brake repair in the general industry. Two, it is continuing to reference the non-asbestiform minerals in the regulatory text of provisions which are revised versions of current provisions which include specific mention of non-asbestiform minerals. The reason for the continued reference in the revised provisions is to avoid confusion if OSHA presented both the old and new text, each version applicable to separate minerals. At the conclusion of the separate rulemaking relating to regulation of these non-asbestiform minerals (Docket H-033d), OSHA will make appropriate changes in the entire regulatory text of the revised asbestos standards to reflect the outcome of that proceeding and thus to remove reference of the non-asbestiforms, if appropriate.

Separate comprehensive standards for general industry and construction were issued in 1986 which shared the same permissible exposure limit (PEL) and most ancillary requirements. The standards reduced the 8-hour time weighted average (TWA) PEL tenfold to 0.2 f/cc from the previous 2 f/cc limit. Specific provisions were added in the construction standard to cover unique hazards relating to asbestos abatement and demolition jobs.

Several major participants in the rulemaking proceeding including the AFL-CIO, the Building and Construction Trades Department (BCTD) of the AFL-CIO, and the Asbestos Information Association (AIA), challenged various provisions of the revised standards. On February 2, 1988, the U.S. Court of Appeals for the District of Columbia issued its decision upholding most major challenged provisions, but remanding certain issues to OSHA for reconsideration (*BCTD, AFL-CIO* v. *Brock*, 838 F.2d 1258). The Court held that where rulemaking participants had recommended regulatory provisions which, on the record, appeared to be feasible and to confer more than a *de minimis* benefit in reducing significant risk, OSHA must either adopt them, refute the evidence of feasibility or benefit, or more persuasively explain why OSHA did not adopt the provisions. The Court also ordered OSHA to clarify the regulatory text for two provisions and found one provision, a ban of spraying asbestos-containing products, unsupported by the record. In addition, OSHA's failure to adopt a short-term exposure limit (STEL) was ordered to be reconsidered within 60 days of the Court's mandate. In partial response, OSHA issued a STEL of 1 f/cc measured over a 30-minute sampling period, on September 14, 1988 (53 FR 35610).

On June 10 and July 18, 1989, BCTD and the AFL-CIO petitioned the Court to enforce its remand order by ordering OSHA to resolve all remand issues on the record of the 1986 rulemaking proceeding within 7 to 60 days. The Court, in an October 30, 1989 order, divided the remand issues into three categories as follows. With respect to three issues, the Court ordered OSHA to take action by December 14, 1989. These issues were:

Issue 1. Formally delete the ban on the spraying of asbestos-containing materials;

Issue 2. Clarify that periodic monitoring in the construction industry must be resumed after conditions change; and

Issue 3. Clarify the exemption for "small-scale, short duration operations" from the negative-pressure enclosure requirements of the construction standard to limit the exemption to work operations where it is impractical to construct an enclosure because of the configuration of the work environment.

OSHA issued its response on these issues on December 14, 1989 (54 FR 52024, December 20, 1989). In that document OSHA (1) removed the ban on the spraying of asbestos-containing materials; (2) changed the regulatory text to clarify that construction employers must resume periodic monitoring whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional asbestos exposure; and (3) explained why OSHA was not amending the regulatory text to clarify the limited exemption for "small-scale, short-duration operations" in the construction industry standard, but instead would institute rulemaking on this issue.

With respect to the second group of issues, the Court ordered OSHA to complete its response on the existing record by January 28, 1990. These issues are:

Issue 4. The possibility of further regulations governing employee smoking controls;

Issue 5. The effectiveness levels of various respirators and OSHA's policy of requiring respirators to protect workers at only PEL level; and

Issue 6. The possibility of bi-lingual warnings and labels for employers with a significant number of non-English-speaking employees.

The Court stated that if OSHA determines that these issues could not be resolved on the existing record, OSHA may explain why and commence new rulemaking instead.

On January 28, 1990, OSHA issued its response on these issues (55 FR 3724, February 5, 1990). In that document, OSHA:

(1) Prohibited workplace smoking in areas where occupational exposure to asbestos takes place; expanded training requirements to include information about available smoking cessation programs; required the distribution of self-help smoking cessation material; required a written opinion by the physician stating that the employee has been advised of the combined dangers of smoking and working with asbestos;

(2) Explained how and why the 1986 respiratory protection standards will reduce employee risk below that remaining solely as a result of the PEL, and that the effectiveness levels of respirators are under review; and

(3) Required employers to ensure that employees working in or near regulated areas understand warning signs, and required training programs to specifically instruct employees as to the content and presence of signs and labels.

Finally, as to the third group of three remaining remand issues, the Court ordered OSHA to resolve these issues after rulemaking. These issues are:

Issue 7. The establishment of operation-specific permissible exposure limits;

Issue 8. The extension of reporting and information transfer requirements; and

Issue 9. The expansion of the competent person requirement to all employers engaged in any kind of construction work.

In addition, the Court granted OSHA's unopposed request to publish the Notice of Proposed Rulemaking on this group of issues on April 13, 1990, to allow sufficient time to consult with the Advisory Committee on Construction Safety and Health (ACCSH). Under the Construction Safety Act (40 USC 333) and regulations in 29 CFR 1911.10 and 29 CFR 1912.3, OSHA was required to consult with that committee in the formulation of regulatory proposals which would apply to employment in construction. OSHA presented the proposed regulatory text and pertinent explanatory materials to the ACCSH and consulted with them on March 14, 1990. The Committee submitted comments and suggestions which are discussed, where appropriate, throughout this narrative. The Committee's draft of a revised regulatory text and other submissions are available as Exhibit 1–126.

The Court, on May 2, 1990 granted OSHA's further motion and extended the time to issue the proposal until July 12, 1990, in order to allow coordination of the proposal with other regulatory agencies, in particular EPA.

II. Pertinent Legal Authority

Authority for issuance of this standard is found primarily in sections 4(b)(2), 6(b), 8(c), and 8(g)(2) of the Occupational Safety and Health Act of 1970 (the Act), 29 U.S.C. 643(b)(2), 655(b), 657(c), and 657(g)(2) and in the Construction Safety Act, 40 U.S.C. 333. Section 6(b)(5) governs the issuance of occupational safety and health standards dealing with toxic materials or harmful physical agents. Section 3(8) of the Act defines an occupational safety and health standard as:

> * * * a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment.

The Supreme Court has said that section 3(8) applies to all permanent standards promulgated under the Act and requires the Secretary, before issuing any standard, to determine that it is reasonably necessary and appropriate to remedy a significant risk of material health impairment. *Industrial Union Department* v. *American Petroleum Institute,* 448 U.S. 607 (1980).

The "significant risk" determination constitutes a finding that, absent the change in practices mandated by the standard, the workplaces in question would be "unsafe" in the sense that workers would be threatened with a significant risk of harm. *Id.* at 642. A significant risk finding, however, does not require mathematical precision or anything approaching scientific certainty if the "best available evidence" does not warrant that degree of proof. *Id.* at 655–656; 29 U.S. 655(b)(5). Rather, the Agency may base its finding largely on policy considerations and has considerable leeway with the kinds of assumptions it applies in interpreting the data supporting it, *Id.* 655–656; 29 U.S. 655(b)(5). The Court's opinion indicates that risk assessments, which may involve mathematical estimates with some inherent uncertainties, are a means of demonstrating the existence of significant risk.

OSHA believes that compliance with proposed amendments to reduce the PEL to 0.1 f/cc as a time-weighted average measured over 8 hours would further reduce a significant health risk which exists after imposing a 0.2 f/cc PEL. OSHA's risk assessment showed that lowering the TWA PEL from 2 f/cc to 0.2 f/cc reduces the asbestos cancer mortality risk from lifetime exposure from 64 deaths per 1,000 workers to 7 deaths per 1,000 workers. OSHA estimated that the incidence of asbestosis would be 5 cases per 1,000 workers exposed for a working lifetime under the TWA PEL of 0.2 f/cc. Counterpart risk figures for 20 years of exposure are excess cancer risks of 4.5 per 1,000 workers and an estimated asbestosis incidence of 2 cases per 1,000 workers.

OSHA's risk assessment also showed the persistence of a significant risk at the 0.1 f/cc action level. The excess cancer risk remaining at that level is a lifetime risk of 3.4 per 1,000 workers and a 20 year exposure risk of 2.3 per 1,000 workers. OSHA concludes therefore that continued exposure to asbestos at the TWA permitted level and action level presents residual risks to employees which are still significant.

The DC Circuit Court of Appeals affirmed OSHA's conclusion that the excess risk stemming from average exposures of 0.1 f/cc "could well be found significant." *BCTD* v. *Brock,* 838 F.2nd at 1266.

OSHA also finds, following the analysis suggested by the DC Court of Appeals that " implied real exposures" triggered by a 0.1 f/cc PEL, would still present a significant risk. The Court noted that "there is no legal basis for totally disregarding a gap between real-world average exposures and nominal legal ceilings" in assessing the significance of a risk at that nominal limit (838 F.2nd at 1266).

OSHA found in the preamble to the 1986 standards that a ratio of about 2 to 1 between a PEL and a resulting average exposure level was exaggerated, because there is significant controllable exposure level fluctuation, which such a prediction ignores (51 FR at 22653). In its preamble to the asbestos "ban" regulation, EPA noted that OSHA's own inspection data do not support the assertion that current exposures are significantly below the PEL (54 FR at 29474, July 12, 1989). Thus OSHA concludes that measured exposures for asbestos-exposed workers where employers are attempting compliance with a 0.1 f/cc TWA limit, would most likely on the average be no less than 0.075 f/cc. Using linear proportionality to previously calculated risks, these predictions are a lifetime (45 year) excess risk of about 2.5 per 1,000 workers, and an excess cancer risk for 20 years of more than 1.5 per 1,000 workers. OSHA believes these risks are clearly not insignificant. Further, OSHA does not issue citations unless the PEL, plus an allowance for variability, is exceeded.

After OSHA has determined that a significant risk exists and that such risk can be reduced or eliminated by the proposed standard, it must set the standard "which most adequately assures, to the extent feasible on the basis of the best available evidence, that no employee will suffer material impairment of health * * *", section 6(b)(5) of the Act. The Supreme Court has interpreted this section to mean that OSHA must enact the most protective standard necessary to eliminate a significant risk of material health impairment, subject to the constraints of technological and economic feasibility. *American Textile Manufacturers Institute, Inc.* v. *Donovan,* 452 U.S. 490(1981). The Court held that "cost benefit analysis is not required by the statute because feasibility analysis is." *Id.* at 509.

Authority to issue this standard is also found in section 8(c) of the Act. In general, this section gives the Secretary

authority to require employers to make, keep, and preserve records regarding activities related to the Act. In particular, section 8(c)(3) gives the Secretary authority to require employers to "maintain accurate records of employee exposures to potentially toxic materials or harmful physical agents which are required to be monitored or measured under section 6." Provisions of OSHA standards which require the making and maintenance of records of medical examinations, exposure monitoring, and the like are issued pursuant to section 8(c) of the Act.

The Secretary's authority to issue this proposed standard is further supported by the general rulemaking authority granted in section 8(g)(2) of the Act.

Because the Asbestos Standard is reasonably related to these statutory goals, the Secretary finds that this standard is necessary and appropriate to carry out her responsibilities under the Act.

In addition, section 4(b)(2) of the Act provides for OSHA standards to apply to construction and other workplaces as well as in general industry.

IV. Summary and Explanation of the Proposed Amendments

This document constitutes OSHA's response on the third group of remand issues and on the issue of exemption of "small-scale, short duration operations" from the negative-pressure enclosure and other requirements, deferred from the December 20, 1989 response. In this proposal OSHA is defining the term "small-scale, short term operations" differently, limiting conditions for the exemption to specific situations and limiting the exemption to the negative-pressure enclosure requirement. OSHA is also proposing narrowly-focused exemptions for roofing operations, floor tile removal operations, and where erection of an enclosure is infeasible. OSHA is clarifying the regulatory text such that aside from the specific exemptions just mentioned, all employers engaged in demolition, renovation, and removal operations must establish a negative-pressure enclosure for that operation, regardless of exposure levels at the site. This requirement will also respond to the Court remand issue 7 by requiring operation-specific controls to reduce risk.

On issue 7, the establishment of operation-specific permissible exposure limits, OSHA is proposing to lower the permissible exposure limit for the construction industry and general industry to 0.1 f/cc as an 8-hour time-weighted average. OSHA is adding specific control and work practices applicable to certain operations that will apply regardless of the exposure level, thus further reducing worker exposure. OSHA believes that the 0.1 f/cc PEL is feasible and can be achieved using engineering controls and work practices specified in the proposed standard.

On issue 8, the extension of reporting and information transfer requirements, OSHA is expanding the communication provisions in the standards to require owners of buildings to communicate known information concerning the location of asbestos to occupants of the building when contemplating asbestos-related work. Employers conducting major construction activities which disturb asbestos are also to communicate information regarding asbestos hazards and steps being taken to reduce exposure risks to employees and employers likely to be exposed. OSHA is also proposing a requirement that all employers engaged in non-small-scale, short-term demolition, renovation, and removal operations notify OSHA prior to commencement of work.

On issue 9, OSHA is clarifying that a competent person will be required on sites which are exempted from the negative-pressure enclosure requirement. In addition, the duties of the competent person and the attendant training requirements must be matched to the unique nature of the hazards and protective measures at each site.

A. Proposed Requirement for Establishing a Negative-Pressure Enclosure

The issue of when a negative-pressure enclosure must be established for removal, renovation, and demolition operations was originally remanded to OSHA by the Court of Appeals, for Agency clarification based on the earlier rulemaking record (*BCTD at 1279*). OSHA responded in its December 20, 1989 notice that additional rulemaking was required to evaluate the effectiveness and drawbacks of negative-pressure enclosures, and technological advances in these controls (54 FR at 52067). This rulemaking will also allow OSHA to examine the experience with alternatives, such as glove bags and negative-pressure glove boxes, which were either unavailable or had limited performance data in 1986.

Based on its preliminary review of the 1986 record, relevant policy considerations, and the still limited data concerning the effectiveness of the control systems mentioned above, OSHA is proposing clarifying revisions to paragraph (e)(6) of the construction standard, § 1926.58. They will require employers to establish negative-pressure enclosures before commencing any asbestos removal, demolition, and renovation operation, regardless of the exposure level, unless specifically exempted. OSHA is also proposing to clarify the exemptions from this requirement as follows: Small-scale, short-duration operations which meet newly proposed specification criteria; operations where the erection of negative-pressure enclosures are infeasible; and roofing and floor tile removal jobs. Unlike the 1986 standards, however, OSHA is proposing to separately require that "competent persons" supervise all removal, renovation, and demolition jobs, even if they are exempt from the negative-pressure enclosure requirement.

The basis for the 1986 requirement for negative-pressure enclosures for asbestos removal, demolition, and renovation was conclusive record evidence that asbestos presents a significant risk even at levels well below the permissible exposure limit. Since asbestos disturbed during abatement and renovation activities likely would spread beyond the point where the asbestos is handled to pose a risk to other workers engaged on the worksite, containment and other precautions would be needed if the risk to bystanders is determined to be significant. For typical renovation, removal, and demolition jobs, the amount of asbestos requiring containment is substantial. The application of negative-pressure ensures that asbestos fibers remain inside even if a leak develops in the enclosure shell. In 1986, OSHA believed, based on limited reports of experience using such enclosures for asbestos work, that the full enclosure, which encloses the work and the workers and limits access, would be effective in containing asbestos. In addition, change rooms attached to the full enclosure for removal of contaminated clothing and equipment were expected to further reduce the spread of contamination. The negative-pressure system draws the contaminated air into a filter prior to venting to the outside, which might reduce exposures to employees within the enclosure to some as yet unquantified degree.

For the same reasons as in 1986, this proposal continues the requirement that renovation, removal, and demolition jobs be conducted within a full negative-pressure enclosure. Additionally, the regulatory text makes explicit that a full negative-pressure enclosure must be established regardless of measured asbestos levels. OSHA notes that removal jobs generate highly variable amounts of asbestos, reducing the

predictability of exposure levels from one monitoring event to the next. Moreover, measured asbestos levels cannot be used to determine the need for a full negative-pressure enclosure, because of the time required by the testing laboratory to complete the test and report the results.

As stated above, renovation, removal, and demolition jobs typically involve handling substantial quantities of asbestos. General contamination of the workplace has resulted from failure to confine asbestos using strict regulated area procedures, and asbestos-related diseases have been found in workers of a different trade exposed to asbestos contamination from the activities of asbestos workers. Negative-pressure enclosures, when used properly, limited this exposure. OSHA believes that installing negative-pressure enclosures in asbestos abatement work is now recognized as prudent practice by the asbestos abatement industry, and is generally done by abatement contractors, even where jobs are not covered by OSHA's standard. Is this proposal targeted to those situations where these contractors believe negative-pressure enclosures are appropriate?

Most importantly, as noted above and by the Court, significant risk exists at levels below the PEL. Therefore requiring that the spread of asbestos be contained where it is likely, even if not certain, that the PEL would be exceeded is both appropriate and necessary to reduce still significant risk to bystander employees. Therefore, this specification also partially responds to remand issue 7 which calls for establishing operation-specific PELs. Although a separate PEL is not proposed for removal, demolition, and renovation, the regulated area controls are proposed to apply even when exposures may be less than the newly proposed PEL of 0.1 f/cc. OSHA believes that the nature of all asbestos removal projects, e.g., scraping away asbestos from solid surfaces, results in substantial asbestos fiber release, and regulated area controls found in the asbestos standard and this proposed modification are necessary.

Information submitted to the 1986 rulemaking and the Agency's subsequent enforcement experience, study results, and public comment show that asbestos fiber contamination occurs outside the immediate area of abatement unless means are provided to contain the abatement activity. In 1986, testimony was presented that there was significant secondary contamination of work areas adjacent to asbestos removal operations. (Tr. June 28, 1984 at 341 et seq). However OSHA has not yet been able to estimate the risk to bystander employees. OSHA recognizes that the above information is not necessarily representative of bystander employee exposures and requests comment on: (1) Level of exposure to bystander employees; (2) the number of affected employees; and, (3) frequency of exposure of any given employee.

In an EPA-study described by Breen et al (Exh. 1–23) in 1986, elevated levels of asbestos fibers (up to 16 f/cc by TEM) were detected immediately outside some of the barriers which separated the asbestos removal work area from the remainder of the school.

In a submission to OSHA of the Asbestos Abatement Council-AWCI (Exh. 1–142), monitoring data from a large number of abatement projects were presented. These data consistently indicated that exposures outside the negative-pressure enclosures were much lower than inside, with exposures in the decontamination areas being intermediate. For example, during a removal operation within a sub-basement, the personal samples ranged from 0.03 to 0.07 f/cc; while the area samples within the enclosure were between 0.12 and 0.15 f/cc; the decontamination chamber level was less than 0.01 f/cc; the bag load-out chamber, 0.01 f/cc, and the sample taken at the negative air exhaust was less than 0.01 f/cc.

Much abatement work is undertaken in basement areas of commercial buildings. Large numbers of janitorial workers work in such areas during and after removal activities. Large-scale renovation of commercial buildings exposes many adjacent workers to asbestos contamination including other workers in construction trades, such as electricians, carpenters, drywallers, as well as employees working in adjacent office or commercial space and communication workers (see e.g. docket H–033c, Tr. June 28, 1984 at 346 et seq).

OSHA seeks comment on applying the requirements for negative pressure enclosure for all removal, demolition and renovation jobs which involve asbestos. OSHA also seeks comments on whether any additional controls, such as respirator use, should also be a specification for employees performing these operations.

Since the revised asbestos standards were issued in 1986, OSHA has been contacted informally by various asbestos abatement contractors who have asked the Agency to comment on the patentability of a system to establish required negative-pressure enclosures. OSHA believes that the issue of patentability should be appropriately determined by the U.S. Patent Office, and through other administrative or judicial proceedings where any such claim would be formally reviewed.

The Agency adopted the requirement to erect negative-pressure enclosures in 1986, in part because of the Agency's institutional knowledge that the application of the general principles of negative-pressure would assure that asbestos fibers would tend to remain in an enclosure placed under negative-pressure, if that enclosure were damaged. Neither in the 1986 requirement, nor in this proposal, did or does the Agency intend that the negative-pressure enclosure requirement be met by any specific combination or configuration of barriers, fans, exhaust systems, or entry/egress ways. The illustrations and explanatory text in non-mandatory appendix F are illustrative only. Different devices, systems, and materials and configurations may be used to create enclosures, to establish negative-pressure, and to erect attached decontamination facilities.

OSHA is interested in information, comments and data on whether the costs of erecting required enclosures, or of any other asbestos abatement technology, are affected by the existence of patents and, if so, how such additional costs affect the feasibility of the standards.

1. Other Controls

OSHA is also considering whether alternative control methods should be allowed for renovation, removal and demolition operations in lieu of negative-pressure enclosures. These include:

a. *Glove bags.* OSHA is proposing to require negative-pressure walk-in enclosures unless specific exemption criteria are met because other, more limited, containment systems do not yet appear to be equally effective in protecting removal and bystander employees. OSHA has received inquiries and faced enforcement situations where employers were using glove bags instead of walk-in enclosures for removal operations where negative-pressure enclosures appeared feasible.

Glove bags are sealed compartments with attached inner gloves used for handling certain materials containing asbestos, such as insulated piping and valves with asbestos gaskets. The glove bag also relies on the principle of containment. Tools and wetting agents are enclosed in the bag which is then sealed around the pipe or other fixture. After completion of the task, the bag is

collapsed and properly disposed of. OSHA notes that there are cost advantages to the employer in avoiding erecting a full enclosure where a glove bag can be installed. There are also potential advantages to the employee if the bag is properly designed, installed and used, since unlike the full enclosure which contains both the worker and the asbestos, the glove bag separates the worker from the contamination.

Available data indicates that glove bags in use may not always provide adequate protection. For example, NIOSH Health Hazard Evaluations on glove bags confirm the fact that, if improperly used, an employee can puncture the bag with tools or sharp debris thereby generating high exposures in the employee's breathing zone (Ex. 1–1, 1–2, 1–20, 1–22). While NIOSH has also shown that employees can improve their performance using glove bags over time, the potential for damage to the plastic containment remains high. OSHA shares NIOSH's concern about the poor performance of glove bags in containing asbestos in the hands of poorly trained or infrequent users.

b. *Glove boxes.* A promising refinement of the glove bag is the glove box or rigid glove bag that can be subjected to negative-pressure without collapsing, as is the case with glove bags composed of flexible plastic materials. This type of equipment appears to combine the advantages of removal of the worker from the asbestos and protection from asbestos which may be expelled through a puncture. At this time, however, OSHA is unaware of any published studies of experience with this equipment, including potential exposures during dismantling and disposal of removed asbestos.

Because the current data concerning the performance of glove boxes and bags in controlling asbestos exposure are limited and inconclusive, OSHA believes that the general requirement that full negative-pressure enclosures must be provided to protect workers from asbestos exposure in activities covered by this standard continues to be necessary. As described below, there are limited situations where glove bags must be used in addition to the protection afforded by full enclosures or as a substitute where no feasible alternative exists. Nevertheless, in light of the known limitations of glove bags, these exemptions have been narrowly drawn. OSHA seeks additional comment and data on this preliminary determination including any proven improvements to glove bag/box design and/or construction which might minimize breakage and leakage.

c. *New technologies.* Various manufacturers have informed OSHA of the development of innovative asbestos removal techniques. In particular, one technique utilizes a rectangular frame, placed around a pipe section, which encloses and provides water to be sprayed on four planes completely surrounding the pipework. Claims that worker exposures are dramatically reduced have been made. Information concerning this system, which has been used abroad, has been placed in the record (Exh. 1–138); however, exposure data has not yet been submitted. OSHA is interested in receiving all information and data concerning this and other new techniques for removing asbestos. Data concerning direct and indirect worker exposures and area exposures should also be submitted. Since the Agency now does not have adequate data to evaluate the effectiveness or feasibility of these new techniques, this proposal does not include them. The Agency will consider providing for new technology in the final standard to the extent supported by the record developed in this rulemaking.

2. Proposed Exemptions from the Negative-pressure Enclosure Requirement

In addition to clarifying the negative-pressure enclosure requirement in paragraph (e)(6), OSHA is proposing four sets of circumstances where employers engaged in asbestos demolition, renovation, and removal operations are exempted from that requirement. These proposed exemptions are for: small-scale, short-duration operations, roofing operations, floor tile removal operations, and operations where establishment of full size negative-pressure enclosures is infeasible. These exemptions were included in the original negative-pressure enclosure requirement or in the original definition of small-scale, short-duration operations. The proposal specifies more clearly the conditions an employer must meet to qualify for an exemption. Since the exemptions would be conditioned on compliance with newly required protective measures, such as local containment and work practices, OSHA believes that employees who work on or near exempt operations will be protected from significant asbestos exposure. OSHA also believes that the proposed specific exemption provisions represent a narrowing of the 1986, more general exemptive regulatory language. Therefore fewer removal employees are expected to work without negative pressure enclosures than was the case under the 1986 regulations.

OSHA provided a general discussion of the justification for some exemptions from negative pressure enclosures in its December 20, 1989 Federal Register notice. There OSHA explained why it would propose a new definition of the small-scale, short-duration exemption and initiate rulemaking, rather than limiting the exemption to operations where it is impractical to construct a negative-pressure enclosure because of the configuration of the work environment.

First, the Agency stated its belief, based on its experience in enforcing the construction standard, that limiting the exemption only to situations where negative-pressure enclosures are impractical might not reduce employee risk from asbestos exposure. Second, OSHA described the practical limits placed on the scope of the existing small-scale, short-duration exemption by administrative interpretations. OSHA believes that, in light of the evidence existing in the record, the proposed exemptions should be narrowly defined to isolate those cases where negative-pressure enclosures do not appear likely to add more than a *de minimis* increment to employee or bystander worker protection. They represent cases where practicality or limited exposure suggests that steps other than erection of a walk-in enclosure be taken to protect workers from the risks of asbestos.

a. *Clarification of the Small-Scale, Short Duration Exemption.* OSHA is proposing to clarify and modify the exemption from the requirements of paragraph (e)(6) in the case of small-scale, short duration operations. The Agency is both providing general criteria and specifically identifying certain operations which will not require negative pressure walk-in enclosures. The proposed definition states that these operations include "only those demolition, renovation, repair, maintenance, and removal operations which affect small surfaces or volumes of material containing asbestos, tremolite, anthophyllite, or actinolite" and which are unlikely to expose bystander workers to significant amounts of asbestos, and which will be completed within one work shift. OSHA is identifying in the regulatory text, individual tasks which would be deemed to be exempt. The definition lists such tasks, modified by cut-offs for time required for completion, and/or amount of asbestos disturbed or area of operations. Thus the proposed text of the new definition would exempt:

* * * repair of asbestos on piping that is less than 21 linear feet; repair or removal of asbestos panel that is less than 9 square feet; pipe valve repair or replacement of pipe valves containing asbestos gaskets or electrical work that disturbs asbestos that is completed by one worker in less than four hours; removal of drywall which is completed for the facility within an eight-hour workday; renovation projects involving endcapping of pipes and tile removal that is completed in less than four hours; and installation of conduits that is completed within an eight hour work shift.

The Agency bases the above definition on both specific suggestions in the record from its field personnel who have observed asbestos operations, and its general enforcement and consultative experience with the 1986 and 1972 asbestos standards. The proposed criteria are intended to reflect realistic workplace operations. There is no attempt to define operations which rarely exist.

Several additional suggestions and observations were received from field personnel relating to the proposed definition of small scale, short duration operations. Comment and additional information and data are sought by OSHA on these suggestions. They are as follows:

(1) Removal of transite panels should be exempt from the negative-pressure enclosure requirement as long as the transite is removed without cutting or otherwise abrading the material;

(2) Inclusion of size or square footage criterion in the definition of small-scale, short duration operations renders it too inflexible, not allowing adequate use of professional judgment;

(3) There should be no linear footage limit for removal of asbestos insulation on pipe as long as proper glove bag techniques are used;

(4) Adopt the NESHAP reporting criteria as the cutoff for OSHA's small-scale, short duration operations;

(5) Remove exemptions and require negative-pressure enclosures on all projects;

(6) Mini-enclosures should not be included as a suggested method for use in small-scale, short duration jobs; and

(7) OSHA should require *area* monitoring to assess the success of containment and the extent of clean-up.

In addition, OSHA is considering extending the exemption to other operations which are truly small-scale, short-term, even though they may not be listed in the proposed standard. For example, the employer should be able to demonstrate that the claimed exemption applies to a non-recurring operation which does not expose bystander employees to asbestos and which is completed in less than a day by not more than 1 person, or in less than 4 hours by not more than 2 employees and which is not expected to release asbestos in excess of the PEL. OSHA seeks commment on these general criteria and whether they should be included in the regulatory text.

This proposed definition replaces a similar, but more general definition by example in current 29 CFR 1926.58, which appeared to consider all operations such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation as "small-scale, short duration". The Court of Appeals stated that OSHA had not drawn the parameters of the exemption with enough specificity. The new definition attempts to add greater specificity for many of the operations originally defined as operations involving small-scale, short-duration exposures.

The Agency believes that the amount of asbestos contamination released during repair and maintenance activities is often of the same magnitude as other "renovation" or removal jobs. The work operations too are similar, calling for identical work practices, isolation techniques or local ventilation controls.

Based on its experience, the Agency cannot now define a cutoff, either in temporal, spatial, or other terms, which can be classified as always assuring *de minimis* exposure potential. Thus, the proposal considers all repair and maintenance which will disturb asbestos-containing material as requiring appropriate work practices and other controls to protect the worker. In addition, OSHA believes the proposed expansion of the competent person requirement to include oversight of small-scale, short duration operations will also enhance protection of repair and maintenance workers. OSHA seeks comment on the inclusion of these activities as small-scale, short duration operations.

OSHA also solicits information and comment on the validity of listing specific operations and how well the listed criteria correlate with actual practice. For example, is it usual, or even possible, for one worker to perform electrical work which disturbs asbestos in four hours, or are two workers or more time commonly needed for small jobs? Should four hours of floor tile or ceiling tile removal qualify as a small-scale, short duration job? Are other repair, renovation or maintenance jobs which are unlisted, capable of being identified in terms of time, manpower and/or area of disturbance? Should they too be earmarked for an exemption from the negative pressure requirement? Are the general criteria under consideration for additional small-scale, short duration operations appropriate and sufficiently detailed?

In addition, OSHA seeks comment on whether a volume amount of asbestos should be specified in the new definition of small-scale, short duration operations. What difficulties in volume determination would likely be encountered? OSHA also requests comments on the ACCSH recommendation, described below, that OSHA define small-scale, short-term operations primarily in terms of the amount of asbestos disturbed, rather than the surface area of the structural members from which the asbestos is removed. The Agency believes that this suggestion deserves consideration as an alternative to the proposed regulatory text.

In its enforcement of the 1986 standards, OSHA has observed that some employers have divided large-scale asbestos abatement jobs into a series of smaller jobs so as to claim an exemption from the negative pressure enclosure requirement. In order to make clear that the exemption does not apply in such circumstances, the proposal identifies qualifying jobs as those that are completed within stated timeframes and specifically requires that jobs must be "non-repetitive" to qualify as "small-scale, short duration."

OSHA is, nonetheless, requesting comments on this potential problem and the desirability of including specific alternative language in the definition of small-scale, short-duration operations to address these concerns.

In order to assure that workers engaged in small-scale, short-duration operations receive adequate protection from significant asbestos exposure, OSHA has proposed to require alternative protective strategies. The proposed provision for small-scale, short-duration operations requires that the employer use a feasible containment or enclosure method, where appropriate, such as glove bags, including negative-pressure glove boxes, mini-enclosures, or wet methods to reduce worker exposure to asbestos and to minimize any spread of contamination beyond the immediate work area. For some of the operations identified in the definition, additional protection should be easily employed; for example, glove bags can be used in pipe removal and valve replacement. In addition, this proposal specifically would newly require that appropriately trained competent persons supervise small-scale, short duration operations. As discussed below, OSHA

is proposing that a competent person specially trained for small-scale, short-duration operations must be present at the work site to assure that workers engaged in these jobs are protected from hazards of asbestos.

In its March 14, 1990 recommendation, ACCSH offered two alternatives as definitions for small-scale, short duration operations. These are as follows:

Small scale, short-duration operation means an operation which meets all of the following requirements:

(1) A maintenance, repair, or renovation task where the removal, handling or treatment of asbestos is not the primary goal of the job.

(2) An activity where employees' exposures to asbestos can be kept below the action level via worker isolation techniques and methods described in Appendix G.

(3) An operation which has been included in the employer's or building owner's asbestos maintenance program, as required in Appendix G.

(4) The operation is non-repetitive, i.e. not one of a series of small-scale or short-duration jobs which if performed at one time would not constitute a small-scale short-duration operation.

(5) Where the operation results in the removal or disturbance of asbestos or asbestos-containing material, the amount of asbestos or asbestos-containing material may not exceed _____ cubic feet, i.e. the amount of asbestos or asbestos-containing material that would be contained in a _____ gallon sealed drum.

The second definition suggested by ACCSH contains the same language as the first except that (5) is replaced with the following:

(5) Where the operation results in the removal of asbestos or asbestos-containing material, the amount of asbestos or asbestos-containing material shall not exceed that which can be contained in a single glove bag containing not more than two sets of gloves.

OSHA expects that the removal and renovation operations that qualify for the exemption typically will be secondary to the normal business conducted on the premises or by the employer.

Demolition work is not expected to be exempt under the small-scale, short duration definition. However, some demolition work may be exempt under the proposed provisions covering the configuration of the work environment which make the erection of an enclosure infeasible. OSHA notes that to the extent that stripping of asbestos is required prior to demolition, such activity is considered removal work under OSHA's standard and must be contained in a negative-pressure enclosure, unless a specific exemption applies.

The Agency requests comments on the relative merits of the proposed definition of small-scale, short-duration operations, and those of ACCSH, and on its application of the definition to removal, renovation and demolition operations. In particular, the Agency encourages comment on individual elements of the definition and requests submission of any data on the exposures potentially associated with any of these operations.

b. *Other Proposed Exemptions to the Negative-Pressure Enclosure Requirement.* OSHA is also proposing a second exemption from the negative-pressure enclosure requirement, for roofing operations. This would apply almost entirely to the removal of asbestos-containing roofing material. OSHA does not believe that requiring negative-pressure enclosures will result in more than a *de minimis* benefit to workers removing roofing or to other employees in their vicinity. Such installation might pose safety hazards to workers stationed on roofs or scaffolding; thus it is unlikely that there will be any potential net safety and health benefit from the use of such enclosures. OSHA is proposing that employers engaged in roofing operations take specific additional steps to reduce employee exposure to asbestos. These include use of airtight chutes to lower debris from the roof to the ground, or immediate bagging and lowering of debris rather than dumping it from a height. Wetting would be required where feasible to reduce contamination. These methods have been shown to successfully reduce employee and bystander worker exposures.

OSHA notes that roofing materials often contain a high percentage of asbestos and if severely weathered, can be quite friable and fibers potentially airborne. Therefore, it is essential that all other feasible methods be employed to protect workers from asbestos exposure during roofing operations.

ACCSH suggested the addition of the following to the regulatory text describing the exemption of roofing operations from the negative-pressure enclosure requirement:

In roofing operations, where the employer shall institute all feasible controls to minimize exposures including:

1. Establishing the entire roof as a regulated area:
2. Using wet methods prior to and during the cutting and handling of asbestos-containing roofing material (ACRM);
3. Cutting or removing ACRM using hand methods whenever possible;
4. Equipping all powered tools with a HEPA vacuum system or a misting device;
5. HEPA vacuuming all loose dust left by the sawing operation;
6. Double bagging, wrapping in two layers of 6 mil polyethylene, or containerizing all waste material, and requiring all bags, wrapped material and drums be lowered to the ground using a hoist or crane;
7. Isolating all roof level air intake and discharge sources or shutting down all mechanical systems and sealing off all outside vents using two layers of 6 mil polyethylene.

OSHA invites comments on whether it should require employers to adopt all the above provisions, and whether they are feasible in roofing removal operations.

Additionally OSHA is proposing to exempt removal of asbestos containing floor tile from the negative-pressure enclosure requirement. In the preamble to the 1986 standards, OSHA stated that: "data obtained * * * indicate that when the recommendations of the Resilient Floor Covering Institute (e.g., wet sweeping and handling, and prohibiting powersanding and blowing asbestos dust) were followed average TWA airborne fiber concentration were below the 0.2 f/cc PEL during the removal of the old floor." In a recent submission to OSHA from Environ Corporation on behalf of the Resilient Floor Covering Institute and other, mean exposures were between 0.0045 and 0.03 f/cc for workers performing floor tile removal, removal of resilient sheet flooring, or removal of cutback adhesive. These measurements were made during removals which employed work practices recommended by the Resilient Floor Covering Institute. These practices included a prohibition of sanding of floor or residual felt backing, use a of a HEPA vacuum cleaner before and after removal, prohibition of dry sweeping, application of new material over old tiles without removal if possible, wet removal of residual felt, and bagging and disposal of waste in 6 mil plastic containers. Further, the Resilient Floor Covering Institute recommends that unless absolutely positive that a floor is a non-asbestos product, assume it contains asbestos and treat it in the manner prescribed. OSHA is not proposing to include this requirement in this proposal, however, OSHA requests information and data regarding this issue, including any information on the use of the date of installation or manufacture of the floor material in determining whether or not it is likely to contain asbestos. OSHA also seeks information as to safe, effective methods for removal of adherent floor tiles.

In the studies submitted to OSHA, measurements were made of the exposures of bystanders—industrial

hygienists and supervisory personnel. Their 8 hour TWA were even lower than those of the workers performing the removals, with means in the three operations ranging from 0.0043 to 0.023 f/cc. Therefore, OSHA is proposing to exempt such removals from the requirement to establish a negative-pressure enclosure. As in the case of roofing operations OSHA does not feel that requiring enclosures will offer more than a *de minimis* benefit to workers performing floor tile removal nor to bystander employees. OSHA proposes to require that employers engaged in these operations must follow the work practices described by the Resilient Floor Covering Institute to reduce employee exposure to asbestos.

OSHA is also mindful of the potential that deteriorated asbestos containing flooring, backing and adhesives might have for release of asbestos fibers. OSHA requests information on the level of this exposure and comment on the necessity for negative-pressure enclosure and hygiene facilities in instances of flooring removals in which the material is likely to release a significant amount of asbestos fibers. OSHA also solicits comment on the adequacy of the work practices of the Resilient Floor Covering Institute to control worker exposure. OSHA seeks information as to any additional measures to be taken to assure employee safety while performing these operations.

A fourth exemption from the negative-pressure enclosure requirement proposed by OSHA would be wherever an employer demonstrates that such a measure is infeasible. This exception was included in the 1986 standard and is restated in this proposal to make clear that OSHA standards promulgated under section 6(b)(5) of the Occupational Safety and Health Act must be "feasible," as defined by the courts. OSHA's feasibility analysis indicates that very few activities will qualify for this exemption. OSHA seeks comments on factors other than work configuration which might render the establishment of negative pressure walk-in enclosures infeasible.

OSHA is narrowly defining and qualifying these exemptions in order to clarify the conditions under which negative-pressure enclosures are not required to provide significant worker protection. In these narrowly-drawn circumstances, localized containment methods and work practices, if conscientiously used, should reduce exposure to levels equivalent to those achieved with negative pressure enclosures and associated ventilation systems. OSHA notes here, as it advised the Court of Appeals, that it is using this rulemaking to discuss the effectiveness and drawbacks of negative-pressure enclosures, glove bags, and alternative control systems; and to specify more clearly under what circumstances various control systems may be used. Also, OSHA is considering new technology unavailable in 1986, such as negative-pressure glove bags, which appear to offer improved employee protection in certain circumstances either as an alternative to walk-in enclosures, or as required in lieu of conventional "glove bags". These data along with evidence on experience with these systems may limit rather than expand the walk-in enclosure requirement, provide further justification for the proposed exemptions, or provide a basis for expanding the scope or number of exemptions. OSHA also requests information and data on work practices and installation techniques to improve the performance of glove bags and similar equipment. Additional OSHA is concerned about potential electrical and slipping hazards which may result from use of wet methods and seeks comment and information regarding these potential hazards.

In roofing operations and situations where establishment of a negative-pressure enclosure is determined to be infeasible, the hazard that asbestos exposure always presents to employees and bystander workers remains. Therefore, these operations are exempt only from the requirement to establish the walk-in negative-pressure enclosure and not from other worker protective requirements, such as training, work practices, decontamination, showers, clean room, and equipment room. OSHA seeks comment as to the extent to which these requirements should apply to short-term, small-scale operations.

Under the 1986 standards, an employer exempted from the negative-pressure enclosure requirement on the basis that the operation qualified as a small-scale, short-duration operation was also exempted from the competent person requirement. As described more fully below, OSHA is proposing revisions to the construction standard which will require the presence of competent persons on all construction sites subject to this standard. Thus, none of the proposed limited exemptions from the negative-pressure enclosure requirement would exempt employers from the newly clarified and expanded competent person requirements.

B. Proposed Lowering of Permissible Exposure Limit

The Court of Appeals in *BCTD, AFL–CIO* v. *Brock* remanded for reconsideration the issue of whether a permissible exposure limit lower than 0.2 f/cc was warranted in those industries where evidence in the record demonstrated general feasibility of attaining a lower level. The Court was interested in better understanding the Agency's rationale for determining that 0.2 f/cc PEL should be applied across all industry lines, including the weight given to such factors as administrative difficulty of excessive disaggregation or excessive random fluctuations in exposure levels represented in the data. In response, OSHA is proposing a two-part revision. It is reducing across the board the time-weighted average permissible exposure limit to 0.1 f/cc, and is also proposing operation-specific work practices and controls which must be employed, regardless of exposure levels achieved. The basis for the reduced PEL of 0.1 f/cc is OSHA's review of compliance data, new studies available since 1986, and supervening events such as the refinement and development of control methods. OSHA believes that it is feasible for most industry sectors to reach the reduced PEL. The proposed required operation-specific work practices are for certain industry sectors where evidence now points to the success of such practices in reducing exposures, and thus, risk. OSHA believes combining a general performance approach of exposure reduction along with specifying proven control strategies will yield maximum benefit to all employees who may be exposed to asbestos and will avoid administrative and policy concerns relating to enforcing different PELS in different sectors. OSHA also notes the observation that a significant proportion of the personal (8-hour TWA) monitoring samples in its IMIS compliance data since 1986 (Exh. 4) fell within the range of 0.1 to 0.2 f/cc, for example, in asbestos product manufacturing (SIC 3292) approximately 20% were within this range and 22% of those within SIC 1799 (special trade contractors) also were.

In its risk assessment described in the 1986 Asbestos Standard, OSHA found that lifetime exposure at 0.2 f/cc (8-hr TWA) resulted in 7 excess deaths due to cancer per 1,000 workers. Reduction to a 0.1 f/cc PEL reduces this estimate to 3 excess cancer deaths per 1,000 workers. Although this is a substantial reduction, significant risk would remain even at the new PEL. Thus, the newly required

work practices target those operations where they may reduce exposures below the new PEL as well.

Recently, EPA prohibited, at three staged intervals from August 1990 to August 1996, the future manufacture, importation, processing and distribution in commerce of asbestos in almost all products (54 FR at 29460, July 12, 1989). However, the ban would not affect abatement activities involving asbestos or the servicing of asbestos brake and clutch. OSHA requests comment on the proposed reduction in the PEL in light of this ban. OSHA is concerned that the reduction of the PEL would require in some cases, installation of major control systems whose costs would accelerate EPA's scheduled phase-out of various asbestos-producing sectors. Therefore, OSHA is proposing allowing the reduced PEL to be met through the use of respiratory protection for all primary and secondary manufacturing sectors until the dates schedules for phase-out for each sector when engineering controls would be required. In this way, the reduced PEL would not impose engineering control costs on any general industry sector in a way that would change EPA's scheduled phase-out. Either an industry sector would shut down on or before the effective date of the ban, so the engineering control requirement would be irrelevant, or the ban's effective date would have been stayed or lifted, in which case the phase-out schedule would have been changed by supervening events, outside OSHA's purview.

The dates when engineering controls would be required which correspond with the EPA schedules ban are as follows:

Stage 1, August 27, 1990:
- flooring felt
- roofing felt
- pipeline wrap
- asbestos/cement (A/C) flat sheet
- A/C corrugated sheet
- vinyl/asbestos floor tile
- asbestos clothing
- new asbestos products

Stage 2, August 25, 1993:
- beater-add gaskets (except specialty industrial gaskets)
- sheet gaskets (except specialty industrial gaskets)
- clutch facings
- automatic transmission components
- commercial and industrial friction products
- drum brake linings (original equipment market)
- disc brake pads for light- and medium-weight vehicles

Stage 3, August 26, 1996:
- A/C pipe
- commercial paper
- corrugated paper
- rollboard
- millboard
- A/C shingle
- specialty paper
- roof coatings
- non-roof coatings
- brake blocks
- drum brake linings (aftermarket)
- disc brake pads (aftermarket)

OSHA notes that other revised requirements of the standards will become effective in all industries on the effective date for all revisions of the standards.

OSHA requests information and comment on this approach, especially concerning costs of additional respirator programs that a lower PEL would trigger and whether such costs are feasible for sectors schedules for banning. In addition to the proposed requirement for respirator use in general industry just discussed, OSHA is considering whether it should require employers in designated construction operations to use respiratory protection regardless of measured exposures, because variability in exposures is a particular concern and/or because the controls primarily utilized are not considered sufficiently reliable. For example, in construction should OSHA as proposed in mandatory appendix G, require employees working with glove bags always to use respirators because of the possibility of bag leakage? Should employees removing large amounts of asbestos-containing materials wear respirators because exposure levels are expected to vary so that one day's measurements cannot be considered predictive of future exposures?

The Agency seeks comments on expanding the operations in the general industry and construction standards for which respirators should be required, based on the nature of the operation. Commentors should consider whether also requiring respirators, in addition to engineering and work practice controls, would undercut the incentives for employers and employees to install and conscientiously apply such controls. Would employers and employees tend to rely instead on respirators as their major source of protection? OSHA stated in its February 5, 1990 response (55 FR at 3724), that:

> In addition to the problematic nature of respirator use, reliance on engineering and work practice controls for asbestos is preferable because they measurably reduce exposures of employees directly involved in asbestos producing operations, reduce or eliminate bystander exposures, avoid the deposit of asbestos dust on work surfaces and employee clothing which results in further exposures, and include methods of controls such as substitution, or fully bonded asbestos-containing materials which will eliminate or reduce future asbestos exposures.

The Agency will consider requiring additional respirator use, in light of these concerns.

In the case of general industry standards, the affected industries can be divided into two general categories: (1) The asbestos brake and clutch repair and service sector, which employs well over 90% of general industry employees covered by the standard, and (2) numerous processing and manufacturing sectors, which account for relatively few workers and are declining in product volume and employee populations. For the former sector, as described below, employers must use one of several combinations of engineering controls and work practices which are set out in the standard, to reduce exposures below the proposed permissible exposure limit. For the latter group of industries, in general, OSHA believes that those that continue in operation will be able to achieve the proposed PEL using existing engineering controls and work practices.

OSHA also believes that most construction operations will be increasingly able to achieve the proposed reduced PEL, if they conscientiously follow the work practices required in the proposal. As noted above, OSHA acknowledges that in the largest construction sector, abatement operations, variability in exposures because of changing conditions make exposure predictions uncertain. Routine maintenance work may achieve compliance with the proposed reduced PEL where deterioration of asbestos materials is limited and where the work practices in appendix G are followed (Docket H-033c, Exh. 3 at 32-33). Although OSHA is proposing a reduced PEL for this sector, OSHA believes that additional specifications for required work practices will be equally important to assure reduced exposures. OSHA notes that the 1986 record contains data showing reduced exposures during abatement activities and subsequent comment contends that exposure below 0.1 f/cc can be routinely obtained during some major renovation projects (Exh 3-6 and Exh. 84-474, Table A.11) and that "minor" removal activities would be able to comply with 0.1 f/cc on a TWA basis, Docket H-033c, Exh. 84-474, Table 3.10. OSHA is interested in exploring which control devices and work practices demonstrate such reductions in exposure and the conditions of the worksites where low levels were consistently achieved.

Installation of new asbestos-containing construction materials, based on OSHA's enforcement data, and data in the 1986 record is predicted to be able

to easily meet the new exposure limit of 0.1 f/cc (see 51 FR 22662–22663).

In the 1986 asbestos standards, an action level of 0.1 f/cc, half the PEL, triggers monitoring, medical surveillance and training. The Court instructed OSHA to consider reducing the action level to 0.05 f/cc, should the PEL be reduced to 0.1 f/cc. ACCSH, too, has recommended an action level of 0.05 f/cc. However, for two reasons OSHA is not here proposing a reduced action level. First, one technical issue that OSHA must address in resolving this question is whether the variability of sampling would render such measurements unreliable for triggering requirements at an action level of 0.05 f/cc. OSHA believes that especially at the infrequent intervals dictated in the OSHA standard, measurements at such low levels would not be sufficiently reproducible to be readily enforceable. OSHA noted in its STEL notice (53 FR 35610, September 14, 1988) that the excursion limit promulgated, 1 f/cc measured over 30 minutes which corresponded to a time-weighted average of 0.063 f/cc, was the lowest reliable level of detection. The second reason is that OSHA does not believe that more than a *de minimis* benefit would result from a 0.05 f/cc action level which would effectively require only medical surveillance and monitoring to be instituted at that level. In regard to training, OSHA believes that in the two largest employee sectors, brake repair in the general industry standard and abatement work in the construction standard, actual training would not be significantly affected by a reduced action level. First, OSHA believes many removal, renovation and demolition workers are now required to be trained because they are being exposed at or above the current action level. The enhancement of supervisory training in this proposal will additionally protect these employees. Secondly, OSHA does not believe that a reduction of the action level would lead to an expansion of training for brake repair workers, because based on OSHA's data, most such workers have exposures below 0.05 f/cc. In its rule, Asbestos-Containing Materials in Schools (52 FR at 41826, October 30, 1987), EPA noted that the limit of reliable quantitation of the PCM method is 0.01 f/cc. However, at least five samples are required for clearance and all must be below this limit. OSHA feels that for a single workplace monitoring sample, the limit of reliability for the method is substantially above 0.01 f/cc. Comment on this issue is requested.

OSHA is seeking comment on the reduction of the PEL to 0.1 f/cc in all industries and omitting the action level of one-half the PEL from the requirements. OSHA additionally requests comment on the alternative of setting operation-specific PELS rather than lowering the PEL to 0.1 f/cc across the board and prescribing operation-specific work practices. In addition, OSHA seeks information regarding improvement of the methodology for measuring airborne asbestos levels, specifically whether it has advanced sufficiently to allow reliable and reproducible measurements at an action of level of 0.05 f/cc. In addition, OSHA seeks comments on the ACCSH proposal that the STEL be lowered to 0.5 f/cc measured over a 30 minute period.

OSHA is considering some minor modifications to existing laboratory methods of asbestos fiber measurement and a new description, OSHA lab method ID 160, which will provide a safer method and a more complete procedure to follow. These are in the Docket (H033e) as Exhibit 1–129.

1. The Proposed Standard for the Automotive Brake and Clutch Service Industry

As noted above, OSHA is proposing to lower the permissible exposure level for all general industry including the automotive brake and clutch service and repair sectors to 0.1 f/cc as an 8-hour time weighted average. Evidence in the 1986 record demonstrates that exposures below 0.1 f/cc can be achieved using one or more combinations of currently available engineering controls and work practices now included in non-mandatory appendix F to the existing standard. OSHA is now proposing to make three methods, as an alternative and in a revised formulation, mandatory requirements. In addition, OSHA proposes to allow the use of equivalent engineering controls or work practices if the employer can demonstrate that the use of such methods will reduce employee exposure to the same level as the use of the specified methods. Since OSHA believes that the available evidence shows that either of the three methods can reliably reduce exposures to or below 0.05 f/cc, the employer must demonstrate that alternate methods can achieve at least the same level of performance. Use of these or equivalent methods will significantly reduce the risks of asbestos exposure for employees in this largest of the general industry sectors which use materials containing asbestos, tremolite, anthophyllite, or actinolite.

The rationale for this proposal is as follows. In 1986, OSHA established a uniform PEL of 0.2 f/cc for all general industry sectors. The Agency found that brake and clutch repair could achieve exposure levels below 0.2 f/cc by utilizing solvent-spray and HEPA-vacuum methods. The Court asked OSHA to re-examine its PEL for this industry in light of the 1986 record. In re-examining the feasibility data in the record at the time of its original determination and a subsequent study by the National Institute for Occupational Safety and Health (NIOSH) on the exposure levels that can be consistently achieved in brake and clutch repair operations, the Agency believes that the previously recommended combinations of engineering controls and work practices must be made mandatory in order to reduce the significant risk posed by asbestos, in addition to reducing the PEL for this sector. OSHA is adding the wet brush-recycle method to the two recommended work practices, based on the findings in the NIOSH study that this wet method can also reduce asbestos exposures.

Brake repair workers are the largest group of workers occupationally exposed to asbestos in general industry. Data in the National Occupational Hazard Survey by NIOSH estimates that 150,000 brake mechanics and garage workers in the United States are potentially exposed to asbestos during brake servicing operations. (The difference between this and OSHA's estimate of the number of employees at 526,998 may be that OSHA did not convert the number of brake repair workers to full-time equivalents. The OSHA estimates included all potentially exposed auto repair workers, both clutch and brake repair workers.) Workers who repair brakes and clutches made with asbestos are exposed to asbestos fibers because as brakes and clutches deteriorate with wear, asbestos fibers become airborne as asbestos dust. Asbestos dust on automotive brake and clutch parts is easily disturbed during servicing.

Based on the 1986 rulemaking record and additional data, OSHA believes that it is feasible for the automotive brake and clutch service industry to reduce exposures to below 0.1 f/cc by using engineering controls and work practices specified in the proposed standard. This determination is based in part on data obtained from the OSHA IMIS compliance data base and from a November 22, 1982 study by NIOSH used to determine the feasibility of the 1986 standard's general industry PEL of

0.2 f/cc. The OSHA data contained 47 observations of asbestos fiber release resulting from brake servicing operations with a mean 8-hour TWA exposure of 0.03 f/cc, during the period 1979 through 1984. Analysis of OSHA compliance data collected from 1986 through 1989 yielded a mean of 0.012 f/cc as 8-hour TWA in those samples in which any fiber was detected. The NIOSH study demonstrated that average exposures were below 0.1 f/cc when using either the solvent mist/spray can method, the HEPA-filter vacuum system methods or the wet brush-recycle method.

In addition, a December 1989 article entitled "Control of Asbestos Exposure During Brake Drum Service" (Ex. 1–112) reports the results of a NIOSH study quantifying the level of mechanics' exposure to asbestos during brake drum servicing operations using several different control techniques, including the HEPA-filter vacuum system, the solvent mist/spray can system, and the wet brush-recycle method. The study examined the application of the control techniques to a range of vehicle brake repair operations. Eighty-three samples of airborne asbestos fibers from the mechanics' personal breathing zones were collected during the brake servicing operations and analyzed using both phase contrast microscopy (PCM) and transmission electron microscopy (TEM). The concentrations measured ranged from less than 0.013 f/cc to 0.052 f/cc using TEM for all control methods. TEM yields consistently higher exposure estimates than PCM. The results of the study demonstrated that the proposed PEL of 0.1 f/cc can be met using feasible engineering control and work practice methods. OSHA acknowledges that the record may also support the feasible reduction of exposures in this industry to 0.05 f/cc using the proposed work practices and therefore proposes to add mandatory work practice requirements in this sector. Rather than reducing the PEL for this sector to 0.05 f/cc, OSHA has chosen to specify the work practices and controls which appear to be most effective in reducing exposures and will in fact have that effect. The advantages of this approach are the relative administrative ease in enforcing a specification standard and OSHA's belief that reliance on measurements at widely spaced intervals and of doubtful reliability at lower levels would not give employers and employees significant information or protection over the proposed approach.

The proposed standard for the automotive brake and service industry specifies that the employer shall institute the enclosed cylinder/HEPA-filter vacuum system method, a solvent mist/spray can system method, a wet brush-recycle method or any equivalent method of engineering control and work practices which will prevent worker exposure in excess of 0.05 f/cc during brake and clutch servicing operations. Each method consists of engineering controls which must be installed and maintained, and work practices which must be closely followed if the full protection of the control method is to be achieved. As the NIOSH study describes in detail, workers can inadvertently circumvent the protection provided using even those methods that rely most on engineering controls (e.g. the enclosed cylinder/HEPA-filter vacuum method) if certain work practices are not scrupulously applied. The proposed revision to the standard includes the addition of a mandatory appendix which sets out required engineering controls and work practices which must be followed when performing brake and clutch repair operations using the specified methods.

OSHA notes that NIOSH has recommended that while removing, containing and disposing of HEPA filters used during these methods of brake repair, employees wear respirators. OSHA is not adopting that recommendation in this proposal. We note that filter changes occur infrequently (from monthly to more than yearly intervals) and there is no reported data in the record demonstrating that exposures during these operations approach the PEL and/or excursion levels. OSHA notes that requiring respirators triggers other protective provisions of the standard. OSHA does not believe that requiring the regulatory package of respirator-based requirements during these operations would confer any significant benefit. Instead, OSHA requests information concerning recommended work practices employed during filter changes to assure that employees handling asbestos contaminated filters in brake repair and in other operations are not unnecessarily exposed to asbestos.

OSHA has specified three methods that employers may use to achieve compliance, the HEPA-filter vacuum system, the solvent mist/spray can, and the wet brush-recycle method. These three methods have been used successfully for several years and have been studied by NIOSH and private researchers, as indicated in the record [Ex. 84–263, Ex. 90–148]. The enclosed cylinder/HEPA-filter vacuum method and wet brush-recycle method are commercially available, while the solvent mist/spray can system is easily and inexpensively installed. Other methods, as described below, may be acceptable controls, if used according to the specifications in the appendix, to bring exposures of employees engaged in brake and clutch repair to below the proposed PEL. If the rulemaking record provides sufficient supporting evidence, such additional equivalent performance methods may be specified in the final rule as well.

a. *Enclosed cylinder/HEPA vacuum system method.* Paragraph (f)(1)(x) of the proposed standard instructs an employer to comply with the standard through the use of the enclosed cylinder/HEPA-filter vacuum system specified in the proposed appendix. This control method consists of a cylinder designed to enclose the brake or clutch parts during the servicing of the parts. The cylinder must also be designed to prevent the release of asbestos fibers into the worker's breathing zone. The cylinder must have viewing ports and impermeable sleeves through which the worker can handle the brake and clutch servicing. An HEPA-filter vacuum is fitted onto a connection inside the cylinder. A compressed air hose with a nozzle is fitted onto the cylinder and compressed air is used to loosen asbestos dust from the parts. The vacuum is used to remove and contain the loosened material apart from the parts and the cylinder.

A steel cylinder/vacuum enclosure system was one of the five control methods used in the NIOSH study. The steel cylinder/HEPA-filter vacuum enclosure consisted of, besides the steel cylinder, a single glove at one end of the cylinder and an adjustable seal on the other end. While using the steel cylinder/vacuum enclosure in a brake drum servicing operation, the arithmetic mean concentration of airborne asbestos fibers, resulting from the servicing operation, in the personal samples was less than 0.044 f/cc using TEM detection. The study reported that brake dust was observed escaping from the seal of the steel cylinder during the cleaning of the brake parts with compressed air. The problem of scraping asbestos dust from the seals of the steel cylinder would be mitigated by the use of respiratory equipment as specified in the appendix or greater care when directing the spray of compressed air.

An unpublished study of a cylinder held under negative-pressure and the equivalent method described by NIOSH below indicate promising results for reduction of employee exposures in this operation. Since the type of cylinder

which has already been in wide use demonstrates successful achievement of levels below the permissible exposure limit, OSHA is not proposing at this time that negative-pressure cylinders be required.

b. *Solvent/spray can system method.* Paragraph (f)(1)(x) of the proposal allows an employer to comply with the proposed standard through the use of a solvent mist/spray can system as specified in appendix F, as a control method. This system consists of an aerosol or pump spray can filled with a solvent or solvent solution. The spray can is used to dispense the solvent or solvent solution in order to wet the brake or clutch parts. The wetted parts are wiped clean with a cloth which is disposed of according to ways specified in paragraph (k) of the standard or laundered in a way to prevent the release of asbestos fibers in excess of the 0.1 f/cc PEL. The solvent mist/spray can system can be used concurrently with a local exhaust ventilation system to limit the escape of airborne asbestos fibers into the ambient air, but since the method achieves levels well below the PEL without using local exhaust ventilation, OSHA is not proposing to require engineering controls for what appears to be a *de minimis* reduction in exposure over the basic approach.

In the NIOSH study, the aerosol solvent mist/spray can system consisted of the spray can filled with solvent without the use of a ventilation system. The wetted parts were wiped clean by some mechanics using this control method and washed with the aerosol solvent by other mechanics. The use of the aerosol spray can yielded the highest concentrations of ambient asbestos fibers of the four other control methods used in the study. The use of the aerosol spray can method in the study yielded arithmetic mean asbestos fiber concentrations of 0.052 f/cc using TEM detection. The principal advantages of the solvent mist/spray can method are its low cost and the capability to use it on all sizes of brake drums; therefore it is a recommended control method. The problem with the system is that too much force from the solvent spray may cause the suspension of asbestos dust in the air. While the use of a local exhaust ventilation system would catch the suspended dust, OSHA believes that work practices are a practical and immediately applicable substitute.

c. *Wet brush-recycle method.* The wet brush/recycle method used in the NIOSH study consists of a fluid reservoir, a pump, a delivery system (either a low velocity nozzle or a brush attached to a nozzle), and a catch basin. An aqueous solution containing an organic solvent is pumped out of the nozzle or the bristles of the brush and the fluid and brush are used to wash down the dust in the brake assembly into a catch basin. The fluid in the catch basin is returned to a reservoir and recirculated. Using TEM detection, the arithmetic mean concentration of asbestos fibers in the personal samples was less than 0.013 f/cc. The wet brush/recycle system can be used on all sizes of brake systems and limited wetting can be done with the brake drum in place. The wetted brake dust is rinsed down into the catch basin which yields better control of asbestos fibers when the brake drum is removed for further cleaning and servicing. The problem with this system is that the method involves a more problematic cleanup and disposal. The aqueous asbestos contaminated waste must be disposed of in a way which does not violate any OSHA waste disposal or EPA hazardous waste disposal standards. The article recommends that any spill of the contaminated solution be cleaned up using an HEPA filter vacuum or thorough wet mopping and re-mopping. The use of this control method resulted in the lowest concentrations of airborne asbestos fibers among all the control methods used in the NIOSH study.

d. *Equivalent methods.* OSHA has information about potential "equivalent" methods. The NIOSH study describes two alternate engineering controls (a glove box/ vacuum enclosure method, and a HEPA-filter vacuum without enclosure), which may qualify as suitable equivalent methods. Results of the study demonstrated that these control methods are capable of keeping the mechanics' asbestos exposure level to less than 0.05 f/cc. These methods and their characteristics are described below.

The glove box/vacuum enclosure method consists of an adjustable-height, clear plastic, two-glove box with an overlapping neoprene seal; a double motor HEPA filter-equipped vacuum unit; and connections inside the box for an air hose and a vacuum hose. In the study, the glove box was fitted over the brake drum and backing plate on all vehicles except a large truck. Using TEM detection, the arithmetic mean concentration of personal samples was 0.021 f/cc. The article notes the glove box/vacuum enclosure as a superior control method because the two gloves of the system allow both hands to manipulate parts and tools within the enclosure. The primary problem with this control method is the potential for exposure when maintaining and replacing the vacuum filter and when cleaning the enclosure. Care must be taken, through the use of work practices specified in the appendix, to prevent exposures maintenance and replacement of the system parts. Another problem of the system is that it may not be used on all larger brake systems.

The HEPA-filter equipped vacuum cleaner method is used to vacuum dust from inside the brake drum and from around the brake assembly, before and during servicing, as well as dust that falls to the floor and work area. No enclosure, compressed air, or wet methods are used in this control method. The use of this control method resulted in an arithmetic mean concentration of asbestos fibers in personal samples of 0.022 f/cc using TEM detection. One problem with this method is that in order to use the vacuum the drums must be removed before cleaning and this presents a potential for release of asbestos fibers. There is also the potential for exposure during the maintenance and replacement of the vacuum filter and parts. The vacuum cleaner does not use compressed air nor does it generate dust that would need to be contained, as in the vacuum enclosure systems. The vacuum cleaners can be used on brake drums of any size.

In addition to the preferred methods, OSHA is proposing to allow employers to achieve compliance using any other methods equivalent to the solvent spray, wet brush-recycle, and/or HEPA filter vacuum methods, and any other preferred method specified in the final standard. Appendix F also requires that the equivalent method of engineering control and work practices comply with housekeeping standards of paragraph (k) of the standard and labeling requirements of paragraph (j)(2)(ii) of the standard.

Unlike the use of the three specified methods, the employer must demonstrate that the equivalent method reduces employee exposures in that work place to levels approximating the expected reduction achieved through the preferred methods. OSHA is not proposing to use the PEL as the benchmark for equivalency since, as noted above, the reference methods and likely available substitute methods reduce asbestos concentration levels to below the PEL. Based on the evidence available to it, the Agency believes that these reference methods can routinely reduce exposures to or below 0.05 f/cc. OSHA therefore has proposed to require that the employers proof of "equivalency" demonstrate that the

method is capable of routinely achieving such exposure levels. The proposed standard would require that "Such demonstration shall include monitoring data conducted under workplace conditions closely resembling the process, type of asbestos containing materials, control method, work practices and environmental conditions when the equivalent method will be used * * *" Further, the method must be reproducible and the number of measurements should be adequate to be valid. Also it must be demonstrated that the "equivalent" method results in exposures which are "equal to or less than the exposures resulting from the use of Method A, the Enclosed Cylinder/HEPA Vacuum System Method, as set for in Ex. 1–112 (Sheehy, J.W., T.C. Cooper, D.M. O'Brien. 1989. Control of Asbestos Exposures During Brake Drum Service. Appl. Ind. Hyg. 4:313–319) In addition, an equivalent method must be used according to manufacturer specifications, the employer must instruct employees in work practices and provide the method in written form to the employee to ensure its correct use, and employ appropriate housekeeping methods. OSHA also is considering whether the employer should be required to request a variance pursuant to section 6(d) in the Act, in order to prove that this method is "equivalent". OSHA seeks information as to what criteria should be included in the standard to ensure that a method meets these tests. Comment on this is sought.

The Agency is requesting comments on each of the methods described as a preferred control method for brake and clutch repair operations. OSHA requests information on any experiences in use of techniques which should be added to the specifications for engineering controls or work practices. In particular, OSHA is asking for comments on the need for local exhaust ventilation during use of the solvent spray can method. Additionally, OSHA is requesting comments on the utility of specifying the described equivalent methods as designated control methods. OSHA seeks comment on whether there are additional work practices OSHA should require which would effectively reduce asbestos exposure. Further, OSHA requests comment on the appropriateness of lowering the permissible exposure limit in brake and clutch repair to 0.05 f/cc.

d. *Additional housekeeping requirements.* Housekeeping practices have been shown to be effective means of reducing employee exposure to asbestos, tremolite, actinolite and anthophyllite. Consequently, OSHA is proposing to specify that the now required cleaning of floors and surfaces on which dust containing asbestos can accumulate be performed at least once per shift in primary and secondary manufacturing. In addition to the current requirement that a vacuum containing a HEPA-filter must be used, OSHA is proposing that where feasible, wet methods must also be used for clean-up. Once asbestos dust is entrained, it can accumulate on surfaces leading to potentially substantial levels of exposure. Routine removal of dust can greatly reduce these accumulations and the risks that they pose.

e. *Sanding requirements.* OSHA is proposing new §§ 1926.58(g)(2)(iv) and 1910.1001(f)(1)(xi), which would prohibit the sanding and/or buffing of floor tiles containing asbestos with high-speed sanders(buffers). In accordance with EPA recommendations (Exhibit 1–108), only low abrasion pads may be used at speeds lower than 190 rpm in these operations. OSHA believes that without such restrictions this type of mechanized activity may result in the release of levels of asbestos fibers into the air, which may pose a significant risk to workers and to bystander employees. OSHA is also requiring that employers inform employees that high-speed floor buffing may expose them to asbestos.

In October 1989, A.F. Meyer and Associates, Inc., an occupational health and safety consultant, conducted a study on the presence and amount of asbestos fiber released from routine buffing (with standard red buffing pad and standard buffing solution) and stripping, two methods: (1) With standard stripping mixture mopped on and standard black stripping pad, and (2) with mist spray of stripper solution and standard black stripping pad) of vinyl asbestos floor tiles in a Maryland public school. The tests conducted before, during, and after these buffing and stripping operations indicated the following results, published in "Vinyl Asbestos Floor Tile Study—Routine Buffing and Stripping Operations for WRC–TV Washington". Air samples collected in the test classroom before any buffing or stripping were performed detected airborne fiber densities of 30.5 and 45.8 structures per mm^2 (0.01 and 0.015 structures per cc). Asbestos densities of air samples collected inside the work area during the first stripping operation were 91.6 and 229.0 structures per mm^2 (0.029 and 0.072 structures per cc). Air samples collected during the second stripping operation indicated airborne fiber densities of 236,167.6 and 276,316.1 structures per mm^2 (77.5 and 89.2 structures per cc). Air samples collected after the final stripping operation indicated airborne fiber densities of 137.4 and 183.2 per mm^2 (0.045 and 0.06 structures per cc).

On January 25, 1990, in response to the A.F. Meyer study, EPA published a "Recommended Interim Guidance for Maintenance of Asbestos-Containing Floor Coverings," (Ex. 1–106) outlining its analysis of the Meyer's findings. The Agency concluded that, although there was "no clear evidence" that "routine" stripping significantly elevated levels of asbestos fibers, it observed that higher levels did occur after a stripping machine was used on a relatively dry, unwaxed floor.

Work practices recommended by EPA in the same guidance memo ensure that the least abrasive pad available is used to strip wax or finish coat from asbestos-containing floors. EPA also suggests that sanding equipment be operated infrequently and at slow speeds (e.g., 175–190 rpm) to prevent a sudden violent disturbance of asbestos fibers.

On the basis of these and other data, OSHA believes that sanding vinyl floor tiles would likely release high levels of asbestos and, in some cases, asbestos fibers in concentrations in excess of the OSHA proposed permissible exposure limit of 0.1 f/cc. Therefore, OSHA is proposing this prohibition of high-speed sanding. The data indicate that low-speed sanding (i.e., less than 190 rpm) or buffing would not result in levels of airborne asbestos that pose significant exposure risks to employees involved in routine operations, maintenance and repair activities. OSHA's proposed action would reduce the risk from exposure to airborne asbestos fibers with only minimal losses in benefits (i.e., dirtier floors and/or longer cleaning times by hand). OSHA also notes that ACCSH recommended these restrictions, as well as more specific work practices. These recommendations are as follows:

> The stripping of wax or finish coat from asbestos-containing floor coverings shall be performed as infrequently as possible. When this operation is performed, the floor shall be kept adequately wet during the entire operation. Prior to machine operation, an emulsion of chemical stripper in water shall be applied to the floor with a mop to soften the wax or finish coat. Following stripping and prior to application of the new wax or finish coat, the floor shall be thoroughly clean, while wet. The machine shall be equipped with the least abrasive pad possible for the operation, and shall be run at speeds no greater than 190 rpm. Stripping shall cease when the old surface coat is removed so as to prevent overstripping. Machines with an

abrasive pad shall not be used on unwaxed or unfinished floors.

Comments on this suggested expansion of the provisions are requested.

C. The Proposed Expansion of the Competent Person Requirement

A competent person is defined in the current asbestos construction standard (29 CFR 1926.58 (b)) as "* * * one who is capable of identifying existing asbestos * * * hazards in the workplace, and has the authority to take prompt corrective measures to eliminate them * * *". The current standard requires employers to designate competent persons to oversee large-scale removal, demolition, and renovation operations; such operations occur at job sites at which employers are also required to establish negative-pressure enclosures. Specially designated training is required for such "competent persons". Exempt from competent person requirements are small-scale, short-duration removal, renovation and demolition operations where negative-pressure enclosures are not erected. In *Building and Construction Trades Department. AFL–CIO* v. *Brock* (DC Cir. Feb 2, 1988), the Court remanded to OSHA the question of whether employers engaged in any kind of asbestos related construction work should be required to designate "competent persons" to oversee safety measures.

OSHA agrees that all construction site employees would benefit from the presence of a competent person to oversee asbestos-related work. Therefore, OSHA is proposing to expand the competent person requirements to require supervision of all asbestos construction work sites by a "competent person" whose qualifications are keyed to the kind of asbestos operation.

First, the proposed revisions in this asbestos rulemaking clarify the general responsibilities of the competent person by referencing the General Provisions for Safety and Health. Currently, the General Safety and Health Provisions for Construction (29 CFR 1926.20 et seq.) require employers to designate a competent person to ensure compliance with general safety and health requirements at every construction job site. The competent person's duties in this regard include prohibiting the use of machinery or tools not in compliance with safety standards, identifying and removing all machinery or tools not in compliance with safety standards, allowing only trained or otherwise qualified employees to operate equipment and machinery, and instructing employees in how to recognize and avoid unsafe conditions and making them aware of the safety and health regulations applicable to their work. OSHA has determined that these general safety and health-related duties apply to all job sites where worker exposure to asbestos occurs. Therefore, at every construction asbestos job site, an employer must comply with these worker protection requirements. The proposed revisions in this asbestos rulemaking clarify the general responsibilities of the competent person by referencing the General Provisions for Safety and Health.

In addition, the 1986 rulemaking record documented the need to specify the prerequisite training necessary for competent persons who will be working at those sites where there is likely to be substantial exposure to asbestos. Thus as noted above, in addition to the general competent person required at all job sites, the current standard requires employers to designate a competent person specifically for asbestos removal, demolition, and renovation work except for small-scale, short term jobs. The duties of the competent person who will oversee asbestos-related jobs include setting up a regulated area, enclosure, or appropriate containment, ensuring the integrity of the enclosure or containment, controlling entry to and exit from the enclosure, and supervising compliance with this standard. The competent person must also be trained in how to identify, recognize, handle, and remove asbestos, in a comprehensive course such as the one conducted by an EPA Asbestos Training Center, a 5-day course (29 CFR 1926.58 (e)(6)(iii). OSHA notes that ACCSH recommended that a comparably trained competent person be assigned to every construction work site, not just abatement operations, and that installation of new asbestos-containing materials requires the presence of a trained competent person.

OSHA is proposing to expand the current competent person provisions of the asbestos standard to require the designation of a specially trained competent person at all renovation, removal and demolition operations covered by the standard. The proposed revisions also clarify the responsibilities of competent persons at such sites and specify the training and qualifications required to equip a competent person to fulfill these duties. The proposed revisions tier the training requirements. Competent persons for small-scale, short-duration operations need not receive the same training as those for large-scale asbestos operations; however, some competent persons who will be overseeing small-scale, short-duration operations may find the additional training useful. Thus, training for small-scale, short-duration operations need not include setting up large-scale enclosures or containment, large-scale removal, demolition, and repair techniques, or other topics applicable only to large-scale operations.

To ensure that competent persons receive training, prospective competent persons will be required to complete a comprehensive training course. OSHA is not proposing at this time to require specific curricula or OSHA accreditation for these training courses. Numerous sources currently offer courses that cover the topics listed above; for example, those courses designed to meet the requirements of EPA's Asbestos Containing Materials in Schools Standard (40 CFR part 763). EPA's Model Accreditation Plan specifies curricula for courses directed at asbestos inspectors, management planners, project designers, abatement contractors, supervisors, workers, and operations and maintenance personnel. The Model Plan specifies the required length of each course and the minimum criteria the course must satisfy in order to receive EPA accreditation. Specifically EPA has stated the following:

> * * * inspectors must take a 3-day training course; management planners must take the inspection course plus an additional 2 days devoted to management planning; and abatement project designers are required to have at least 3 days of training. In addition, asbestos abatement contractors and supervisors must take a 4-day training course and asbestos abatement workers are required to take a 3-day training course. For all disciplines, persons seeking accreditation must also pass an examination and participate in annual re-training courses. A complete description of accreditation requirements can be found in the Model Accreditation Plan at 40 CFR part 763, subpart E, appendix C.I.1.A. through E. (54 FR November 29, 1989 at 49190).

EPA, up until October 15, 1989, required accreditation for training programs offered to meet the requirements of 40 CFR part 763. By that time, EPA had accredited 1,362 courses. States will continue to certify courses with assistance from EPA.

Courses designed to train asbestos abatement supervisors and operations and maintenance personnel are likely to be sufficient training for competent persons. Courses for supervisory

personnel generally last from 4 to 5 days, whereas those for operations and maintenance personnel last about 2 days. The supervisory courses cover all aspects of employee health and safety, use of protective equipment, recognition and handling of asbestos, and emergency procedures. These courses may be sufficient for competent persons overseeing large-scale asbestos operations. Operations and maintenance courses generally cover recognition and identification of asbestos, small-scale removal techniques, employee safety and health, emergency procedures, and glove-bag techniques. These courses may be sufficient for training competent persons to oversee small-scale, short-duration asbestos operations. Some asbestos training programs also offer courses specifically for small-scale, short-duration operations or restricted-handler operations. These courses cover issues specific to small-scale and short-duration removal operations as well as general employee safety techniques. Some asbestos training facilities also offer training that is custom-designed for specific job sites or types of operations.

As a more extensive alternative, ACCSH submitted the following recommendations for training of competent persons:

(i) Prior to performing or supervising any work covered by this section, the competent person shall be trained, examined and certified in accordance with the requirements for the training, examination, and certification of employers set for in paragraph _____ of this standard.

(ii) For small-scale, short-duration operations, the competent person shall be trained, examined and certified in all aspects of asbestos work applicable to small-scale short-duration operations, including the contents of this standard, subpart C of part 1926, and section 59 of part 1926 (Hazard Communication Standard), the identification of asbestos, the ability to determine whether an operation meets the requirements of this section for designation as a small-scale, short-duration operation, procedures for setting up and use of glove bags and mini-enclosures, use of wet methods, and all other controls, techniques, work practices and other requirements of appendix G of this Standard.

The ACCSH further recommended the following regarding the training, examination, and certification of employers:

(1) This paragraph applies to all competent persons engaged in, or supervising, work covered by this section. The training, examination and certification of all of the employer's competent persons shall constitute compliance by that employer with the requirements of this paragraph.

(2) Prior to engaging in any work covered by this section, employers shall be trained, examined, and certified in all of the subjects set forth in paragraph (k)(3) (iii) and (iv) of this section as well as in the following:

(i) Assessing the estimated level of potential asbestos exposure through a knowledge of percentage weight of asbestos in asbestos-containing material, friability, age, deterioration and location.

(ii) Personal air monitoring requirements and procedures, and the knowledge of PEL and action levels.

(iii) The degree of protection afforded by different types of respirators, and the feasibility of different types of respirators for different asbestos-related operations.

(iv) Preparing a work area for asbestos work, including defining the regulated areas, constructing negative-pressure enclosures, otherwise isolating work areas to prevent employee, bystander or public exposure, establishing decontamination areas, and preparing work areas after completion of work.

(v) Employee and employer training, examination and certification requirements and procedures, and qualification requirements for instructors.

(vi) Bonding and insurance requirements for employers engaged in asbestos work.

(vii) Reporting, recordkeeping and record transfer requirements.

(viii) Supervisory techniques and procedures.

(ix) Contract specifications.

(x) Requirements and procedures for providing information to employees and their designated representatives.

(xi) All other duties and functions of competent persons contained in this Standard.

(2) The training required by this paragraph shall include both classroom-type training and hands-on performance-type training.

(3) Examination and Certification. (i) Prior to engaging in any work covered by this section, employers shall be examined by qualified instructors not employed by such employer or by any company affiliated with such employer, on all subjects as to which training is required by this paragraph. The examination shall include both written questions and answers and hands-on proficiency evaluation.

(ii) Certifications issued to employers by qualified instructors shall contain the name, address and telephone number of the employer so certified, the name, address and telephone number, and certification dates and numbers, of all competent persons employed by the employer, the name, address and telephone number of the instructors who provided the employer training and examinations and who issued the certification, the date of issuance of certification, and statement that the certification is valid for one year only.

(4) Access to Training Materials. The employer shall make readily available to affected employees and their designated representatives, without cost, all written materials related to the employer training program and a copy of the employer's current certification.

Although not specifically an issue in the Court remand, OSHA is presenting the following ACCSH recommendations regarding the qualification and certification of employers and employees:

(1) All training of employees and employers, required by paragraphs (k) ___ and ___, shall be provided by individuals knowledgeable and experienced in the construction trade involved, possessing academic credentials and/or field experience in asbestos work, trained in teaching skills, and certified as meeting all such qualifications. Instructors providing training of employees and employers engaged in asbestos removal, renovation or demolition shall be accredited as meeting requirements no less stringent than those contained in the EPA model contractor accreditation plan (52 FR 15876, 1987).

(2) Instructors providing training in air monitoring requirements and procedures must be certified industrial hygienists. Instructors providing instruction on the health effects of asbestos and on medical surveillance program requirements and procedures must be either industrial hygienists or certified health professionals.

Finally, the Committee also described its proposed OSHA oversight of training programs, examinations and certification:

(1) Employee and employer training programs, including training materials, course curricula, course outlines and manuals, description of teaching methods and of hands-on facilities, examinations and examination procedures, and certifications and certification procedures, as well as the names, telephone numbers and addresses of the employer's competent persons and of instructors of employee and employer training, shall be provided to OSHA upon request. OSHA may require changes in any of these items for the purpose of assuring that employees, employers and instructors possess the qualifications set forth in this section.

OSHA believes that the recommendations of ACCSH pertaining to the competent person and training and certification requirements deserve careful consideration. Therefore, OSHA requests comment on these recommendations.

Additionally, OSHA requests comments, including suggested alternatives, on several questions related to training: Are courses available that are sufficient to cover the requirements for specially tailored competent persons? Is the training offered in courses adaptable to small-scale, short-duration operations? Should OSHA supply model curricula for training? Do existing competent person training curricula and requirements need to be updated by incorporating training in new technologies? Should OSHA require certification of training courses? Could OSHA's required training be effectively incorporated into training

that meets current EPA asbestos training requirements? Should training be required for employees in all asbestos removal, demolition and/or removal operations? OSHA additionally requests comment on all aspects of its proposed competent person requirement.

OSHA believes that expanding the competent person requirement raises no feasibility issue. The general construction "competent person" requirement requires no special training. As noted, requiring additional training for supervisors of small-scale, short duration operations would entail a 16-hour asbestos-control course. OSHA believes that demands for this training can be met either by existing resources or by training resources expanded to meet any demands created by this amendment. Comment on this is requested.

In addition to its recommendations for training of competent persons, ACCSH has recommended the following regarding training of *all* exposed workers:

(3) Employee Information and Training. (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, and shall ensure their participating in the program. The training program shall include examination and certification components. The employer shall not allow any non-certified employee to perform work covered by this section. To be certified, employees must be trained and examined as provided below.

(ii) Training, examination and certification shall be provided by a qualified instructor prior to the time of initial assignment by the employer unless the employee has been provided equivalent training, examination and certification within the preceding 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each employee is trained and examined in the following:

(A) Methods for recognizing asbestos, and physical characteristics of asbestos and asbestos-containing material.

(B) The health effects associated with asbestos.

(C) The relationship between smoking and asbestos in producing lung cancer.

(D) The names, addresses, and telephone numbers of public health organizations which provide information, materials and/or conduct programs concerning smoking cessation. The employer may distribute the list of such organizations contained in appendix J to comply with this requirement.

(E) The nature of operations that could result in harmful exposures to asbestos, and the importance of controls to minimize such exposures, including engineering controls, work practices, protective equipment including respirators and protective clothing, housekeeping procedures, hygiene facilities, decontamination procedures, emergency procedures, and waste disposal procedures, and all necessary instruction in the use of these controls and procedures.

(F) The purpose, selection, fitting, testing, maintenance and cleaning, and limitations of respirators.

(G) Medical surveillance program requirements.

(H) the contents of this standard, including appendices, and of 1926.59 (Hazard Communication Standard), subpart C of part 1926 (General construction Safety and Health Standards), and 1910.20 (Employee Access to Exposure Records and Employee Medical Records).

(iv) Notwithstanding paragraph (k)(3)(ii), in addition to the requirements in paragraph (k)(3)(iii), prior to commencing asbestos work at any project or building, every employee shall be trained by the employer in all proper and applicable job-specific work practices including respiratory protection, work area preparation, decontamination, spill and emergency, and waste disposal procedures. Employers shall not allow any employee to perform work at the project or building unless the employee has received such job-specific training.

(v) The training required by paragraphs (k)(3) (iii) and (iv) shall include both classroom-type training and hands-on performance-type training.

(4) Examination and Certification. (i) The examination required by paragraph (k)(3) shall include both written questions and answers and hands-on proficiency evaluation.

(ii) Certifications issued to employees by qualified instructors shall contain the name, address and telephone number of the employee, the name, address and telephone number of the employer, the type of asbestos work in which the employer is engaged, the date of issuance of the certification, the name, address and telephone number of the instructors who provided the training and examination and issued the certification, and a statement that the certification is valid for one year only, and that job-specific training must be provided by the employee's employers at every project and building during the year the certification is in effect.

(5) Access to Training Materials. (i) The employer shall make readily available to all affected employees, and their designated representatives, without cost, all written materials relating to the employee training program.

(ii) Employees shall have access to copies of examinations they have taken, including examination grades and instructor comments. Designated employee representatives shall have access to such information, except for individually identifiable exam results which shall be made available only with the employee's authorization.

(6) Employee Retesting. The employer shall allow trainees to be retested at reasonable intervals and shall adopt written procedures for this purpose which shall be made available to trainees and their designated representatives.

OSHA invites comments on these proposed expansions of the training requirements for asbestos-exposed workers.

Recently, OSHA learned that Congress is considering extending the training requirements of EPA's rule pertaining to Asbestos-Containing Materials in Schools (52 FR 41826, October 30, 1987) pursuant to the Asbestos Hazard Response Act (AHERA) to public and commercial buildings. The EPA rule requires maintenance and custodial staff to receive at least 2 hours of awareness training and that staff which will disturb asbestos-containing building materials receive an additional 14 hours of training. Further, it requires accreditation of persons who inspect for ACM in school buildings; who prepare management plans for such schools; and/or who design or conduct response actions. Accreditation is gained from a State that has instituted a program at least as stringent as the requirements of the EPA's Model Plan (52 FR 15875, April 30, 1987) or by passing an EPA-approved training course an examination consistent with the Model Plan. The Plan requires persons seeking accreditation to take an initial course, pass an examination and participate in continuing education.

OSHA realizes that, if adopted, these requirements will likely impact the training of workers covered under the OSHA standard and wishes to reconcile any differences or inconsistencies in the training requirements for asbestos workers which might lead to confusion or misunderstanding. Therefore, OSHA seeks comment as to how to best apply the training requirements to ensure worker protection and coordinate them with those of other agencies. OSHA seeks comment on the question of whether OSHA should adopt similar training requirements for asbestos workers covered under its standard as those specified in AHERA.

Training programs required in the asbestos standards are to be provided by the employers, who also must ensure the participation of affected employees. As discussed above, most major elements of the required OSHA training program are covered by an asbestos-worker training program required under AHERA. However, the AHERA-required training exceeds in breadth and length of training sessions, the OSHA requirements. Above, OSHA has asked for comments on whether the AHERA worker training and certification should be required also by OSHA.

OSHA now requires that employers provide all training except for initial training under the construction standard if an employee has received "equivalent

training within the previous 12 months." (29 CFR § 1926.58(k)(3)(ii)). This is in recognition of the fact that many abatement workers change employers frequently. Thus, requiring duplicate training from each new employer at each new job would be of *de minimis* benefit to employees. The intent however, of this exception was not to shift to the employee the cost of required OSHA training, nor to encourage him/her to obtain, at employee expense AHERA certification within 12 months of applying for work covered by the OSHA standards.

OSHA has been informed that in certain regions employers are requiring AHERA certification as a condition of employment for abatement work covered by OSHA standards. The Agency is interested in comments and information concerning how widespread such a practice is; whether the reason is to shift the OSHA training cost to employees, or whether there are other reasons; whether such a practice results in little or no job site training; and if so, how employee health and safety are affected.

D. Proposed Extension of Reporting and Information Transfer Requirements

1. Notification and Reporting Requirements

OSHA is proposing expanded notification and reporting provisions in the construction standard to respond to the Court of Appeals remand order and to incorporate some recommendations of the Advisory Committee on Construction (Exhibit 1–126).

The Court's decision dealt with two notification and reporting issues. First BCTD has asked OSHA to require employers contracting asbestos-related work to establish, maintain and transfer to building owners written records of the presence and locations of asbestos or asbestos products, in order to facilitate identification and prevention of asbestos hazards. The Court remanded this issue so that the Agency reach "its own judgment on the issue" of whether it was legally empowered to adopt such a requirement (See *BCTD* v. *Brock, supra* at 1278).

The second issue is whether OSHA should require all construction industry employers to file reports with it prior to engaging in any asbestos work, as maintained by BCTD. The Court remanded the issue for consideration on remand, after finding that the record contains "uncontradicted (and unanalyzed) evidence of non-*de minimis* benefits" (*Id*).

The following discussion explains OSHA's proposal as it pertains to certain of these issues. First, OSHA discusses its expanded provisions dealing with notification by and between employers and building owners in order to facilitate identification of and protection from asbestos in buildings. Second, OSHA discusses proposed provisions requiring some construction employers to report asbestos-related work to the Agency before it is begun.

2. Communication Among Employers, Employees and Building Owners

a. *Notification to and from building owners.* Current regulations, in paragraph (d), require employers to notify other employers in the building of the existence and location of asbestos work. However, the Agency had applied a narrower definition to the term "employer" based on its concern that building owners were "outside the domain of the OSH Act." (OSHA Brief at 96). As noted above, the Court remanded this issue to OSHA for further consideration in light of the statutory prescription that standards are to require conditions, or the adoption or use of one or more practices, means, methods, operations, or processes reasonably necessary or appropriate to provide safe or healthful employments and places of employment" (29 U.S.C. 652(8)). Upon further analysis, the Agency believes that it has authority to require building owners who are statutory employers to take necessary and appropriate remedial action such as notifying other employers, to protect employees other than their own. In other standards OSHA has required building owners and other employers who are not the direct employers of the employees exposed to a particular hazard, to warn of defects, take remedial action or provide information to the directly employing employer. For instance, the Hazard Communication standard requires that manufacturers provide information to downstream employers to protect their employees (29 CFR 1910.1200). The powered platform standard, promulgated in 1989, (54 FR 31408, July 28, 1989, at 341412–3) requires the building owner to assure the contract employer that the building and equipment conform to specified design criteria.

Because it is evident that the building or project owner is the best and often the only source of information concerning the location of asbestos installed in structures, OSHA believes it is appropriate to require the owner to receive, maintain, and communicate knowledge of the location and amount of asbestos-containing materials, to employers of employees who may be exposed.

b. *Communication provisions.* OSHA is proposing a comprehensive notification scheme for affected parties—building owners, contract employers and employees, to assure that information concerning the presence, location and quantity of asbestos-containing material in buildings is communicated appropriately and in a timely manner to protect employees who will work with or in the vicinity of such materials. OSHA has reviewed and incorporated in the regulatory text many suggestions recommended by ACCSH at its March 14, 1990 meeting.

The highlights of the proposed notification scheme are as follows. Before non-small-scale, short duration renovation, removal or demolition operations take place, building and/or project owners must notify their own employees and employers whose employees may work in or contiguous to the areas of such operations, of the quantity and location of asbestos-containing materials present in such areas. Employers who have not received notice from the building owner of impending asbestos-related activity, must notify the building owner if the employer is planning any such covered activity and of the location and quantity of asbestos material known or later discovered. The building owner must keep record of all information received through this notification scheme, or through other means, which relates to the presence, location and quantity of asbestos-containing materials in his/her building and must transfer all such information to successive owners.

Other employers may not normally be aware of projects going on in other parts of the building, including regulated areas. Staff and crews not working directly with asbestos, tremolite, anthophyllite, or actinolite may nevertheless come into proximity with the regulated areas, and these staff are unlikely to be aware of the hazards of these substances and of appropriate protection measures. Because the safety and health of his or her employees in the workplace is the responsibility of the building owner, the Agency believes that the building owner must also notify his/her employees who may work near where the work with asbestos is being done. OSHA believes that the employee's presence in the workplace places him at increased risk from asbestos exposure regardless of whether he/she is actually working with asbestos.

Additionally, the proposal expands OSHA's current employer notification

requirements which apply only to multi-employer worksites. Any employer planning to perform work which will be in a regulated area, before starting, must notify the building owner of the location of asbestos and protective measures taken; (Paragraph (d)(2)(i)); upon discovering unexpected asbestos, must immediately provide similar notification ((d)(2)(iii)); and, upon work completion must provide to the owner a written record of the remaining asbestos at the site ((d)(2)(iv)).

To provide notification in small-scale, short-term operations and to make this notification scheme effective, OSHA is building upon its requirement to post regulated areas to encourage posting of small-scale, short duration operations. Thus, notification requirements for these operations will be met if appropriate signs which inform about the fact that asbestos exposing activities are present are posted. OSHA considers site posting to be a particularly effective means to alert employees of hazardous areas. Because, by definition, small-scale, short-term activities present greatly reduced hazard potential, OSHA believes that site posting will adequately notify potentially affected employees who are not working on the operation.

The expanded notification provisions are limited to the construction standard because the primary purpose of the proposed expanded notification provisions is to protect employees from asbestos exposure resulting from construction activities which disturb previously installed asbestos-containing materials in structures and buildings. The ACCSH identified employees who perform security services as requiring notification of in-place asbestos-containing materials. OSHA has no information indicating that such employees face increased hazards from asbestos exposures in buildings, above those faced by other building occupants. Therefore OSHA has not included these employees in its notification scheme. Comments are requested on this approach. However employees who buff asbestos-containing floor tile, as part of a removal activity, would be performing a construction operation, and as a housekeeping function, would be performing a general industry operation. Thus, OSHA has prohibited high-speed buffing of asbestos-containing floor tile in both standards. The newly proposed prohibitions cannot be sufficiently protective unless employees know that the floor is asbestos-containing. Therefore, OSHA has included in the provisions prohibiting high-speed buffing, an additional element that employees must be informed of the reason for the prohibition, i.e. that high-speed buffing may release asbestos fibers.

OSHA requests comments on the proposed notification requirements. In addition, OSHA invites comments on setting a cutoff for asbestos-containing material with minimal asbestos content. For example, is 0.1% asbestos minimum, as provided in the Hazard Communication Standard, appropriate to this standard? In addition, OSHA seeks comment on whether the Agency should require building owners to determine the presence, location and amount of asbestos within their buildings. OSHA requests information on experience and costs involved in such a requirement.

3. Proposed Requirements for Notifying OSHA of Demolition, Renovation, or Removal Operations

OSHA is proposing to add a new provision to the standards that will require employers to provide OSHA with written notification prior to engaging in any building demolition, renovation, and removal operations which involve materials containing asbestos, tremolite, anthophyllite, or actinolite. Operations which meet the proposed definition of small-scale, short duration operations are exempt from this notification requirement.

The Building and Construction Trades Department (BCTD), AFL–CIO, suggested that OSHA should require all construction industry employers to file reports concerning any building demolition, renovation or removal project involving asbestos prior to beginning such project. BCTD believed that information generated by such reports would enable the Agency to more efficiently enforce the regulations, which would have the effect of increasing employer compliance and decreasing the risk to workers. BCTD also pointed out that workplace standards for acrylonitrile and inorganic arsenic require employers to supply the address of their workplace, report the number of employees working within the regulated area, and describe each operation that will cause employees to be exposed to the regulated substances.

The Court remanded the notification issue to OSHA for it to reconsider whether a notification requirement would increase compliance by generating better information for targeting inspections and by increasing self-policing among employers who must submit reports. OSHA is proposing to institute a notification requirement, based on its preliminary conclusion that a notification requirement can be designed in such a way that it will improve the targeting of inspections and heighten employer awareness of applicable requirements without imposing unwarranted burdens on employers or strains on limited Agency enforcement resources. OSHA concludes that such provisions will substantially improve worker protection.

Consistent with the proposed NESHAP revision (54 FR at 912, January 10, 1989), in which EPA proposed a uniform 10-day period for written notification, OSHA is similarly proposing a 10-day requirement. The written notification supplied to OSHA must include the name, address, and telephone number of the employer; the location of the facility where the operation will occur; the scheduled start and completion dates of the operation; a description of the facility on which the operation is to occur, including its size, age, number of floors, how the facility is used at present and was used in the past; the procedure used to detect the presence of asbestos material in the facility; the estimated amount of materials containing asbestos; a description of the planned operation, including methods that will be used to perform the demolition, renovation, or removal activity; a description of work practices and engineering controls to be used to comply with the OSHA worker protection standards for the construction industry; certification that a competent person as required by paragraph (o) of this section will supervise the operation described in the notification.

Given the complexity of some building demolitions and renovation work, it is possible that some asbestos may not be discovered until after the work has begun; therefore, OSHA is considering whether notification should also include a description of the procedures to be used in the event that unexpected amounts of asbestos are discovered during the operation. Written notification of such a contingency plan would enable the OSHA area office to evaluate whether the employer is prepared to adequately handle such a situation. OSHA seeks comment on this matter.

OSHA believes that employer notification would act as an incentive for employers to comply with the worker protection standards and better enable them to police their workplace for hazards. OSHA's objective in proposing these new notification standards is to encourage compliance and to better enforce compliance with health and safety standards through inspections and monitoring. Notification assists

OSHA in locating sites where asbestos projects are scheduled to occur so that OSHA can inspect and monitor the site for compliance with the regulations. Scheduled inspections can be prioritized according to relative risk to workers, based on the information provided in the notification. The notification will also assist OSHA in assessing the success of its regulation and the status of compliance among its local regulated community.

The proposed OSHA notification standard requires that the employer provide notice of an asbestos project in connection with an impending demolition, renovation or removal operation 10 days prior to beginning such an operation; thus, prior notice gives OSHA the opportunity to evaluate compliance efforts before the regulated activity actually begins and thus provides the opportunity for preventive action as opposed to just corrective action. The information included in the notification would also provide OSHA with written indication of how successful the regulations are in achieving compliance among the regulated parties.

The proposed notification is modeled after the notification requirement concerning asbestos abatement projects that occur in conjunction with building demolition and renovation operations as contained in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR part 61.146). Employers in all building demolition operations, and in renovation operations involving amounts of asbestos at least 260 linear feet on pipes and 160 square feet on other facility components must provide notice of these operations to the EPA. One of the purposes of the notification of EPA is to assist the Agency in enforcing its regulations. EPA is in the process of revising its rule to clarify its notification requirements.

Employers can satisfy the OSHA notification requirement simply by forwarding a copy of the EPA form to the OSHA area office when complying with EPA's asbestos NESHAP. The individual items of information requested in the proposed OSHA notification standard parallel the information requested in the Asbestos NESHAP notification requirements. OSHA recognizes that there are minor differences in the content of the OSHA notification and the NESHAP notification but does not believe that these differences will impede the achievement of OSHA's objective in promulgating the notification requirements, that is, to encourage compliance among employers and to facilitate inspection and monitoring. Comment on the proposed method of notification of OSHA is requested.

In its proposed NESHAP revision (54 FR 912, January 10, 1989), EPA proposed to require additional notification if the demolition or removal operation will begin on a date other than the one specified in the original notification. OSHA requests comment as to whether its proposed notification requirements should be similarly modified.

EPA has expressed the belief that the revision of the Asbestos NESHAP to include more stringent notification requirements will serve to improve compliance within the regulated community and to improve enforcement of the regulations (54 FR 915, January 10, 1989). EPA has increased enforcement against employers who fail to comply with notification requirements; such failure is a clear violation that can be cited even if the operation has been completed by the time the inspector arrives. The number of notification submissions has increased substantially during the past few years, from 23,022 to 52,571 between 1985 and 1988. EPA expects to receive an estimated 60,000 notifications in 1989. EPA attributes this increase in notification submissions to increasing employer familiarity with the NESHAP rather than to merely increased numbers of abatement actions. Given the number of notifications that the EPA receives each year, OSHA can expect that its offices would receive as many or more. Such a large number of responses could strain OSHA's administrative resources; therefore, OSHA may share enforcement information with EPA. Information concerning current requirements of local jurisdictions concerning reporting of asbestos-work is requested.

EPA extended the major provisions of the 1986 asbestos standard to state and local government employees not covered by the OSHA standards in its worker protection rule (52 FR 5618, February 25, 1987). Among the few differences between the EPA rule and the OSHA standard is the requirement that EPA be notified 10 days before the start of an abatement project involving more than 3 linear feet or 3 square feet of friable asbestos. No notification is required however, for jobs which do not involve friable asbestos. Comment is requested on this cut-off, as well that the NESHAP cutoff notes above, for the amount of asbestos for exemption from the notification requirements of this proposal.

As noted above, employers involved in operations defined as small scale, short duration are exempt from this requirement to notify OSHA. There are a large number of small-scale, short-duration projects, and such projects are typically completed very quickly. It is anticipated that many notifications reported to OSHA will involve those operations whose size falls between the OSHA-defined small-scale, short duration operation and EPA's minimum for notification, as well as those larger operations which involve asbestos, but for which notification of EPA is not required.

Due to the potential for asbestos emissions in asbestos handling, EPA has proposed to clarify its definition of asbestos-containing material in its NESHAP regulation as follows:

> Asbestos-containing material means friable asbestos material and non-friable asbestos material that potentially can be broken, crumbled, pulverized, or reduced to powder in the course of operations regulated by this subpart. (54 FR 925, January 10, 1989)

As a result of this change, more information will be provided to EPA and existing notification procedures improved. ACCSH agreed that OSHA should require pre-job notification from asbestos employers, but, on a broader basis. Comments are requested on ACCSH's recommended reporting requirements.

OSHA has participated in interagency initiatives to coordinate agency regulation involving communication and notification. EPA and OSHA, along with other agencies which regulate asbestos exposure, are continuing to coordinate their efforts by means of a Federal Asbestos Task Force. Minutes of some meetings of the task force are in the docket of this proceeding (Exh. 1-____). The most recent such effort was begun in 1989 when EPA established "Asbestos in Public and Commercial Building Policy Dialogue" whose purpose is to obtain input from a variety of perspectives on the problems and potential solution to problems related to asbestos in commercial and public buildings. Participants included representatives of the following:

Realty interests
Lenders and insurance interests
Unions
Asbestos manufacturers
Public interest
Asbestos consultants and contractors
States

Following a series of meetings held between May 1989 and May 1990, the "Policy Dialogue" group issued a draft final report on May 31, 1990 (Ex. 1-186). The group failed to reach a consensus on all issues, but did generally agree on

some issues. There was general agreement among the participants that the presence of asbestos should be known to building service workers. Union representatives, citizen representatives, asbestos consultants and contractors, and state officials felt that there should be a requirement to notify workers and building occupants in all circumstances in accordance with the likelihood of building workers of occupants disturbing asbestos. OSHA has recognized these general approaches in its proposed amendments.

The major area of disagreement among the participants in the Policy Dialogue Group dealt with the characterization of risk to general building occupants and office workers. Unions, public interests, and asbestos consultants and contractors held that building occupants are at risk especially when the presence of asbestos is unknown and therefore subject to inadvertent disturbance, resulting in exposure. State, union, public interest representatives, and asbestos consultants and contractors believe that available data is insufficient to allow the conclusion that building occupants are generally safe, regardless of how the asbestos is managed.

The representatives of realty, lenders, and insurance interests as well as those of asbestos manufacturers believe that the data do not show a significant health risk to general building occupants and that building occupants are generally safe, irrespective of how the asbestos in the building is managed. Further, the latter group held that only building service personnel were at potential risk from asbestos and therefore their exposure should be subject to regulation by OSHA.

Union and citizen representatives believe it to be a public health problem, and that EPA should assume the primary regulatory role.

The need for a specific federal asbestos inspection requirement was also discussed by the Policy Dialogue Group, but agreement could not be reached on this point. In the preamble to its 1986 asbestos standards, OSHA stated that it "did not explore in detail the complex area of asbestos contamination in buildings because the available evidence shows that buildings containing even disturbed asbestos expose employees (i.e. who are building occupants) to levels considerably below the action level adopted in this (the 1986) standard." OSHA seeks new information which might be available concerning the risk to building occupants presented by asbestos in buildings.

Additionally, OSHA seeks comment on the question of whether or not to include as a requirement, the operation and maintenance (O & M) program which was part of non-mandatory appendix G in the 1986 standard. This program included: Development of an inventory of all asbestos-containing materials in the facility; periodic examination of all asbestos-containing materials to detect deterioration; written procedures for handling asbestos materials during the performance of small-scale, short duration maintenance and renovation activities; written procedures for asbestos disposal and emergencies; and a training program for maintenance staff. In this rulemaking OSHA proposes to exclude this requirement from mandatory appendix G.

OSHA believes that its requirements in the construction standard, as proposed to be revised are consistent with EPA's NESHAP requirements. OSHA's requirements are directed at reducing worker exposure from all operations which disturb asbestos using effective work practices and engineering controls in order to reduce still significant risks of asbestos-related disease to exposed workers. EPA's requirements are primarily aimed at reducing asbestos emissions from large-scale renovation and demolition activities in order to reduce risk to the general public from increases in ambient levels of asbestos. Therefore some, but not all, OSHA-covered asbestos related activities would be subject to NESHAP requirements; and vice versa. Large-scale removal and renovation projects involving large quantities of asbestos-containing materials (ACM) would be covered under both regulations. However, maintenance and repair activities disturbing small quantities of ACM would not be subject to most NESHAP requirements. A large-scale renovation job subject to both regulatory schemes would, in the Agency's view, not be subject to inconsistent requirements. Thus, under OSHA's regulations, a negative pressure enclosure must be established; under NESHAP, wet methods must be used for removal; under both standards, both Agencies must be notified in advance, but OSHA would accept the EPA notification form. OSHA requests comment on whether it too should explicitly require use of wet methods for all abatement work. The Agency notes that the proposed mandatory appendix G would require that an employer must use feasible wet methods to avail himself of the small-scale, short duration operation exemption from the requirement for establishing a negative-pressure enclosure.

OSHA recognizes the benefits of consistency with other regulatory agencies in its requirements and seeks comments and information from participants to avoid inconsistencies or conflicts. OSHA desires that the Agency's requirements be congruent with those of other agencies and minimize confusion. Comment on the proposed notification requirements is requested. In particular, OSHA seeks to learn of any difficulties or confusion encountered by contractors seeking to comply with the regulations of more than one agency.

E. Other Issues

1. Scope and Application

OSHA is proposing clarifying regulatory text to be inserted in the scope and application paragraph of the construction standard. This would unambiguously state that coverage under the construction standard is based on the nature of the work operation involving asbestos, not on the employer's primary activity (29 CFR 1926.58 (a)(7)). This position in accord with the Agency's longstanding policy on this issue, and should assure that employers are aware of the fact that construction activities trigger the requirements of the construction standard.

2. Maritime Asbestos Activities

In its 1986 rulemaking, OSHA considered maritime asbestos operations to be regulated under the general industry standard (1910.1001). Upon subsequent reconsideration, OSHA has noted that many maritime activities are construction-like in nature. Therefore, OSHA seeks information and comment as to how best to provide equivalent protection to workers engaged in maritime activities.

3. Naturally-Occurring Asbestos in Soil

In recent submissions to the asbestos docket (Exh. 3–10 and 3–11), OSHA has been informed that naturally occurring asbestos deposits are present in areas of the United States and that when disturbed, for example during earthmoving projects, mining and milling operations, drilling, blasting and rock sawing operations, the asbestos in the deposit can become airborne and expose workers performing these activities to significant levels of asbestos fibers. OSHA proposes to consider that this exposure is included under its present construction standard for asbestos and that methods of control be employed to avoid worker exposure

to naturally occurring asbestos deposits which might become airborne during disturbance of the deposits. OSHA solicits comments on this matter. Are there additional or changed requirements to the provisions in the current construction standard which should be adopted in order to protect workers engaged in these activities? Further, OSHA seeks information on the appropriate method for determination of the presence of asbestos in soil and the effectiveness of wet methods and/or other methods in controlling worker exposure. OSHA also requests information on effective decontamination methods for exposed workers.

IV. Preliminary Regulatory Impact and Regulatory Flexibility Analysis: Introduction

In this proposed revision to the standards governing occupational exposure to asbestos, tremolite, anthophyllite and actinolite, OSHA is seeking to lower the permissible exposure limit in all affected industry sectors to 0.1 f/cc as an 8-hour time-weighted average; extend reporting and transfer requirements for employers engaged in asbestos removal, renovation and demolition; expand the competent person requirement to all employers in construction; require the establishment of negative-pressure enclosures; require engineering and work-practice controls in the automotive brake and service industry; redefine small-scale, short-duration construction operations; add requirements for housekeeping in general industry; and prohibit high-speed sanding of asbestos floor tile. This preliminary regulatory impact analysis examines the population at risk and significance of risk from exposure to asbestos, the estimated costs of compliance, the projected reduction in cancer cases as a result of lower exposures, and the estimated economic impacts of the proposed rule. Much of the analysis presented below is based upon the draft final report submitted to OSHA by CONSAD Research Corporation [2].

Executive Order 12291 (46 FR 13197) requires that a regulatory impact analysis be prepared for any proposed regulation that meets the criteria for a "major rule," that is, one that would likely result in an annual impact on the economy of $100 million or more; a major increase in cost or prices for consumers, individual industries, federal, state or local government agencies, or geographic regions; or significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets. In addition, the Regulatory Flexibility Act (5 U.S.C. 601, *et seq.*) requires an analysis of whether a regulation will have a significant economic impact on a substantial number of small entities.

Consistent with these requirements, OSHA has made a preliminary determination that the proposed revision will constitute a major rule. Accordingly, OSHA has prepared this Preliminary Regulatory Impact and Regulatory Flexibility Analysis to demonstrate the technological and economic feasibility of the proposed revision.

Industry Profile

Industry sectors affected by the proposed revision to the asbestos standard are found within primary manufacturing, secondary manufacturing, automotive brake and clutch repair, shipbuilding and ship repair, and construction, as identified in detail in the 1986 Regulatory Impact Analysis (RIA) [1]. The following two sections briefly profile the sectors in general industry and construction affected by the proposed revision.

General Industry

Primary manufacturers use asbestos fiber as a raw material in the production of an intermediate product to be further processed or fabricated into a finished product. The following industries within primary manufacturing will be impacted by the proposal: Asbestos/cement pipe (A/C pipe); asbestos/cement sheet (A/C sheet); asbestos friction materials; asbestos textile products; asbestos gaskets and packing; asbestos paper products; asbestos adhesives, sealants, and coatings; and asbestos-reinforced plastic products. Two processes—fiber introduction and product finishing/dry mechanical—are common to all primary manufacturing operations and have high potential for generating airborne asbestos fiber.

Secondary manufacturers modify or fabricate an asbestos product to yield a final or intermediate asbestos product. Processes that are employed to modify the product include sawing, drilling, sanding, punching, pressing, routing, milling, and beveling, all of which tend to generate high dust levels. Secondary manufacturing activities where occupational exposures are expected to remain above the proposed 0.1 f/cc PEL without respiratory protection are in A/C sheet, friction materials and textile processing.

The general automotive repair and service sector includes establishments involved in brake and clutch repair work and maintenance. The major source of asbestos exposure in this sector occurs when compressed air is used for blowing the residual dust from the brake lining assembly. Replacement of clutch assemblies can also lead to fiber release. OSHA estimated in the 1986 RIA that approximately 285,000 automobile repair shops and garages, brake and clutch repair establishments, and motor vehicle dealers, employing 527,000 workers, are affected by the current asbestos standard. OSHA proposes to mandate specific engineering controls and work practices that represent current use or practice for much of this industry sector.

According to industry experts, the industry structure and work practices of the primary manufacturing, secondary manufacturing, and service sectors have undergone noticeable changes since 1986. [Details of these changes are forthcoming.] In the future, the Environmental Protection Agency ban of almost all asbestos products (54 FR 29460) would prohibit, at staged intervals, the manufacture, importation, processing, and distribution in commerce of asbestos, and would therefore lead to a further elimination of occupational risk to asbestos in general industry. Moreover, OSHA predicted in 1986 that asbestos production would decline as a result of the current standard. OSHA requests public comment on the current market structure within primary and secondary manufacturing and the industry outlook.

OSHA's estimates of the number of workers in general industry currently exposed to asbestos, and their exposure levels by process within each activity, are shown in Table 1. As the table indicates, approximately 568,000 workers in general industry would be affected by the proposed revision, with the overwhelming majority found in auto repair. Current exposures range from 0.007 f/cc for the wet mechanical process in plastics, to 0.15 f/cc for fiber introduction in A/C sheet. OSHA estimates that more than half of the 43 processes in general industry are below the proposed PEL of 0.1 f/cc in the absence of respiratory protection.

TABLE 1.—CURRENT OCCUPATIONAL EXPOSURE ESTIMATES FOR GENERAL INDUSTRY

(by Industry/Process Group)

Industry process groups	Number of plants in industry	Number of Works exposed	Average full time equivalent worker-years of exposure/yr	Estimated mean exposure level for current PEL of 0.2 f/cc	Number of workers exposed above 0.1 f/cc
Primary Manufacturing:					
A/C Pipe:					
All	5	512	512.00		235
Introduction	5	15	15.00	0.138	15
Wet mechanical	5	169	169.00	0.097	0
Dry mechanical	5	220	220.00	*0.015220	*220
Other	5	108	108.00	0.081	0
A/C Sheet:					
All	6	159	159.00		159
Introduction	6	7	7.00	0.150	7
Wet mechanical	6	21	21.00	0.139	21
Dry mechanical	6	28	28.00	0.147	28
Other	6	103	103.00	0.143	103
Friction Materials:					
All	51	4,801	4,801.00		4,801
Introduction	51	96	96.00	0.141	96
Wet mechanical	51	240	240.00	0.134	240
Dry mechanical	51	720	720.00	0.130	720
Other	51	3,745	3,745.00	0.130	3,745
Gaskets and Packings:					
All	18	306	306.00		265
Introduction	18	102	102.00	0.128	102
Wet mechanical	18	102	102.00	0.125	102
Dry mechanical	18	61	61.00	0.125	61
Other	18	41	41.00	0.097	0
Paper:					
All	22	380	380.00		58
Introduction	22	20	20.00	0.091	0
Wet mechanical	22	58	58.00	0.101	58
Dry mechanical	22	58	58.00	0.054	0
Other	22	244	244.00	0.050	0
Coatings and Sealants:					
All	78	1,327	1,327.00		1,018
Introduction	78	1,018	1,018.00	0.108	1,018
Other	78	309	309.00	0.044	0
Plastics:					
All	4	322	322.00		91
Introduction	4	53	53.00	0.048	0
Wet mechanical	4	73	73.00	0.007	0
Dry mechanical	4	91	91.00	0.145	91
Other	4	105	105.00	0.060	0
Subtotal	184	7,807	7,807		6,627
Secondary Manufacturing:					
Friction Materials: Dry mechanical	40	1,458	1,458.00	0.102	1,458
Gaskets and Packings: Dry mechanical	289	8,741	8,741.00	0.048	0
Textiles: Dry mechanical	51	170	170.00	0.137	170
Plastics: Dry mechanical	245	2,450	2,450.00	0.065	0
Auto Remanufacturing:					
All	181	4,669	4,669.00		0
Dry mechanical	181	2,054	2,054.00	0.094	0
Other	181	2,615	2,615.00	0.063	0
Subtotal	806	17,488	17,488.00		1,628
Service Sectors:					
Auto Repair: Dry mechanical	285,188	526,998	16,468.69	0.015	0
Ship Repair:					
All	400	15,000	15,000.00		15,000
Wet mechanical	400	2,251	2,251.00	*0.042	*2,251
Dry mechanical	400	12,450	12,450.00	*0.016	*12,450
Nuclear ripout	400	299	299.00	[b]0.004	[b]299
Subtotal	285,588	541,998	31,468.69		15,000
Industry totals	286,578	567,293	56,763.69		23,255

Source: OSHA [1, pp. V-2 and VI-7, and appendix G].

* Exposure in the Dry Mechanical process of Primary A/C Pipe Manufacturing and in the Wet Mechanical and Dry Mechanical processes in Ship Repair reflect the use of half-mask cartridge respirators to supplement engineering controls and work practices.

[b] Estimated exposure in Nuclear Ripout operations reflect the use of supplied-air respirators to supplement engineering controls and work practices.

Construction

The construction industry is the principal market for asbestos materials and products in the United States. The industry accounted for 50 percent of the demand for asbestos in 1984, and for 35 percent of the demand in 1989 [2, p. 39]. Construction products include A/C sheets and pipes, tiles, papers, coatings and sealants, all used in a variety of buildings and structures. Since the early 1970s, the overall demand for these products has declined due to the availability of effective substitutes and to increased regulatory requirements

and restrictions. EPA's 1989 asbestos rule will ban A/C sheet, roofing felts, flooring felts, pipeline wrap, and vinyl-asbestos floor titles effective August 27, 1990, while A/C pipe, roof coatings and shingles will be banned from use effective August 1996.

In construction, each work site usually has its own pattern of material use, building methods, and number and mix of workers. Considerable variation may exist in actual worker use of, or contact with, asbestos materials and products. Whereas many workers in new construction and maintenance face only occasional risk from working with asbestos products, others (e.g., asbestos pipe installers and abatement/removal specialists) continually come into contact with asbestos. Worker mobility, resulting in considerable shifting among both job sites and employers, is another characteristic of the industry. A construction journeyman will often work for a different employer at each new job site. Moreover, frequent entry and exit from the industry reflects cyclical changes in the economy and seasonal work patterns. Collectively, these factors make it very difficult to estimate the actual number of affected construction workers, their duration of employment in the industry, and the duration of their exposure.

CONSAD estimated the number of workers potentially exposed in the activities affected by the proposed revision using the following sources: Product flow data; building permit data; EPA notification data for asbestos removal and renovation projects; census data on the number of firms in the industry and the number of buildings nationwide; construction costing manuals; and survey results [4, chapter 2] describing the frequency of various construction activities, average crew sizes, and average duration of projects.

CONSAD's esitmate of the population exposed to asbestos in construction is shown in Table 2. The first column gives a range for the estimated number of actual workers at risk, while the second column converts the range into full-time equivalent person-years of exposure to asbestos [see 2, Table 3.9]. The last column shows OSHA's projection of current exposures in the wake of the 1986 standard and reflects anticipated respirator usage [1, Table G–20]. Construction workers who now wear respirators to comply with the current asbestos rule will continue to need them to comply with the reduced PEL, while in three construction activities—A/C sheet installation (high exposures only), and routine gasket installation and pipe insulation repair (regulated areas only)—respiratory protection may be added, and in two others—building demolition and drywall demolition—upgrading of respirators may be necessary for some workers. OSHA notes that improved control technologies have enabled construction teams to reach lower fiber levels than in the past. OSHA requests construction data that reflect current exposures in order to update the information upon which this analysis is based.

TABLE 2.—OCCUPATIONAL EXPOSURE TO ASBESTOS DURING CONSTRUCTION AND ROUTINE MAINTENANCE WORK, BY ACTIVITY

[Includes respirator usage]

Construction activity	Estimated annual number of workers potentially exposed	Estimated annual full-time equivalent person-years of exposure	Estimated current exposure levels, f/cc
New Construction	2,460–22,255	2,460–2,635	
A/C Pipe Installation	955–10,600	955–1,130	0.035
A/C Sheet Installation	1,225–9,760	1,225	0.10
Built-Up Roofing Installation	280–1,895	280	0.022
Asbestos Abatement and Demolition	55,101–79,361	17,144–25,446	
Asbestos Removal	44,491–66,476	13,245–19,790	0.021
Encapsulation	4,610–6,885	1,295–1,935	0.022
Demolition	6,000	2,604–3,721	0.001
General Building Renovation	53,535–70,744	53,535	
Drywall Demolition	51,300	51,300	0.003
Built-Up Roofing Removal	2,235–19,444	2,235	0.012
Routine Maintenance in Commercial/Residential Buildings	129,656–739,448	25,771–40,100	
Repair/Replace Ceiling Tiles	13,686–38,650	725–1,067	0.045
Repair/Adjust HVAC/Lighting	39,434–60,793	2,091–3,285	0.006
Other Work Above Drop Ceilings	5,636–4,847	299–469	0.006
Repair Boiler	7,218–180,984	1,126–1,720	0.018
Repair Plumbing	7,218–180,984	1,126–1,720	0.011
Repair Roofing	24,040–127,621	2,404–3,740	0.012
Repair Drywall	3,576–80,231	3,576–5,662	0.075
Repair Flooring	28,848–65,338	14,424–22,437	0.02
Routine Maintenance in General Industry	183,602–426,474	1,497–2,619	
Remove/Install Gaskets (Small)	58,875–55,600	363–130	0.08
Remove/Repair Boiler Insulation (Small)	25,043–21,242	163–51	0.025
Remove/Repair Pipe Insulation (Small)	25,043–21,242	163–51	0.011
Miscellaneous Routine Maintenance Activities (Small)	47,717–42,669	300–100	0.004
Remove/Install Gaskets (Large)	10,770–105,354	203–855	0.08
Remove/Repair Boiler Insulation (Large)	4,039–47,000	76–371	0.025
Remove/Repair Pipe Insulation (Large)	4,039–47,000	76–371	0.011
Miscellaneous Routine Maintenance Activities (Large)	8,077–86,369	153–691	0.004
Industry Totals	424,354–1,404,758	100,407–175,635	

Source: U.S. Dept. of Labor, OSHA, Office of Regulatory Analysis, based on CONSAD [2, Table 3.9] and OSHA [1, Table G–20].

Non-Regulatory Alternatives

Because there remains a risk to workers from asbestos exposures at levels below the current permissible exposure level, and due to the failure of compensation systems, tort litigation and other agency actions to eliminate this risk, OSHA believes that regulatory action is appropriate. In the next three sections, the weaknesses to the alternatives to OSHA regulation are presented.

Compensation Systems

The long latency period associated with many asbestos-related diseases contributes to the uncertainty regarding the occupational nature of such diseases and violates the time constraints specified by some states for filing a claim for Workers' Compensation. Moreover, particularly with lung cancer, it may be difficult to prove the illness is asbestos-related. For example, in at least one study, only 33 percent of the population of workers with asbestos-related disease filed a Worker's Compensation claim, and only 15 percent of those who filed received some benefits prior to death.

Tort Litigation

Employees with an asbestos-related disease may file a product liability suit against a third-party manufacturer, processor, distributor, sales firms, installer, agency, or contractor. In many cases, however, the absence of information may prevent the initiation of a suit. For example, when a worker is removing or repairing asbestos products installed years ago, he or she may not be aware the product contained asbestos; thus, no "known" exposure will have occured. Also, the cost of litigation may be a prohibiting factor in the initiation of litigation, representing a significant transaction cost to the defendant. Such litigation is enormously expensive—as high as $1 billion in the early 1980s—and does nothing in itself to protect the health of workers. However, the prospect of litigation has sparked significant protective strategies by insurers, employers and other government entities.

Other Agency Efforts

Notable among efforts by other governmental bodies to regulate contact with asbestos is the Environmental Protection Agency's phased ban of asbestos products. If the ban goes into effect as scheduled, many products used in construction, and manufactured for commercial use would no longer appear beginning in 1990. As primary and secondary production of asbestos-containing products is eliminated, the risk to production workers is reduced. Similarly, the replacement of asbestos materials with non-asbestos substitutes in new construction and renovation will eliminate much of the risk that remains to workers in those sectors. However, many of the products affected by the EPA rule will not be banned for a number of years. Furthermore, banning these products will not reduce asbestos exposures to workers encountering asbestos installed prior to the ban. Thus, there remains a risk to the health of workers in general industry and construction despite EPA's scheduled ban of asbestos products.

Technological Feasibility and Compliance Costs

Technological Feasibility

General Industry

OSHA's 1986 RIA describes in detail the controls that would be necessary in order to achieve a PEL of 0.2 f/cc in each of the affected sectors in general industry. OSHA determined that compliance with the 0.2 f/cc PEL was feasible through the use of wet methods, engineering controls, and housekeeping practices. There were two operations (fiber introduction and dry mechanical) for which compliance with the PEL of 0.2 f/cc was not achievable without the use of respirators. These operations are found in primary A/C pipe manufacturing, primary and secondary A/C sheet manufacturing, primary and secondary friction products manufacturing, primary textiles manufacturing, and primary plastics manufacturing. (Table 1 shows the estimated exposure levels following implementation of the 1986 exposure limit of 0.2 f/cc.)

For the proposed PEL of 0.1 f/cc, some manufacturing operations will need to supplement engineering controls and work practices with respiratory protection. In all, 23,255 workers (about 4 percent of the 567,293 workers exposed in these industry sectors) in general industry are expected to need respirators at least part of the workday in order to maintain exposures below the proposed PEL. Since all affected employers in general industry will be able to comply with the proposed PEL through the use of engineering controls or, where necessary, respirators, OSHA concludes that the proposed PEL is technologically feasible.

In addition to respirators, ancillary controls will also be needed in these industry/process groups as a result of the lowering of the PEL. These controls include:

- Regulated areas;
- Disposable protective clothing;
- Changeroom/lockers;
- Showers;
- Lunch areas; and
- Annual update of the written compliance program.

Moreover, the proposed housekeeping provision for primary and secondary manufacturing mandates that all floors and surfaces have to be cleaned at least once per shift with a vacuum containing a HEPA-filter. Where feasible, this housekeeping practice is to be combined with wet methods. However, the 1986 RIA assumed that good housekeeping practices would be used in order to reduce occupational exposures to the current PEL of 0.2 f/cc. These housekeeping practices included the use of vacuums equipped with HEPA-filters to achieve compliance with the current PEL of 0.2 f/cc. The proposed new housekeeping requirements are already assumed to be in effect and are, therefore, technologically feasible.

Finally, the proposed revision to the current standard requires certain engineering controls and work practices for brake and clutch repair and services. These requirements include the mandatory use of an enclosed cylinder/HEPA vacuum system method, a solvent system method, or an equivalent method to reduce employee exposure. The solvent system method was judged to be technologically feasible in OSHA's 1986 RIA and the method remains technologically feasible at the proposed PEL of 0.1 f/cc.

This feasibility assessment for general industry does not consider the impacts of the proposed revisions on the production and use of non-asbestiform tremolite, actinolite and anthophyllite. If these three minerals are brought under the scope of the asbestos standard in future rulemaking, an assessment regarding the feasible application of the rule with respect to these minerals will be conducted.

Construction

The evaluation of technological feasibility in construction focused on the various combinations of engineering controls, work practices, and respiratory protection necessary to reduce current exposures to achieve compliance with the proposed PEL of 0.1 f/cc. In addition, a number of engineering controls, work practices, and ancillary requirements which typically do not directly contribute to reducing employee exposures were examined.

Exposures to asbestos in the construction industry were classified into five activity categories:

• *New construction*—including the installation of vinyl/asbestos floor tile, asphalt roofing felts and coatings, and asbestos/cement (A/C) pipe and sheet.
• *Asbestos abatement*—including both asbestos removal and encapsulation with a polymeric coating, or enclosure.
• *Demolition*—involving asbestos removal prior to the demolition of all or part of a building or industrial facility that contains asbestos materials.
• *General building renovation and remodeling*—including drywall demolition involving the removal of pipe and boiler insulation, fireproofing, drywall tape and spackling, and acoustical plasters, and the removal of built-up roofing.
• *Routine facility maintenance in commercial/residential buildings and in general industry*—including maintenance and repair activities involving disturbance of asbestos materials and products (for example, repair of leaking steam pipes, ceiling tiles, roofing, drywall, or flooring; or adjustment of HVAC equipment above suspended ceilings).

To support the regulatory impact analysis for the 1986 asbestos standard, CONSAD derived baseline exposure levels for each construction activity from a database that included personal and area air samples, OSHA inspection reports, expert testimony, and various published reports [2, pp. 46–47]. The technological feasibility assessments for the present proposal were influenced by expected exposure reduction following the promulgation of the 1986 asbestos standard.

OSHA determined in 1986 that, for a variety of construction activities, it was feasible to reach the current PEL of 0.2 f/cc through the use of available engineering controls and work practices (i.e., without the need for respiratory protection). These construction activities included:

• Asbestos/cement (A/C) pipe installation;
• Asbestos/cement (A/C) sheet installation;
• Floor products installation;
• Plumbing repairs in commercial/residential buildings;
• Floor repairs in commercial/residential buildings;
• Gasket removal and installation in general industry; and
• Pipe insulation repairs in general industry.

For the remaining activities, respiratory protection was necessary in order to reach the current PEL of 0.2 f/cc. OSHA assumed that employers would choose the most cost-effective approach and supply their workers with half-mask supplied-air respirators (or full-facepiece supplied-air respirators for asbestos removal projects) in order to eliminate the need for exposure monitoring [1, p. VI–36]. Thus, for many construction activities, workers are assumed to be already using supplied-air respirators.

OSHA is proposing the prohibition of high-speed sanding and the use of highly abrasive pads during asbestos floor tile work. In CONSAD's 1985 study [3, p. 4.17] and in OSHA's RIA [1, p. G–27], exposures during floor tile installation, removal, and sanding were reported to be generally below 0.1 f/cc when the recommendations of the Resilient Floor Covering Institute were followed. These recommended practices included wet sweeping and handling, and the prohibition of power sanding and blowing asbestos dust. OSHA estimated current exposures in floor repair at 0.02 f/cc under the assumption that the Institute's recommended practices were being widely adopted. Therefore, the prohibition of high-speed sanding in the current proposal is not expected to significantly affect floor repair. OSHA requests comment on the potential impact from prohibiting high-speed sanding and the use of highly abrasive pads.

With the proposed PEL of 0.1 f/cc, additional respiratory protection may be necessary. Specifically, building demolition projects and drywall demolition projects may need to upgrade their respiratory protection from half-mask supplied-air to full-facepiece supplied-air to meet the lower permissible exposure limit.

In sum, certain construction activities may require respiratory protection in order to comply with the 0.1 f/cc PEL. The following activities would not need respiratory protection: A/C pipe installation projects; floor products installation projects; plumbing repairs in commercial/residential buildings; floor repairs in commercial/residential buildings; and small-scale, short-duration pipe insulation and gasket removal and installation projects in general industry. In addition, some routine maintenance activities, some minor removal activities, and some major abatement jobs may be able to achieve the proposed PEL of 0.1 f/cc without respirators.

The other incremental controls necessary to comply with OSHA's proposed asbestos standard, include (depending upon the construction activity):

• HEPA vacuums or HEPA vacuum/ventilation systems;
• Glove bags;
• Regulated areas (air-tight or demarcated with caution signs);
• Protective disposable clothing;
• Decontamination area (adjacent to regulated area or remote showers and changerooms);
• Lunch areas;
• Competent person (40-hour or 16-hour training);
• Training;
• Medical exams;
• Recordkeeping (medical exams and training);
• Notification of building owners by contractors;
• Notification of occupants by building owners; and
• Notification to OSHA area office by contractor.

With the exception of the last three, these controls are discussed in detail in OSHA's 1986 RIA and all are deemed feasible for the appropriate construction activities. In conclusion, therefore, OSHA projects that the proposed revisions to the asbestos construction standard will be technologically feasible because all of the provisions, including the lowered PEL, can be met using existing engineering controls, respiratory protection and work practices. The preceding feasibility assessment does not apply to construction jobs where materials containing non-asbestiform tremolite, actinolite and anthophyllite are installed, removed or repaired. If these three minerals are brought under the scope of the asbestos standard in future rulemaking, an assessment regarding the feasible application of the rule with respect to these minerals will be conducted.

Compliance Costs

OSHA has estimated the costs of complying with the proposed revisions to the asbestos standard for general industry and construction. OSHA's cost assumptions and methodologies are based upon CONSAD's draft final report [2] and the previous regulatory analyses performed by OSHA [1], CONSAD [3] and Research Triangle Institute [5]. The section below presents the estimated costs to general industry, followed by the costs to construction.

General Industry

In developing the annual compliance cost estimates, unit cost estimates were first developed for each of the control practices and ancillary measures required by the proposed PEL for each of the industry/process groups affected by the proposed standard. The annual compliance costs for each affected industry/process group were then

developed by combining the unit costs data with the number of units of each type of control practice needed per year to achieve compliance with OSHA's proposed standard. Compliance costs were also adjusted to reflect current compliance with the required control practices.

The industry/process groups with exposures above the proposed PEL of 0.1 f/cc will require the implementation of a set of uniform control practices, including written compliance programs, regulated areas, respirators (including the respirator unit, accessories, fit testing and cleaning), disposable protective clothing and gloves, change rooms and lockers, shower rooms, and lunch rooms. Other controls, while necessary for compliance with the proposed standard, are also required by the current asbestos standard and, thus, are not incremental controls.

Specifically, the use of a solvent system as one of the mandatory engineering controls in auto repair services is not considered an incremental burden since OSHA included compliance costs for use of the solvent spray method in all affected brake establishments in the 1986 RIA and in the 1988 excursion limit analysis. In addition, certain work practices that were required by OSHA's previous standard with a PEL of 2.0 f/cc, and are required by the current standard, as well as by the proposed revisions to the current standard (e.g. wet handling and the collection, disposal, and labelling of wastes in sealed, impermeable bags), are also not identified as additional costs. It is also assumed that wet methods (to the extent that they are feasible), and the use of HEPA vacuums for housekeeping in primary and secondary manufacturing, are already in use. In order to better estimate current compliance with the proposed requirement for per-shift cleanup with HEPA vacuums, OSHA requests information on the frequency with which HEPA vacuums are used for housekeeping in general industry.

To derive estimates of the annual incremental compliance costs for the industry/process groups affected by the proposed PEL of 0.1 f/cc, the estimated unit cost factors were first multiplied by estimates of the resources necessary to achieve compliance for that industry/process group. These gross annual cost estimates were then adjusted to account for current compliance rates (see CONSAD [2, Table 2.12]), which were first projected in the 1986 RIA and are modified as a result of the Regulatory Impact Analysis for the excursion limit rule in 1988 (53 FR 35610).

For each of the manufacturing processes in the affected industries, CONSAD estimated the number of plants with exposures above the proposed PEL of 0.1 f/cc (the number of plants needing controls), the number of processes to be controlled, the number of work stations to be controlled, the number of workers directly exposed, worker-days of exposure per year, and the direct worker-hours of exposure per year. These estimates are based on: The number of establishments as presented in OSHA's 1986 Regulatory Impact Analysis; the percentage of processes within plants with exposures above the proposed PEL of 0.1 f/cc and requiring controls; and finally, characteristics concerning the number of processes per plant, work stations per process, workers per work station, and the frequency and duration of each process in these affected industries. The resource estimates used to develop annual compliance costs are developed in detail in CONSAD's draft final report [2, Table 2.11].

Based on CONSAD's analysis [2], OSHA estimates that annual costs of compliance in general industry will total $24.4 million. Table 3 presents compliance costs by control practice, for each industry process, for the industry sector as a whole, and for all of general industry. As can be seen by comparing costs per provision along the bottom row of the table, respiratory protection—principally in primary and secondary friction materials production—represents approximately half of the total compliance costs. Protective clothing/gloves, and change rooms/lockers would be the next two costliest provisions, at $4.9 million and $4.2 million, respectively. However they are not expected to be incurred because their effective dates coincide with phase-out of affected industries pursuant to the EPA ban. Of the $24.4 million in total costs for general industry, $17.4 million are projected for primary and secondary materials, where the combination of a relatively large population at risk and high per-process exposure levels necessitate the use of greater controls.

TABLE 3.—ESTIMATED COMPLIANCE COSTS FOR AFFECTED SECTORS IN GENERAL INDUSTRY

[1969 dollars]

Industry/Process groups	Annual update of written compliance program	Install regulated areas	Half mask cartridge respirator with HEPA filter	Disposable protective clothing/ gloves	Change rooms/ lockers	Shower rooms	Lunch areas	Total annual incremental control costs
Primary Manufacturing:								
A/C Pipe:								
All	$134	$47	$29,734	$182,657	$159,211	$101,282	$16,168	$489,233
Introduction	67	23	29,734	11,659	10,162	6,465	1,032	59,143
Wet mechanical	0	0	0	0	0	0	0	0
Dry mechanical	67	23	0	170,998	149,049	94,817	15,136	430,090
Other	0	0	0	0	0	0	0	0
A/C Sheet:								
All	$323	$225	$291,712	$114,382	$99,700	$63,424	$10,939	$580,704
Introduction	81	56	12,843	5,036	4,389	2,792	482	25,678
Wet mechanical	81	56	38,528	15,107	13,168	8,377	1,445	76,761
Dry mechanical	81	56	51,371	20,143	17,557	11,169	1,926	102,303
Other	81	56	188,971	74,096	64,585	41,086	7,086	375,961
Friction Materials:								
All	$2,743	$1,320	$6,884,592	$2,302,500	$2,145,363	$1,496,847	$260,938	$13,094,302
Introduction	686	330	137,663	46,040	42,898	29,931	5,218	262,766
Wet mechanical	686	330	344,158	115,101	107,246	74,827	13,044	655,391
Dry mechanical	686	330	1,032,474	345,303	321,737	224,480	39,133	1,964,143
Other	686	330	5,370,298	1,796,055	1,673,481	1,167,609	203,544	10,212,003
Textiles:								
All	$40	$28	$0	$306,159	$266,860	$169,763	$25,731	$768,581

TABLE 3.—ESTIMATED COMPLIANCE COSTS FOR AFFECTED SECTORS IN GENERAL INDUSTRY—Continued

[1989 dollars]

Industry/Process groups	Annual update of written compliance program	Install regulated areas	Half mask cartridge respirator with HEPA filter	Disposable protective clothing/ gloves	Change rooms/ lockers	Shower rooms	Lunch areas	Total annual incremental control costs
Introduction	0	0	0	0	0	0	0	0
Dry mechanical	40	28	0	306,159	266,860	169,763	25,731	768,581
Other	0	0	0	0	0	0	0	0
Floor Tile:								
All	$0	$0	$0	$0	$0	$0	$0	$0
Introduction	0	0	0	0	0	0	0	0
Dry mechanical	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Gaskets and Packings:								
All	$726	$334	$402,361	$157,768	$137,517	$108,137	$16,226	$823,068
Introduction	242	111	154,871	60,726	52,931	41,622	6,246	316,749
Wet mechanical	242	111	154,871	60,726	52,931	41,622	6,246	316,749
Dry mechanical	242	111	92,619	36,316	31,655	24,892	3,735	189,570
Other	0	0	0	0	0	0	0	0
Paper:								
All	$258	$70	$48,924	$19,184	$23,410	$14,892	$3,312	$110,087
Introduction	0	0	0	0	0	0	0	0
Wet mechanical	296	70	48,924	19,184	23,410	14,892	3,312	110,087
Dry mechanical	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Coatings and Sealants:								
All	$1,049	$534	$1,781,819	$698,660	$550,283	$266,048	$48,325	$3,346,717
Introduction	1,049	534	1,781,819	698,660	550,283	266,048	48,325	3,346,717
Other	0	0	0	0	0	0	0	0
Plastics:								
All	$54	$19	$80,599	$50,415	$43,943	$27,955	$4,695	207,679
Introduction	0	0	0	0	0	0	0	0
Wet mechanical	0	0	0	0	0	0	0	0
Dry mechanical	54	19	80,599	50,415	43,943	27,955	4,695	207,679
Other	0	0	0	0	0	0	0	0
Secondary Manufacturing:								
A/C sheet: Dry mechanical	$309	$78	$458,350	$179,721	$24,865	$15,818	$3,545	$687,687
Friction materials: Dry mechanical	$538	$375	2,244,492	$880,076	$767,110	$267,396	$100,308	$4,260,295
Gaskets and packings: Dry mechanical	$0	$0	$0	$0	$0	$0	$0	$0
Textiles: Dry mechanical	$686	$0	$0	$0	$0	$0	$0	$686
Plastics: Dry mechanical	$0	$0	$0	$0	$0	$0	$0	$0
Auto Remanufacturing:								
All	$0	$0	$0	$0	$0	$0	$0	$0
Dry mechanical	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Service Sectors:								
Auto repair: Dry mechanical	$0	$0	$0	$0	$0	$0	$0	$0
Ship Repair:								
All	$0	$0	$0	$0	$0	$0	$0	$0
Wet mechanical	0	0	0	0	0	0	0	0
Dry mechanical	0	0	0	0	0	0	0	0
Nuclear ripout	0	0	0	0	0	0	0	0
Industry Totals	$6,897	$3,029	$12,222,583	$4,891,520	$4,218,263	$2,531,561	$495,167	$24,369,040

Source: CONSAD [2, Table 2.13].

It should be noted that for the products addressed in this analysis, the EPA scheduled ban will lead to an eventual elimination of exposures in general industry and a corresponding reduction in impacts from OSHA's proposal.

Construction

Within the construction industry, 21 unique activities will come under the scope of the proposed revision. These construction activities are found in new construction, asbestos abatement, demolition, general building renovation and remodeling, and routine facility maintenance in commercial/residential buildings and in general industry.

Although the construction activities under consideration in this study will require the implementation of different control practices and/or combinations of these practices, the basic characteristics of available control practices are relatively uniform, and the options for combining control practices in the construction industry and during routine maintenance and repair activities in general industry are limited in number.

The control mechanisms considered in this analysis include shrouded tools with HEPA vacuums; HEPA vacuum/ ventilation systems; HEPA vacuums; glove bags; regulated areas; respirators (including the respirator unit, accessories, fit testing, cleaning, and training); disposable protective clothing and gloves; decontamination areas (or clean changerooms); lunch areas; training; use of competent persons; exposure monitoring; medical exams; recordkeeping; labelling of installed asbestos products; notification to building owners by contractors; notification to building occupants by building owners; and notification to OSHA. Certain work practices that were required by OSHA's original standard with a PEL of 2.0 f/cc (e.g., wet handling and the collection and disposal of waste in sealed, impermeable bags) are not included as cost elements.

Cost data for control mechanisms were obtained from published price lists of equipment suppliers and from other information collected, developed, and presented in the previous studies by CONSAD [3, 4], RTI [4] AND OSHA [1]. These unit cost estimates, along with the key assumptions, are summarized in CONSAD [2, Tables 3.14 through 3.17]. Unit costs are expressed, as appropriate, on a per-establishment, -crew, -project, -worker, project-day, and worker-day basis.

To derive estimates of the annual incremental compliance costs for the proposed PEL of 0.1 f/cc, the estimated unit cost factors for the controls were multiplied by the estimated number of required control resources. In order to develop net annual compliance cost estimates, these gross annual cost estimates were then adjusted using estimates of current application of controls. Unit costs expressed in 1984 dollars were adjusted to 1989 dollars using appropriate producer price deflators and wage indices.

As indicated in the proposal, EPA notification requirements are sufficient for OSHA notification requirements; thus, to the extent that contractors are notifying EPA when removal, demolition, or renovation work is conducted, no additional incremental cost is assumed. Moreover, in situations where one type of equipment or control requirement is replaced with another (e.g., respirators or increased competent person training), the incremental control cost is calculated as the difference in cost between the two types of equipment or control. This assumes that there will be a sufficient phase-in period so that the full useful life of the already purchased equipment or control can be realized. To the extent that this is not possible, the incremental control cost estimates would be higher to reflect the current non-recoverable value of the capital equipment or control that is now obsolete.

Based on CONSAD's analysis [2], OSHA estimated the costs of compliance with the proposed PEL of 0.1 f/cc and the proposed additional requirements for competent person training and notification. The estimated compliance costs, by control requirement, are shown in Table 4 for each major construction sector. OSHA's estimate of total cost, $103.9 million, is the average cost for a range of construction workers potentially at risk in each of the activities affected by the standard (see CONSAD [2, pp. 92–95]). As can be seen in the last column of Table 4, competent person training will entail the greatest incremental costs: $54.4 million, or 52.4 percent of overall costs in this sector. For competent person training, it was assumed that comprehensive training for large-scale jobs would require five days of training conducted by an EPA-certified asbestos training center, or an equivalent course. The cost for the five-day certification course was estimated by CONSAD [2, p. 146] to be $1,606 per trainee (or $600 for the cost of the course, $756 for five-day salary including fringe benefits, and $250 in travel expenses). For small-scale jobs, two days of training was assumed at a total cost of $702 per trainee ($300 per course, $302 for salary/fringe benefits, and $100 in travel expenses). Competent person training costs will be encountered primarily in routine maintenance activities in general industry ($28.5 million) and in routine maintenance in commercial and residential buildings ($18.4 million).

TABLE 4.—ESTIMATED COMPLIANCE COSTS FOR AFFECTED ACTIVITIES IN CONSTRUCTION

[1989 dollars]

Control requirements	New construction	Asbestos abatement demolition	Renovation remodeling	Routine maint commercial residential	Routine maintenance general industry		Estimated incremental cost
					Small	Large	
Shrouded tools with HEPA vacuums	0	0	0	0	0	0	0
HEPA vacuum/ventilation system	0	0	0	0	0	1,800,841	1,800,841
HEPA vacuums	0	0	0	0	0	(1,706,599)	(1,706,599)
Regulated areas (airtight, caution signs)	0	0	0	0	0	3,515,148	3,515,148
Regulated areas (demarcated, caution signs)	103,480	0	0	0	0	(18,447)	85,033
Glove bags	0	1,539,145	0	25,875,936	1,526,241	460,097	29,401,419
Half mask supplied air respirator	2,855,094	(2,504,662)	(21,414,859)	0	0	1,185,035	(19,879,401)
Full facepiece supplied air respirator	0	2,262,670	19,345,831	0	0	0	21,608,502
Disposable protective clothing/gloves	1,012,922	0	0	0	0	18,402	1,031,324
Decontamination area (adjacent to regulated area)	0	0	0	0	0	7,068,924	7,068,924
Decontamination area (remote) (daily trailer rental)	2,475,507	0	0	0	0	1,606,978	4,082,485
Lunch areas	0	0	0	0	0	0	0
Training	0	0	0	(1,175,853)	0	24,810	(1,151,043)
Competent person	650,843	1,363,701	5,448,542	18,420,712	25,224,534	3,298,964	54,407,296
Exposure monitoring	(1,123,153)	0	0	0	0	0	(1,123,153)
Medical exams	0	0	0	0	0	0	0
Labelling of installed asbestos products	0	0	0	0	0	0	0
Notification to building owners	29,046	263,725	600,147	0	0	465,534	1,358,453
Notification to building occupants	29,046	263,725	600,147	0	0	465,534	1,358,453
Notification to OSHA	0	244,939	800,196	0	0	931,067	1,976,202
Total	6,032,775	3,433,245	5,380,006	43,120,795	26,750,775	19,116,288	103,833,884

Source: CONSAD [2, Table 3.20].

The next costliest provision is the requirement for the use of feasible containment systems (glove bags, mini-enclosures) where negative-pressure enclosures are not feasible. CONSAD estimated that the costs for glove bags (at $8.04 per bag) in asbestos abatement and demolition, routine maintenance in commercial/residential buildings, and routine maintenance in general industry total $29.4 million.

OSHA is proposing to revise the definition of small-scale, short-duration maintenace jobs from an activity-specific definition (pipe repair, valve replacement, installing electrical conduits, etc.) to one that refers to repair of piping of less than 21 feet; repair or removal of asbestos panel that is less than 9 square feet; pipe valve repair, gasket repair or removal, or asbestos-

related electrical work that can be completed by one worker in less than four hours; removal of drywall within an eight-hour workday; renovation projects involving endcapping of pipes and tile removal that can be completed in less than four hours; and installation of conduits that can be completed within an eight-hour work shift. The costs associated with the revised definition for small-scale, short-duration construction activities are an estimated $17.1 million and are found only in routine maintenance in general industry. Of this total cost, $8.7 million are associated with establishing decontamination areas, $3.5 million are associated with the requirement for an air-tight regulated area, while $1.8 million are attributed to the difference between comprehensive and small-scale competent person training. The remaining costs involve notification of building owners, occupants, and OSHA ($2.0 million), the supplemental use of respirator ($1.2 million), and the costs for protective clothing and gloves ($18,402) and employee training ($24,810) associated with establising a regulated area.

In terms of construction sectors, the largest compliance costs, $45.9 million, are associated with routine asbestos maintenance in general industry. For firms in manufacturing, electric utilities and other utilities that replace gaskets, remove boiler insulation, or perform other asbestos-related maintenance operations [see [1, Chapter 2] and [3, pp. 3.46–3.58] for a discussion of these general industry sectors], compliance with the proposed revision to the construction standard will entail competent person training ($28.5 million), use of decontamination areas ($8.7 million), and erection of airtight regulated areas ($3.5 million).

Contractors performing routine maintenance work in commercial/residential buildings will face costs of $43.1 million. Of these total compliance costs, incremental expenses of $25.9 million for glove bags and $17.2 million for competent person training (or a gross cost of $18.4 million minus $1.2 million for current manager training) will be incurred.

Compliance costs for the remaining major construction sectors—new construction, asbestos abatement and demolition, and renovation and remodeling—are expected to total $14.5 million. Incremental training for competent persons represents $7.5 million of the total costs in these three sectors, while incremental notification costs will be $2.8 million.

Benefits

The inhalation of asbestos feber has been clearly associated with three clinical conditions: Asbestosis, mesothelioma (a cancer of the lining of the chest or abdomen), and lung cancer. Studies have also observed increased gastrointestinal cancer risk. Risk from cancer at other sites, such as the larynx, pharynx, and kidneys, is also suspected.

Initial exposure limits for asbestos were based on efforts to reduce asbestosis which was known to be associated with asbestos exposure. The reduction in cases of asbestosis, however, resulted in workers living long enough to develop cancers that are now recognized as associated with asbestos exposure. The following discussion of the benefits associated with a reduction in exposures, therefore, focuses on the number of cancer cases avoided within the exposed work force. The results are expressed in terms of deaths avoided because these cancers almost always result in death.

The benefits of a reduction in the PEL depend upon current exposure levels, the number of workers exposed, and the risk associated with each exposure level. Current ambient air-level estimates for general industry and construction were estimated by CONSAD by applying the respiratory controls projected in the 1986 RIA to the estimated exposures prior to the 1986 standard and assuming 100 percent effectiveness [2, Table 3.9]. These current exposures, the estimated number of workers exposed to asbestos, and the estimated exposure levels after compliance with the proposed rule are presented in Tables 5 and 6 for general industry and construction, respectively. The estimates of the projected exposure levels after compliance with the proposed rule of 0.1 f/cc are based upon CONSAD's [2] application of more-extensive respirator use. The Agency estimated in 1986 that a number of establishments would use engineering controls, work practices and respirators in order to lower exposures below the current 0.1 f/cc action level. Hence, most employees are now estimated to be exposed below 0.1 f/cc. CONSAD estimates that any additional exposure reductions which result from the proposed rule will be the result of increased respirator use.

TABLE 5

Estimated Occupational Exposures to Asbestos and Reduction in Cancer Risk in General Industry as a Result of Proposed Revision to Standard (Annual Averages Using OSHA/CONSAD Current Exposure Estimates)

Sector	Estimated No. of exposed workers	Estimated current exposure levels (f/cc)	Estimated level of exposure (f/cc) after proposed rule	Estimated reduction in cancer deaths
Primary Manufacturing:				
Asbestos/Cement Pipe	512	0.0596	0.0560	0.002
Asbestos/Cement Sheet	159	0.1435	0.0142	0.027
Friction Materials	4,801	0.01304	0.0130	0.729
Textiles	405	0.0207	0.0207	0.000
Floor Tile	276	0.0560	0.0560	0.000
Gaskets and Packings	306	0.1222	0.0243	0.039
Paper	380	0.0606	0.0467	0.007
Coatings and Sealants	1,327	0.0931	0.0187	0.128
Plastics	322	0.0700	0.0700	0.000
Secondary Manufacturing:				
Asbestos/Cement Sheet	345	0.1210	0.0120	0.049
Friction Products	1,458	0.1020	0.0100	0.173
Gaskets and Packings	8,741	0.0480	0.0480	0.000
Textiles	170	0.1370	0.0140	0.027
Plastics	2,420	0.0650	0.0650	0.000

TABLE 5—Continued

Estimated Occupational Exposures to Asbestos and Reduction in Cancer Risk in General Industry as a Result of Proposed Revision to Standard (Annual Averages Using OSHA/CONSAD Current Exposure Estimates)

Sector	Estimated No. of exposed workers	Estimated current exposure levels (f/cc)	Estimated level of exposure (f/cc) after proposed rule	Estimated reduction in cancer deaths
Automotive Remanufacturing	4,669	0.0766	0.0766	0.000
Services:				
Automobile Repair	526,998	0.0150	0.0150	0.000
Shipbuilding and Repair	15,000	0.0197	0.0197	0.000
Total	568,289			1.180

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, based on CONSAD [2, Table 2.8] and OSHA [1, Table V-2]

TABLE 6

Estimated Occupational Exposures to Asbestos and Reduction in Cancer Risk in Construction as a Result of Proposed Revision to Standard

Sector	Estimated full time equivalent workers	Estimated current exposure levels (f/cc)	Estimated level of exposure (f/cc) after proposed rule	Estimated reduction in cancer deaths
New Construction:				
Abestos/Cement Pipe	1,043	0.0350	0.0350	0.000
Abestos/Cement Sheet	1,225	0.1000	0.0010	0.157
Built-Up Roofing Installation	280	0.0020	0.0020	0.000
Asbestos Abatement and Demolition:				
Asbestos Removal	16,518	0.0030	0.0030	0.000
Asbestos Encapsulation	3,163	0.0020	0.0020	0.000
Demolition	3,163	0.0060	0.0010	0.020
General Building Renovation:				
Drywall Demolition	51,300	0.0340	0.0030	*2.056
Build-Up Roofing Removal	2,235	0.0010	0.0010	0.000
Routine Maintenance in Commercial and Residential Buildings:				
Repair/Replace Ceiling Tiles	896	0.0050	0.0050	0.000
Repair/Adjust Ventilation/Lighting	2,688	0.0030	0.0030	0.000
Other Work Above Drop Ceiling	384	0.0030	0.0030	0.000
Repair Boiler	1,423	0.0020	0.0020	0.000
Repair Plumbing	1,423	0.0110	0.0110	0.000
Repair Roofing	3,073	0.0010	0.0010	0.000
Repair Drywall	4,618	0.0080	0.0080	0.000
Repair Flooring	18,430	0.0200	0.0200	0.000
Routine Maintenance in General Industry:				
Gasket Removal and Installation (Small)	247	0.0400	0.0400	0.000
Remove/Repair of Boiler Insulation (Small)	107	0.0120	0.0120	0.000
Remove/Repair of Pipe Insulation (Small)	107	0.0110	0.0110	0.000
Miscellaneous Routine Maintenance Activities (Small)	200	0.0020	0.0020	0.000
Remove/Install Gaskets (Large)	529	0.0800	0.0008	0.054
Remove/Repair Boiler Insulation (Large)	224	0.0120	0.0120	0.000
Remove/Repair of Pipe Insulation (Large)	224	0.0110	0.0001	0.003
Miscellaneous Routine Maintenance Activities (Large)	414	0.0020	0.0020	0.000
Total	113,911			2.291

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, based on CONSAD [2, Table 2.10] and OSHA [1, Table V-2].

Cancers avoided in drywall demolition were originally misreported in the 1986 RIA. These benefits should be realized under this proposed rule as a result of increased respirator use.

In construction, exposure reductions in the general industry maintenance sector are anticipated as a result of the reclassification of some jobs as "large scale". Since regulated areas would now be required for these jobs, it is estimated that supplied-air respirators would be used to avoid the need for exposure monitoring. As can be seen in comparing Columns 2 and 3 of Table 6, exposure reductions would also occur in A/C sheet installation, building demolition and drywall demolition in response to the lowered PEL. In these three sectors some jobs produce exposures above 0.1 f/cc, and therefore respirator upgrading would be anticipated, again to avoid the need for exposure monitoring. In general

industry (Table 5), exposure reductions are the result of the use of respirators in response to the lower PEL.

A discussion of the risk assessment used for OSHA's estimate of the number of cancers prevented by the proposed rule is presented in OSHA's 1986 RIA [1, pp. V-5/V-13]. OSHA updated the 1986 risk assessment to include 1987 mortality rates [8, Table 8.5]. Based upon this revised risk assessment, OSHA has estimated the number of deaths from mesothelioma, lung cancer and gastrointestinal cancer prevented by the exposure reductions resulting from the proposed rule. The estimated reductions in cancers—based upon CONSAD's assumption of 100 percent effectiveness of respirators—are presented in Tables 5 and 6. OSHA estimates that reducing the PEL from the current 0.2 f/cc level to 0.1 f/cc will prevent 1.2 cancer deaths in general industry and 2.3 cancer deaths in construction, or a total of 3.5 cancer deaths per year.

OSHA also estimates that adoption of the proposed rule would prevent cases of disabling asbestosis. As these cases represent disabilities and not deaths, they are not included in the total estimated benefits. Asbestosis cases often lead to tremendous societal costs in terms of health care, worker productivity, and in the quality of life to the affected individual. Their prevention, therefore, would have a positive value.

Similarly, OSHA's analysis does not quantify benefits among those incidentally exposed. Many construction workers, for example, can be exposed to asbestos while present at sites where asbestos work is being done. Since OSHA's revised asbestos standard will reduce ambient asbestos levels at these sites, exposure among these workers will also be reduced. Also, to the extent that negative pressure enclosures and glove bags reduce the release of asbestos fibers, the standard will help prevent accidental and long-term exposure to those permanently employed in other parts of buildings in which asbestos-related construction work is being performed. OSHA requests public comment on the effect of negative pressure enclosures on these secondary and tertiary exposures to asbestos.

There are other provisions of the standard for which benefits are difficult to quantify. The provision for a competent person, for example, would help ensure the integrity of negative pressure enclosures, which in turn reduce asbestos exposures. The provision for notification of building owners could lead to a reduction in cases of accidental exposure. To the extent these provisions may reduce potential exposures, additional benefits would be expected. Public comment is requested on the potential benefits from the more-extensive competent person training and from the requirements for building owner and occupant notification. In addition, OSHA will quantify the risks and benefits to bystander employees in the final rule and requests data on the current level of exposures to such employees, the number of exposed employees and the frequency of exposure.

Economic Impact and Regulatory Flexibility Analysis

OSHA has examined the impacts of the costs of compliance on sales and profits for the firms in general industry and construction affected by the proposed revision to the asbestos standard. OSHA's analysis of the economic impacts, based upon the analysis in CONSAD's draft report [2], are presented below.

General Industry

CONSAD compared the compliance costs anticipated for general industry with three financial indicators: annual payroll, value of shipments and pre-tax profits. The comparison with annual payroll conveys the magnitude of compliance costs relative to labor costs. The comparison with value of shipments provides a measure of the extent to which prices would rise to maintain profit levels assuming firms are able to pass 100 percent of incremental costs forward to buyers. If firms, for competitive reasons, are unable to pass costs forward and must instead absorb the full impact internally, pre-tax profits would be expected to fall.

Table 7 presents the estimated impact of compliance costs on annual payroll, value of shipments and pre-tax profits. The figures for payroll and shipments are taken from preliminary 1987 census data for the industry groups within which primary and secondary asbestos manufacturing are classified [see CONSAD [2, Table 2.15]. CONSAD derived pre-tax profits using Dun and Bradstreet post-tax return-on-sales data, census data on value of shipments, and the 1987 tax code. Post-tax profits were derived by multiplying post-tax returns on sale by value of shipments. CONSAD then calculated pre-tax profits using a formula that contains the marginal corporate tax rates for 1987 [2, pp. 71-72].

TABLE 7.—ESTIMATED ECONOMIC IMPACTS IN GENERAL INDUSTRY AS A RESULT OF THE REVISION TO THE GENERAL INDUSTRY ASBESTOS STANDARD

Annual incremental control costs as a percentage of:	Industry group		
	Annual payroll	Value of shipments	Pre-tax profits
Primary Manufacturing:			
A/C Pipe	5.4	1.4	21.6
A/C Sheet	5.4	1.3	21.4
Friction Materials	14.3	.6	56.7
Textiles	14.3	3.8	56.5
Gaskets & Packing	3.5	0.9	22.1
Paper	*0.0	*0.0	0.1
Coatings & Sealants	3.3	0.3	5.6
Plastics	5.2	1.0	16.1
Secondary Manufacturing:			
A/C Sheet	1.7	0.4	6.6
Friction Materials	5.9	1.5	23.6
Textiles	.0.0	0.0	0.0

Source: CONSAD [2, Table 2.16].
* Impacts in primary paper manufacturing are less than 0.1 percent of payroll and value of shipments.

Incremental control costs are not expected to exceed 6 percent of payroll and 2 percent of value of shipments for most of the industry groups, suggesting that price increases as a result of the proposed revision would not be significant if market conditions enable firms to adjust prices upward without loss of sales. However, if competitive factors prevent a pass-forward of costs, the impacts on profits could be large, as seen in the last column of Table 7. The percentage of profits represented by incremental costs exceeds 56 percent for primary friction and textile manufacturing and exceeds 20 percent for primary A/C pipe, primary A/C sheet, gaskets and packing, and secondary friction materials. Because the market structure probably falls somewhere between the extremes of perfect competition [full cost absorption] and monopoly [full cost pass-forward], OSHA anticipates that some, but not all, of the incremental costs would be passed forward, helping to lessen the impact on profits. However, the precise effect on profits is difficult to estimate at this time.

In accordance with the Regulatory Flexibility Act, OSHA also examined the impacts on small establishments to determine if they would be adversely affected by the proposed standards. CONSAD compared compliance costs for small firms with small-firm annual payroll, value of shipments and pre-tax profits for the industries identified in OSHA's 1986 RIA as containing small establishments. [The industries with no small firms include A/C pipe, A/C sheet, friction materials and textiles in

primary manufacturing and friction materials in secondary manufacturing.) Small-firm impacts for general industry are shown in Table 8. Compliance costs as a percentage of small-firm shipments range from 0.4 for paper manufacturing to 7.4 for secondary A/C sheet manufacturing. Costs as a percentage of pre-tax profits, shown in the last column of Table 8, are significantly higher, suggesting that several profit reductions could be felt by the small firms unable to pass forward their incremental compliance costs. These results should be viewed as preliminary, however, and are independent of the effects from the EPA ban. As the scheduled EPA prohibitions of manufactured and imported asbestos products go into effect, production worker exposures would be expected to decline, leading to a reduction in the number of firms impacted by the rule. OSHA requests comment on the impacts in general industry from the proposed revision to the asbestos standard.

TABLE 8

Estimated Economic Impacts on Small Firms in General Industry as a Result of the Revision to the General Industry Asbestos Standard

Industry group	Annual incremental control costs as a percentage of:		
	Annual payroll	Value of shipments	Pre-tax profits
Primary Manufacturing:			
Gaskets & Packing	31.8	5.8	175.8
Paper	3.3	0.4	7.9
Coatings & Sealants	21.8	1.8	30.0
Plastics	41.2	6.8	140.3
Secondary Manufacturing:			
A/C Sheet	16.8	7.4	157.4

Source: CONSAD [2, Table 2.18].

Construction

CONSAD estimated economic impacts in construction by comparing incremental compliance costs with per-firm payroll, net receipts and profits. First, annual incremental control costs per firm were estimated using the costs presented above for new construction, asbestos abatement and demolition, renovation/remodeling and routine maintenance in commercial/residential buildings. (Routine maintenance in general industry is analyzed separately below.) Table 9 gives the estimated costs per exposed worker and per affected firm or crew (Columns 5 and 6). Based on CONSAD's estimate of the number of affected firms within each construction activity, costs are expected to range from $17 per firm for asbestos encapsulation to $7,418 per firm for drywall repair (for activities incurring compliance costs).

TABLE 9

Incremental Control Costs Per Affected Firm in Construction (1989 dollars)

Industry sector	Annual incremental control costs *(dollars)	No. of exposed workers *	No. of affected firms or crews *	Annual incremental control costs per exposed worker (dollars)	Annual incremental control costs per affected firm or crew (dollars)
New Construction:					
A/C Pipe Installation	0	5,778	1,469	0	0
A/C Sheet Installation	5,954,861	5,493	1,373	1,084	4,337
Roofing Felt Installation	77,914	1,088	249	72	313
Floor Products Installation	0	NA	NA	NA	NA
Subtotal	6,032,775	12,359	3,091	488	1,952
Asbestos Abatement and Demolition:					
Removal	1,747,841	55,484	2,450	32	713
Encapsulation	42,640	5,748	2,450	7	17
Demolition	1,642,764	6,000	2,450	274	671
Subtotal	3,433,245	67,232	2,450	51	1,401
Renovation/Remodeling:					
Drywall Demolition	4,578,180	51,300	17,100	89	268
Remove Built-up Roofing	801,826	10,840	2,478	74	324
Subtotal	5,380,006	62,140	19,578	87	275
Routine Maintenance: Commercial/Residential:					
Remove/Repair/Replace Ceiling Tiles	2,491,305	13,686	13,686	182	182
Repair HVAC or Lighting	7,178,292	39,434	19,717	182	364
Other Work Above Drop Ceiling	1,025,938	5,636	2,818	182	364
Repair Boilers	1,313,915	7,218	7,218	182	182
Repair Plumbing	0	7,218	7,218	0	0
Repair Roofing	4,584,460	24,040	12,020	191	381
Repair Drywall	26,526,888	3,576	3,576	7,418	7,418
Repair Flooring	0	28,848	14,424	0	0
Subtotal	43,120,796	129,656	80,677	333	534
Routine Maintenance: General Industry:					
Gasket Removal and Installation (small)	588,399	58,875	72,993	10	8
Gasket Removal and Installation (large)	2,526,122	10,770	4,205	235	601
Removal/Repair of Boiler Insulation (small)	25,224,534	25,043	72,993	1,007	346
Removal/Repair of Boiler Insulation (large)	7,319,665	4,039	4,205	1,812	1,741
Removal/Repair of Pipe Insulation (small)	0	25,043	72,993	0	0
Removal/Repair of Pipe Insulation (large)	8,128,979	8,077	4,205	283	271
Misc. Maintenance Activities (small)	937,842	47,717	72,993	20	13
Misc. Maintenance Activities (large)	8,128,979	8,077	4,205	1,006	1,933
Subtotal (small)	26,750,775	156,678	72,993	171	366
Subtotal (large)	19,116,287	26,925	4,205	710	4,546
Total	45,867,062	183,603	77,198	250	594
Total for all Activities	103,833,884	271,387	182,994	383	567

Source: CONSAD [2, Tables 3.9, 3.10, and 3.19].

* Represents average incremental control costs, average number of workers exposed, and average number of firms/crews exposed, for new construction, asbestos abatement and demolition, and renovation/remodeling. Represents lower bound incremental control costs, lower bound number of workers exposed, and lower bound number of firms/crews exposed, for routine maintenance activities.

NA—Data not available.

Economic impacts were estimated by calculating the per-firm incremental costs (given in Table 9) as a percentage of payroll, net receipts and pre-tax profits. Table 10 presents CONSAD's derivation of earnings per establishment in construction. As in the impact analysis for general industry, pre-tax profits for each industry group were derived using post-tax return-on-sales measures from Dun and Bradstreet and net dollar value of construction (see the explanation above). Annual payroll was taken from 1986 *County Business Patterns*.

TABLE 10.—NEXT DOLLAR VALUE AND PRE-TAX PROFITS PER ESTABLISHMENT IN CONSTRUCTION

SIC Code	Number of establishments	Number of employees	Number of construction workers	Annual payroll for construction workers (thousands of dollars)	Net dollar value of construction work (thousands of dollars)	Net dollar value per establishment	Post-tax return on sales (percent)	Estimated pre-tax profits per establishment (thousands of dollars)
SIC 15—Building Construction	159,160	1,291,687	932,191	17,447,811	113,641,096	714,005	3.5	29.4
SIC 1521—Single Family	91,235	403,818	312,599	4,447,462	27,954,692	306,403	4.7	16.9
SIC 1522—Residential	8,147	79,538	59,388	1,101,266	5,940,761	729,196	3.6	31.4
SIC 1531—Operative Builders	21,087	173,874	81,367	1,527,552	28,478,030	1,350,502	4.6	85.7
SIC 1541—Industrial Building	7,112	144,290	111,921	2,523,535	11,266,238	1,584,117	2.7	51.2
SIC 1542—Non-Residential	31,579	490,167	366,916	7,847,996	40,001,375	1,266,708	3.0	45.5
SIC 16—Heavy Construction	24,618	495,680	405,428	9,243,157	36,015,751	1,462,984	4.5	90.8
SIC 1623—Water & Sewer	9,865	195,890	164,676	3,450,417	14,570,114	1,476,950	5.3	108.0
SIC 1629—Not Elsewhere Classified	14,753	299,790	240,752	5,792,740	21,445,637	1,453,646	4.5	90.2
SIC 17—Special Trade Contractors	162,484	1,329,511	1,053,928	20,649,141	84,198,661	518,197	4.8	29.3
SIC 1711—Plumbing, Heating & A/C	69,581	612,376	466,673	10,267,131	42,876,843	616,215	3.7	26.8
SIC 1721—Painting & Paper Hanging	29,944	170,033	145,440	2,414,900	7,413,863	247,591	6.2	18.1
SIC 1752—Floor Laying	8,390	45,796	35,411	662,418	3,433,141	409,194	4.8	23.1
SIC 1761—Roofing & Siding	25,627	232,891	188,560	3,164,497	13,821,810	539,346	4.0	25.4
SIC 1795—Wrecking & Demolition	1,267	14,417	11,963	199,324	850,632	671,375	6.4	51.5
SIC 1796—Install Building Equip.	3,759	62,622	50,732	1,475,994	5,106,700	1,358,526	4.0	75.0
SIC 1799—Not Elsewhere Classified	23,916	191,376	155,149	2,464,877	10,695,672	447,218	6.3	33.7
All Industry Segments	346,262	3,116,878	2,391,547	47,340,109	233,855,508	675,372	NA	35.3

Source: CONSAD [2, Table 3.22].
NA—Data not available.

Table 11 shows the impacts by affected construction activity, by activity group, and for all groups in the analysis. Costs as a percentage of net receipts (Column 2) are under 0.5 percent for all activities except for A/C sheet installation (0.6 percent) and drywall repair (1.1 percent). The results suggest that if incremental control costs were fully passed through to building owners—as is believed to be the case throughout much of construction—the effects on prices and rents would be minor. Impacts on profits (Column 3) are significant in A/C sheet installation and drywall repair, but OSHA believes that the assumption of zero cost pass-through underlying this impact measure is not directly applicable in construction. Profit impacts are shown to demonstrate possible results under extreme conditions.

TABLE 11.—ECONOMIC IMPACTS IN CONSTRUCTION

[Excluding Routine Maintenance in General Industry]

Industry sector	Incremental control costs per firm as a percentage of: Payroll per firm(s)	Net receipts per firm(s)	Pre-tax profits per firm(s)
New Construction:			
A/C Pipe Installation	0.0	0.0	0.0
A/C Sheet Installation	3.2	0.6	12.3
Roofing Felt Installation	0.2	0.0	0.9
Floor Products Installation	0.0	0.0	0.0
Subtotal	1.4	0.3	5.5
Asbestos Abatement and Demolition:			
Removal	0.5	0.1	2.0
Encapsulation	0.0	0.0	0.0
Demolition	0.5	0.1	1.9
Subtotal	1.0	0.2	4.0
Renovation/ Remodeling:			
Drywall Demolition	0.2	0.0	0.8
Remove Built-up Roofing	0.2	0.0	0.9
Subtotal	0.2	0.0	0.8

TABLE 11.—ECONOMIC IMPACTS IN CONSTRUCTION—Continued

[Excluding Routine Maintenance in General Industry]

Industry sector	Incremental control costs per firm as a percentage of: Payroll per firm(s)	Net receipts per firm(s)	Pre-tax profits per firm(s)
Routine Maintenance:			
Commercial/ Residential:			
Remove/Repair/ Replace Ceiling Tiles	0.1	0.0	0.5
Repair HVAC or Lighting	0.3	0.1	1.0
Other Work Above Drop Celing	0.3	0.1	1.0
Repair Boilers	0.1	0.0	0.5
Repair Plumbing	0.0	0.0	0.0
Repair Roofing	0.3	0.1	1.1
Repair Drywall	5.4	1.1	21.0
Repair Flooring	0.0	0.0	0.0
Subtotal	0.4	0.1	1.5
Total for All Activities	0.4	0.1	1.6

Source: CONSAD [2, Table 3.23].
(a) The average annual payroll, net receipts, and estimated pre-tax profits per firm are $136,718, $675,372, and $35,268, respectively. These values are averages across all construction industry segments where asbestos exposure may occur (See Table 11).
NA—Data not available.

For the regulatory flexibility analysis, OSHA determined in 1986 [1, VII—38] that the majority of firms in construction average under ten employees. Thus, the impacts described will affect predominantly small firms.

Routine Maintenance in General Industry

CONSAD assumed that routine asbestos maintenance in general industry is performed by plant and maintenance personnel within the establishment. Under this assumption, incremental costs in this sector are expected to impact general industry, despite the classification of these maintenance activities within the construction industry. Incremental costs per affected plant are given in Table 9 and pre-tax profits for affected industry sectors are shown in Table 12. As in the analysis above, incremental costs are expressed as a percentage of annual payroll, value of shipments and pre-tax profits (here, impacts were estimated at the industry level), shown in Table 13. Impacts on value of shipments are negligible (Column 2); the cost ratios are all under 0.1 percent. The third column gives the maximum reduction in profits under the assumption that 100 percent of incremental costs are absorbed internally. As the table shows, impacts on profits are generally less than 0.5 percent.

TABLE 12.—ANNUAL PAYROLL, VALUE OF SHIPMENTS, AND PRE-TAX PROFITS FOR GENERAL INDUSTRY SECTORS PERFORMING ROUTINE ASBESTOS MAINTENANCE

Industry (SIC Code)	Annual payroll per plant (millions of dollars	Value of shipments per plant (millions of dollars)	Post-tax return on sales *(percent)	Estimated pre-tax profits per plant (thousands of dollars)
Manufacturing				
Malt (alcoholic) beverages (2062)	$10.11	$101.56	1.7	$2,851
Paper products (26)	2.65	17.07	3.7	1,026
Chemicals (28)	2.07	19.00	3.7	1,145
Petroleum refining (29)	1.77	57.98	2.7	2,582
Glass/ceramics (321, 322, 323)	1.72	7.91	4.9	620
Iron and steel (331, 332)	4.71	25.44	3.3	1,372
Fabricated metal products (34)	0.98	4.11	4.0	247
Electric Utilities				
Electric services (491)	3.05	28.41	NA	4,253
Combination electric, gas, and other utilities (493)	5.84	NA	7.0	NA
Other Public Utilities				
Gas production and distribution (492)	1.20	24.18	NA	1,009
Water supply (494)	0.17	NA	7.0	NA
Sanitary services (495)	0.37	NA	7.0	NA

Source: CONSAD [2, Table 3.25].
*For Glass/ceramics (SIC 321, 322 and 323), data for SIC 321 and 322 used; for Iron and Steel (SIC 331 and 332), data for SIC 33 used; for Electric Services (SIC 491) and Gas Production (SIC 492), actual data for pre-tax profits utilized; for other utilities, data for SIC 49 used.
NA—Data not available.

TABLE 13.—ECONOMIC IMPACTS IN GENERAL INDUSTRY SECTORS PERFORMING ROUTINE ASBESTOS MAINTENANCE

Industry (SIC code)	Annual incremental control costs per plant(a) as a percentage of:		
	Annual payroll per plant	Value of shipments per plant	Estimated pre-tax profits per plant
Manufacturing:			
Malt (alcoholic beverages (2082)	0.006	0.001	0.021
Paper products (26)	0.022	0.003	0.058
Chemicals (28)	0.029	0.003	0.052
Petroleum refining (29)	0.033	0.001	0.023
Glass/ceramics (321, 322, 323)	0.034	0.008	0.096
Iron and steel (331, 332)	0.013	0.002	0.043
Fabricated metal products (34)	0.038	0.009	0.149
Electric Utilities:			
Electric services (491)	0.019	0.002	0.014
Combination electric, gas, and other utilities (493)	0.010	NA	NA
Other Public Utilities:			
Gas production and distribution (492)	0.050	0.002	0.059
Water supply (494)	0.350	NA	NA
Sanitary services (495)	0.161	NA	NA

Source: CONSAD [2, Table 3.26].
(a) The overall incremental control cost per affected plant ($594) was utilized in these calculations for all industries except fabricated metal products where the overall incremental control cost per affected plant for small-scale projects ($366) was utilized since all plants in this industry perform only small-scale projects (see Table 10).
NA—Data not available to calculate percentage.

The economic impacts on small firms (under 20 employees) in general industry performing routine asbestos maintenance are presented in Tables 14 and 15. The data indicate no serious economic consequences as a result of the proposed rule change.

TABLE 14.—ANNUAL PAYROLL, VALUE OF SHIPMENTS, AND PRE-TAX PROFITS FOR SMALL FIRMS IN GENERAL INDUSTRY SECTORS PERFORMING ROUTINE ASBESTOS MAINTENANCE

Industry (SIC code)	Annual payroll per plant (millions of dollars)	Estimated value of shipments per plant (millions of dollars)	Post-tax return on sales (percent)	Estimated pre-tax profits per plant (thousands of dollars)
Manufacturing:				
Malt (alcoholic) beverages (2082)	$3.00	$6.17	1.7	$175
Paper products (26)	0.16	0.95	3.7	42
Chemicals (28)	0.16	2.79	3.7	172
Petroleum refining (29)	0.20	2.13	2.7	79
Glass/ceramics (321, 322, 323)	0.14	0.33	4.9	19
Iron and steel (331, 332)	0.19	0.49	3.3	19
Fabricated metal products (34)	0.14	0.38	4.0	18
Electric Utilities:				
Electric services (491)	0.24	2.24	NA	335
Combination electric, gas, and other utilities (493)	0.21	NA	7.0	NA
Other Public Utilities:				
Gas production and distribution (492)	0.21	4.23	NA	177
Water supply (494)	0.05	NA	7.0	NA
Sanitary services (495)	0.10	NA	7.0	NA

Source: CONSAD [2, Table 3.27].
NA—Data not available.

TABLE 15.—ECONOMIC IMPACTS FOR SMALL FIRMS IN GENERAL INDUSTRY SECTORS PERFORMING ROUTINE ASBESTOS MAINTENANCE

Industry (SIC code)	Annual incremental control costs per plant(s) as a percentage of:		
	Annual payroll per plant	Value of shipments per plant	Estimated pre-tax profits per plant
Manufacturing:			
Malt (alcoholic) beverages (2082)	0.012	0.006	0.209
Paper products (26)	0.229	0.039	0.869
Chemicals (28)	0.229	0.013	0.213
Petroleum refining (29)	0.183	0.017	0.461
Glass/ceramics (321, 322, 323)	0.261	0.111	1.924
Iron and steel (331, 332)	0.193	0.075	1.924
Fabricated metal products (34)	0.261	0.096	2.047
Electric Utilities:			
Electric services (491)	0.153	0.016	0.109
Combination electric, gas, and other utilities (493)	0.174	NA	NA
Other Public Utilities:			
Gas production and distribution (492)	0.174	0.009	0.207
Water supply (494)	0.732	NA	NA
Sanitary services (495)	0.366	NA	NA

Source: CONSAD [2, Table 3.28].
(a) The overall incremental control cost per affected plant for small-scale projects ($366) was used in these calculations for all industries since all small plants perform only small-scale projects (see Table 10).
NA—Data not available to calculate percentage.

References

(1) U.S. Dept. of Labor, OSHA, Office of Regulatory Analysis, *Final Regulatory Impact and Regulatory Flexibility Analysis of the Revised Asbestos Standard*, 1986.

(2) CONSAD Research Corporation, *Economic Analysis of the Proposed Revisions to the OSHA Asbestos Standards for Construction and General Industry*, Draft Final Report, Contract Number J-9-F-8-0033, April 1990.

(3) CONSAD Research Corporation, *Economic and Technological Profile Related to OSHA's Revised Permanent Asbestos Standard for the Construction Industry and Asbestos Removal and Routine Maintenance Projects in General Industry*, Final Report, Contract Number J-9-F-4-0024, December 31, 1985.

(4) CONSAD Research Corporation and Clayton Environmental Consultants, Inc., *Asbestos Task Order for Construction Alternatives*, Final Report, Contract Number J-9-F-4-0024, May 25, 1984; Addendum to Final Report, June 14, 1984.

(5) Research Triangle Institute, *Regulatory Impact Analysis of the Proposed OSHA Asbestos Standard*, prepared for the U.S. Department of Labor, Occupational Safety and Health Administration, September 1985.

(6) *Vital Statistics of the United States 1987*, Volume II—Mortality, Part B, U.S. Department of Health and Human Services, Public Health Service, Centers For Disease Control, National Center For Health Statistics, 1989.

V. Clearance of Information Collection Requirements

On March 31, 1983 the Office of Management and Budget (OMB) published 5 CFR part 1320, implementing the information collection provisions of the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 et seq. (48 FR 13666). Part 1320, which became effective on April 30, 1983 and was revised May 10, 1988 (53 FR 16618) sets forth procedures for agencies to follow in obtaining OMB clearance for information collection requirements.

OMB has approved information collection requests for existing asbestos standards in accordance with the provisions of the Paperwork Reduction

Act under control numbers 1218–0133 and 1218–0134.

OSHA is seeking clearance for the asbestos construction § 1926.58(i) which requires employers to notify OSHA area offices 10 days prior to removal, demolition, or renovations operations of Asbestos. OSHA estimates 348,915 written notifications will be received annually by the Agency. Public reporting burden for this collection is estimated to average 1 hour per response for the Construction industry.

Send comments regarding this burden estimate and/or other aspects of this collection of information, including suggestions for reducing this burden to the Office of Information Management, Department of Labor, room N–1301, 200 Constitution Avenue., NW., Washington, DC 20210; and to the Office of Information and regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

VI. Public Participation Notice of Hearing

Pursuant to section 6(b)(3) of the Act, an opportunity to submit oral testimony concerning the issues raised by the proposed standard will be provided at an informal public hearing scheduled to begin at 9:30 a.m. at the time and place as follows: Washington, DC: October 23, 1990, The Auditorium, Frances Perkins Department of Labor Building, 200 Constitution Avenue, NW., Washington, DC 20210.

Notice of Intention to Appear

All persons desiring to participate at the hearings must file in quadruplicate a Notice of Intention to Appear, postmarked on or before September 25, 1990, addressed to Mr. Tom Hall, OSHA Division of Consumer Affairs, Docket No. H–033e, room N–3647, U.S. Department of Labor, Third Street and Constitution Ave., NW., Washington, DC 20210; telephone 202–523–8615. The Notice of Intention to Appear also may be transmitted by facsimile to 202–523–5046 or (for FTS) to 8–523–5986, provided the original and 4 copies of the notice are sent to the above address thereafter.

Notices of intention to appear, which will be available for inspection and copying at the OSHA Docket Office (room N2625), telephone 202–523–7894, must contain the following information:

1. The name, address, and telephone number of each person to appear;
2. The capacity in which the person will appear;
3. The approximate amount of time requested for the presentation;
4. The specific issues that will be addressed;
5. A statement of the position that will be taken with respect to each issue addressed;
6. Whether the party intends to submit documentary evidence, and if so, a brief summary of that evidence.

Filing of Testimony and Evidence Before Hearings

Any party requesting more than 10 minutes for a presentation at the hearing, or who will submit documentary evidence, must provide in quadruplicate the complete text of the testimony, including any documentary evidence to be presented at the hearing, to the OSHA Division of Consumer Affairs. This material must be postmarked by September 25, 1990, and will be available for inspection and copying at the OSHA Technical Data Center Docket Office. Each such submission will be reviewed in light of the amount of time requested in the notice of intention to appear. In those instances where the information contained in the submission does not justify the amount of time requested, a more appropriate amount of time will be allocated and the participant will be notified of that fact.

Any party who has not substantially complied with this requirement may be limited to a 10 minute presentation. Any party who has not filed a notice of intention to appear may be allowed to testify, as time permits, at the discretion of the Administrative Law Judge.

OSHA emphasizes that the hearing is open to the public, and that interested persons are welcome to attend. However, only persons who have filed proper notices of intention to appear at the hearing will be entitled to ask questions and otherwise participate fully in the proceeding.

Conduct and Nature of Hearings

The hearings will commence at 9:30 a.m., on October 23, 1990. At that time, any procedural matters relating to the proceeding will be resolved.

The nature of an informal hearing is established in the legislative history of section 6 of the Act and is reflected by the OSHA hearing regulations (see 29 CFR 1911.15(a)). Although the presiding officer is an Administrative Law Judge and questioning by interested persons is allowed on crucial issues, the proceeding shall remain informal and legislative in nature. The Agency's intent, in essence, is to provide an opportunity for effective oral presentations which can proceed expeditiously, in the absence of rigid procedures which impede or protract the rulemaking process.

Additionally, since the hearing is primarily for information gathering and clarification, it is an informal administrative proceeding, rather than an adjudicative one. The technical rules of evidence, for example, do not apply. The regulations that govern hearings and the pre-hearing guidelines to be issued for this hearing will ensure fairness and due process and also facilitate the development of a clear, accurate and complete record. Those rules and guidelines will be interpreted in a manner that furthers that development. Thus, questions of relevance, procedure and participation generally will be decided so as to favor development of the record.

The hearing will be conducted in accordance with 29 CFR part 1911. The hearing will be presided over by an Administrative Law Judge who makes no decision or recommendation on the merits of OSHA's proposal. The responsibility of the Administrative Law Judge is to ensure that the hearing proceeds at a reasonable pace and in an orderly manner. The Administrative Law Judge, therefore, will have all the powers necessary and appropriate to conduct a full and fair informal hearing as provided in 29 CFR part 1911 including the powers:

(1) To regulate the course of the proceedings;

(2) To dispose of procedural requests, objections and comparable matters;

(3) To confine the presentations to the matters pertinent to the issues raised;

(4) To regulate the conduct of those present at the hearing by appropriate means;

(5) In the Judge's discretion, to question and permit the questioning of any witness and to limit the time for questioning; and

(6) In the Judge's discretion, to keep the record open for a reasonable, stated time to receive written information and additional data, views, and arguments from any persons who has participated in the oral proceedings.

Written Comments

Interested persons are invited to submit written comments on the issues raised in the proposal. Written comments must be postmarked by September 25, 1990 and submitted in quadruplicate to the Docket Office, Docket Number H–033e, room N–2625, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210. The telephone number of the Docket Office is (202) 523–7894, and its hours of operation are 8:15 a.m. to 4:45 p.m., Monday through Friday, except Federal holidays. Comments limited to

10 pages or less in length may also be transmitted by facsimile to (202) 523-5046 or (for FTS) to 8-523-5046, provided the original and 4 copies of the comment are sent to the Docket Officer thereafter. Written submissions must clearly identify the issues raised in this Notice which are addressed and the position taken on each issue.

All materials submitted will be available for inspection and copying at this address. All timely submissions will be part of the record of the proceeding.

Certification of Record and Final Determination After Hearing

Following the close of the post-hearing comment period, the presiding Administrative Law Judge will certify the record of the hearing to the Assistant Secretary of Labor for Occupational Safety and Health.

The proposed standard will be reviewed in light of all testimony and written submissions received as part of the record and a standard will be issued based on the entire record of the proceeding, including the written comments and data received from the public.

State Plan Applicability

The 25 States with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within six months of the publication date of a final revised standard. These States include: Alaska, Arizona, California, Connecticut (for State and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (for State and local government employees only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming.

List of Subjects

29 CFR Part 1910

Asbestos, Cancer, Health, Labeling, Occupational safety and health, Protective equipment, Respiratory protection, Signs and symbols.

29 CFR Part 1926

Asbestos, Cancer, Construction industry, Hazardous materials, Health, Labeling, Occupational safety and health, Protective equipment, Respiratory protection, signs and symbols.

VII. Authority and Signature

This document was prepared under the direction of Gerard F. Scannell, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210. Accordingly, pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 635, 653, 657), section 107 of the Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333), the Longshore and Harbor Workers Compensation Act (33 U.S.C. 941), 29 CFR Part 1911 and Secretary of Labor's Order No. 1-90 (55 FR 9033), it is hereby proposed to amend 29 CFR parts 1910 and 1926 as set forth below.

Signed at Washington, DC, this 12th day of July, 1990.

Gerard F. Scannell,

Assistant Secretary of Labor.

Proposed Amended Standards

Part 1910 of title 29 of the Code of Federal Regulations would be amended as follows:

PART 1910—[AMENDED]

Subpart Z—[Amended]

1. The authority citation for subpart Z of part 1910 would be revised to read as follows:

Authority: Secs. 6, 8, Occupational Safety and Health Act, 29 U.S.C. 655, 657; Secretary of Labor's Orders 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033) as applicable; and 29 CFR part 1911.

All of subpart Z issued under section 6(b) of the Occupational Safety and Health Act, 29 U.S.C. 655(b), except those substances listed in the Final Rule Limits column of Table Z-1-A, which have identical limits listed in the Transitional Limits columns of Table Z-1-A, Table Z-2 or Table Z-3. The latter was issued under Section 6(a) (29 U.S.C. 655 (a)).

Section 1910.1000, the Transitional Limits columns of Table Z-1-A, Table Z-2 and Z-3 also issued under 5 U.S.C. 553. Section 1910.1000, Table Z-1-A, Z-2 and Z-3 not issued under 29 CFR part 1911 except for the arsenic, benzene, cotton dust and formaldehyde listings.

Section 1910.1001 also issued under Sec. 107 of Contract Work Hours and Safety Standards Act, 40 U.S.C. 333.

Section 1910.1002 not issued under 29 U.S.C. 655 or 29 CFR part 1911; also issued under 5 U.S.C. 553.

Section 1910.1003 through 1910.1018 also issued under 29 U.S.C. 653.

Section 1910.1025 also issued under 29 U.S.C. 653 and 5 U.S.C. 553.

Section 1910.1028 also issued under 29 U.S.C. 653.

Section 1910.1043 also issued under 5 U.S.C. 551 *et seq.*

Sections 1910.1045 and 1910.1047 also issued under 29 U.S.C. 653.

Section 1910.1048 also issued under 29 U.S.C. 653.

Sections 1910.1200, 1910.1499 and 1910.1500 also issued under 5 U.S.C. 553.

Part 1910 of title 29 Code of Federal Regulations is hereby amended as follows:

2. Section 1910.1001 would be amended by revising paragraph (c)(1), (f)(1), (p)(1) and (2), and appendix F and adding paragraphs (c)(3), (f)(1)(x), (xi) and (xii), and (k)(7), (o)(4) and (o)(5), as follows:

§ 1910.1001 Asbestos, tremolite, anthophyllite, and actinolite.

* * * * *

(c) *Permissible exposure limits (PELS)*—(1) *Time-weighted average limit (TWA) for asbestos.* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in appendix A of this section, or by an equivalent method.

* * * * *

(3) *Time-weighted average limit (TWA) for tremolite anthophyllite and actinolite.* The employer shall ensure that no employee is exposed to an airborne concentration of tremolite, anthophyllite, actinolite or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in appendix A of this section, or by an equivalent method.

* * * * *

(f) *Methods of Compliance*—(1) *Engineering controls and work practices.* (i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the exposure limit prescribed in paragraph (c) of this section, except to the extent that such controls are not feasible and pursuant to paragraph (f)(xii) of this section.

* * * * *

(x) *Engineering controls and work practices for brake and clutch repair and service.* During automotive brake and clutch repair operations, the employer shall institute engineering controls and work practices to reduce employee exposure to materials containing asbestos using an enclosed cylinder/HEPA vacuum system method, solvent system method or wet brush-recycle method, which meets the detailed requirements set out in Appendix F. The employer may also comply using an equivalent method, which follows written procedures, which the employer demonstrates can achieve results equivalent to Method A in

Appendix F as set out in Exhibit 1–112, (Sheehy, J.W., T.C. Cooper, D. M. O'Brien. 1989. Control of Asbestos Exposure During Brake Drum Service. App. Ind. Hyg. *4*:313–319). Such demonstration must include monitoring data conducted under workplace conditions closely resembling the process, type of asbestos containing materials, control method, work practices and environmental conditions when the equivalent method will be used, or objective data, which documents that under all foreseeable conditions of brake and clutch repair applications, the method results in exposures which are equivalent to the results of Method A cited above.

(xi)(A) Floor tile containing asbestos may be buffed and/or sanded only with low-abrasion pads at speeds of 190 rpm or less. Buffing and/or sanding of such tile or material at speeds greater than 190 or using highly abrasive pads are prohibited.

(B) Employers shall inform employees buffing and/or sanding floor tile or material containing asbestos that non-compliance with paragraph (f)(i)(xi)(A) may result in exposure to asbestos fibers.

(xii) For the following industry sectors up to and including the following dates, the employer may comply with the revised TWA PEL of 0.1 f/cc by any combination of respiratory protection that complies with the requirements of paragraph (g) of this section, work practices and feasible engineering controls.

August 27, 1990

Flooring felt
Roofing felt
Pipeline wrap
Asbestos/cement (A/C) flat sheet
A/C corrugated sheet
Vinyl/asbestos floor tile
Asbestos clothing
New asbestos products

August 25, 1993

Beater-add gaskets (except specialty industrial gaskets)
Sheet gaskets (except specialty industrial gaskets)
Clutch facings
Automatic transmission components
Commercial and industrial friction products
Drum brake linings (original equipment market)
Disc brake pads for light- and medium weight vehicles

August 26, 1996

A/C pipe
Commercial paper
Corrugated paper
Rollboard
Millboard
A/C shingle
Specialty paper
Roof coatings
Non-roof coatings
Brake blocks
Drum brake linings (aftermarket)
Disc brake pads (aftermarket)

* * * * *

(k) *Housekeeping.*

* * * * *

(7) In primary and secondary manufacturing operations, floors and surfaces shall be cleaned at least once per shift with a vacuum containing a HEPA-filter, combined, where feasible, with wet methods.

* * * * *

(o) *Dates.*

* * * * *

(4) The requirements of paragraphs (c)(1), (f)(1)(x) and (xi) and (p) (1) and (2) shall be complied with (insert date 60 days from publication of the final rule in the Federal Register).

(5) The requirements of paragraphs (i) (1), (2), and (3) which are triggered by the 0.1 f/cc TWA PEL shall be complied with by the following dates for the following industry sectors:

August 27, 1990

Flooring felt
Roofing felt
Pipeline wrap
Asbestos/cement (A/C) flat sheet
A/C corrugated sheet
Vinyl/asbestos floor tile
Asbestos clothing
New asbestos products

August 25, 1993

Beater-add gaskets (except specialty industrial gaskets)
Sheet gaskets (except specialty industrial gaskets)
Clutch facings
Automatic transmission components
Commercial and industrial friction products
Drum brake linings (original equipment market)
Disc brake pads for light- and medium weight vehicles

August 26, 1996

A/C pipe
Commercial paper
Corrugated paper
Rollboard
Millboard
A/C shingle
Specialty paper
Roof coatings
Non-roof coatings
Brake blocks
Drum brake linings (aftermarket)
Disc brake pads (aftermarket)

* * * * *

(p) *Appendices.* (1) Appendices A, C, D, E, and F to the section are incorporated as part of this section and the contents of these Appendices are mandatory.

(2) Appendices B, G and H to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

* * * * *

Appendix F to § 1910.1001—Work Practices and Engineering Controls for Automotive Brake and Clutch Repair and Assembly—Mandatory

This mandatory appendix specifies engineering controls and work practices that must be implemented by the employer during automotive brake and clutch repair and assembly operations. Proper use of these engineering controls and work practices will reduce employees' asbestos exposure below the permissible exposure level during clutch and brake repair and assembly operations. The employer shall institute engineering controls and work practices using either the method set forth in paragraph [A] or paragraph [B], or paragraph [C], or any other method which the employer can demonstrate to be equivalent in terms of reducing employee exposure to asbestos as defined and which meets the requirements described in paragraph [D]:

[A] Enclosed Cylinder/HEPA Vacuum System Method

(1) The brake and clutch assembly and repair work shall be enclosed in a cylinder designed to cover and enclose the wheel/brake assembly and repair to prevent the release of asbestos fibers into the worker's breathing zone.

(2) The cylinder shall be sealed tightly and thoroughly inspected for leaks before work begins on brake and clutch repair and assembly.

(3) The cylinder shall have viewing ports to provide visibility and impermeable sleeves through which the worker can handle the brake and clutch assembly and repair. The integrity of the sleeves and ports shall be examined before work begins.

(4) A HEPA-filtered vacuum with a compressed-air hose and nozzle that fits into a connection on the cylinder shall be used to remove asbestos fibers or particles from the cylinder.

(5) The vacuum cleaner shall be used first to loosen the asbestos containing residue from the brake and clutch parts and then to evacuate the loosened asbestos containing material from the cylinder and capture the material in the vacuum filter.

(6) The vacuum's filter, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to paragraph (j)(2)(ii) of this section and disposed of according to paragraph (k) of this section.

(7) Any spills or releases of asbestos containing waste material from inside of the cylinder or vacuum hose or vacuum filter shall be immediately cleaned up and disposed of according to paragraph (k) of the standard.

[B] Spray Can/Solvent System Method

(1) The spray can/solvent system shall be used to first wet the brake and clutch parts.

Then, the brake and clutch parts shall be wiped clean with a cloth.

(2) The cloth shall be placed in an impermeable container, labelled according to paragraph (j)(2)(ii) of the standard and then disposed of according to paragraph (k) of the standard, or the cloth shall be laundered in a way to prevent the release of asbestos fibers in excess of 0.1 fiber per cubic centimeter of air.

(3) Any spills of solvent or any asbestos containing waste material shall be cleaned up immediately according to paragraph (k) of the standard.

(4) The use of dry brushing during solvent spray operations is prohibited.

[C] Wet Brush-Recycle Method

(1) A catch basin shall be placed under the brake assembly, positioned to avoid splashes and spills.

(2) The reservoir shall contain water containing an organic solvent or wetting agent. The flow of liquid shall be controlled such that the brake assembly is gently flooded through the bristles of the brush to prevent the asbestos-containing brake dust from becoming airborne.

(3) The aqueous solution shall be allowed to flow between the brake drum and brake support before the drum is removed.

(4) After removing the brake drum, the wheel hub and back of the brake assembly shall be thoroughly wetted to suppress dust.

(5) The brake support plate, brake shoes and brake components used to attach the brake shoes shall be thoroughly washed before removing the old shoes.

(6) In systems using filters, the filters, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to paragraph (j)(2)(ii) of this section and disposed of according to paragraph (k) of this section.

(7) Any spills of asbestos-containing aqueous solution or any asbestos-containing waste material shall be cleaned up immediately and disposed of according to paragraph (k) of this section.

(8) The use of dry brushing during wet brush-recycle operations is prohibited.

[D] Equivalent Methods

An equivalent method is one which has sufficient written detail so that it can be reproduced and has been demonstrated that the exposures resulting from the equivalent method are equal to or less than the exposures resulting from the use of Method A, the Enclosed Cylinder/HEPA Vacuum System Method, as set forth in Exhibit 1–112 (Sheehy, M.J., T.C. Cooper, D.M. O'Brien. 1989. Control of Asbestos Exposure During Brake Drum Service. Appl. Ind. Hyg. 4:313–319).

PART 1926—[AMENDED]

Subpart D—[Amended]

3. The authority citation for subpart D of 29 CFR part 1926 would be revised to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Sec 107, Contract Work Hours and Safety Standards Act (Construction Safety Act), 40 U.S.C. 333; and Secretary of Labor's Orders 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736) or 1–90 (55 FR 9033), as applicable. Sec. 1926.55(c) and 1926.58 also issued under 29 CFR part 1911.

4. Section 1926.58 would be amended by adding paragraph (a)(7), adding a new definition to paragraph (b), adding paragraphs (c)(3), and (g)(2)(iv); revising paragraphs (c)(1), (d), (e)(1) and (6); redesignating paragraphs (o) and (p) as paragraphs (q) and (r) and revising newly redesignated paragraphs (r) (1) and (2); and adding paragraphs (o), (p) and (q)(4) as follows:

§ 1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

(a) *Scope and Application.*

* * * * *

(7) Coverage under this standard shall be based on the nature of the work operation involving asbestos exposure, not on the primary activity of the employer.

(b) *Definitions.*

* * * * *

Small-scale, short-duration operations means only those demolition, renovation, repair, maintenance, and removal operations which are non-repetitive, affect small surfaces or volumes of material containing asbestos, tremolite, anthophyllite, or actinolite, and will be completed within one work day, and are not expected to expose bystander employees to significant amounts of asbestos. The following operations are included within the definition of small-scale, short-duration: Repair or removal of asbestos on pipes that is less than 21 linear feet; repair or removal of asbestos panel that is less than 9 square feet; pipe valve repair or replacement of pipe valves containing asbestos gaskets or electrical work that disturbs asbestos that is completed by one worker in less than four hours; removal of drywall which is completed for the facility within an eight-hour workday; renovation projects involving endcapping of pipes and tile removal that is completed in less than four hours; and installation of conduits that is completed within an eight hour work shift.

* * * * *

(c) *Permissible exposure limits (PELs)*—(1) *Time-weighted average limit (TWA) for asbestos.* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in appendix A of this section, or by an equivalent method.

* * * * *

(3) *Time-weighted average (TWA) for tremolite, anthophyllite and actinolite.* The employers shall ensure that no employee is exposed to an airborne concentration of tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in appendix A of this section, or by an equivalent method.

(d) *Communication among employers and owners*—(1) *Notification by owners.* (i) Project or building owners shall provide notification of available information concerning the presence, location, and quantity of asbestos-containing materials on a prospective job site to the following persons before work covered by this section is performed and with respect to new construction contracts for work covered by this section, before the execution of the contract. This requirement does not apply to work and contracts for work which constitute small-scale, short term operation as defined in paragraph (b) of this section:

(A) Employers working on the project or in the building, or prospective employers applying or bidding for work covered by this section whose employees reasonably can be expected to work in or contiguous to areas containing such material; and

(B) Employees of the owner who work in or contiguous to areas where work covered by this section will be performed.

(ii) Upon receipt of notification pursuant to paragraph (d)(2) of this section, project and building owners shall immediately provide written notification of any additional information obtained concerning the presence, location, and quantity of asbestos or asbestos-containing materials to the persons specified in Paragraph (d)(1)(i) of this section and of protective measures to be taken to the extent that such project or building owner previously failed to provide the notification required by paragraph (d)(1)(i).

(iii) Project and building owners shall maintain records of all information provided pursuant to this section or otherwise concerning the presence, location, and quantity of asbestos-containing materials in the building. Such records shall be kept for the duration of ownership and shall be transferred to successive owners of such buildings.

(2) *Notification by Employers.* (i) Any employer planning to perform any work covered by this section except for small-scale, short duration operations as defined in paragraph (b) of this section, shall, prior to the commencement of such work, notify the project or building owner of the presence, location and quantity of asbestos-containing materials on the job site, the nature of operations reasonably expected to result in exposure to asbestos and the measures to be taken by the employer to protect other employees and building occupants from exposure to such materials, to the extent the owner previously has not notified such employer pursuant to paragraph (d)(1) of this section.

(ii) On multi-employer worksites, an employer planning to perform any work covered by this section except for small-scale, short duration operations as defined in paragraph (b) of this section, shall inform all other employers on the site of the presence, location, and quantity of asbestos or asbestos-containing materials to which employees of such employers reasonably can be expected to be exposed, the nature of operations reasonably expected to result in such exposures, and the measures taken by the employer to protect such employees from such exposures.

(iii) Any employer who discovers the presence in the workplace of material containing asbestos, actinolite, tremolite, or anthophyllite, shall immediately notify as required by paragraph (d)(2)(i) of this section, the project or building owner and, on multi-employer sites, other employers as required by paragraph (i)(2)(ii) of this section.

(iv) Following the completion of work covered by the notification requirements of paragraph (d)(2) (i), (ii) and (iii) of this section, by any employer, the employer shall provide to the project or building owner a written record of the presence, location and quantity of asbestos-containing material on the job site as of the time of such completion of work.

(3) *Other Notification Requirements.* (i) Before commencing small-scale, short duration demolition, renovation, repair, removal and maintenance operations as defined in paragraph (b) of this section, the employer shall notify the building owner; and all employers and employees who may reasonably be expected to work in or contiguous to the regulated area of the presence of asbestos and the need for protective equipment before entering the work area.

(ii) Notification to the building owner required by paragraph (d)(3)(i) of this section may be made in writing or verbally.

(iii) Notification to employees and employers required by paragraph (d)(3)(i) of this section will be considered satisfied by the posting of warning signs required by paragraph (k)(1) of this section.

(e) *Regulated areas*—(1) *General.* Except for asbestos removal, demolition, maintenance and renovation operations, the employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

* * * * *

(6) *Regulated areas for asbestos removal, maintenance, demolition, and renovation operations.* (i) All asbestos removal, demolition, maintenance, and renovation operations shall be treated as regulated areas and shall comply with the requirements of paragraphs (e) (1) (2) (3) and (5) of this section.

(ii) In addition, the employer shall establish negative-pressure enclosures before commencing any removal, demolition, maintenance, and renovation operation, except as provided in paragraph (e)(6)(iii) of this section.

(iii) *Exceptions to negative-pressure enclosure requirements.* The employer is not required to install negative-pressure enclosures in the following work situations:

(A) Where establishing a negative-pressure enclosure is not feasible, because of the configuration of the work area. In such situations, the employer shall institute all feasible additional controls to reduce the exposure to asbestos of workers engaged in the removal, demolition, or renovation operation and minimize the spread of contamination to workers not engaged in the removal, demolition, or renovation.

(B) In roofing, where the employer shall institute all feasible additional controls to reduce employee exposure, such as using wet methods to the extent feasible, immediately bagging all asbestos containing materials, and lowering asbestos containing materials to the ground level using airtight chutes.

(C) In small-scale, short-duration operations, as defined in paragraph (b), where the employer uses alternative feasible containment or enclosures, such as glove bags or mini-enclosures pursuant to the requirements in appendix G of this section, and uses feasible wet methods to handle, install, disturb, and/or remove asbestos-containing material pursuant to the requirements in appendix G of this section.

(D) In removal of asbestos-containing floor tile or flooring material where the employer shall institute the following work practices:

(*1*) Flooring or its backing may not be sanded to remove them from the floor;

(*2*) Vacuums equipped with a HEPA filter, disposable dust bag, and metal floor tool (no brush) shall be used to clean floors;

(*3*) All sheet removal shall be done using detergent solution;

(*4*) All felt scraping shall be done wet;

(*5*) All scraping of residual adhesive shall be performed wet;

(*6*) Dry sweeping is prohibited.

* * * * *

(g) *Methods of Compliance.*

* * * * *

(2)(iv)(A) Floor tile containing asbestos may be buffed only with low-abrasion pads at speeds of 190 rpm or less. Buffing of such tile or material at speeds greater than 190 rpm or using highly abrasive pads are prohibited. (B) Employers shall inform employees buffing floor tile containing asbestos that non-compliance with paragraph (g)(2)(iv)(A) may result in exposure to asbestos fibers.

* * * * *

(o) *Competent person*—(1) *General.* On all construction worksites covered by this standard, the employer shall designate a competent person, having the qualifications and authorities for ensuring worker safety and health required by subpart C, General Safety and Health Provisions for Construction (29 CFR 1926.20 through 1926.32).

(2) *Requirements for asbestos removal, demolition, maintenance, and renovation operations.* (i) On all worksites where employees are engaged in removal, demolition, and renovation of asbestos, tremolite, anthophyllite, and actinolite, the competent person designated in accordance with paragraph (g)(1) of this section shall also perform or supervise the following duties, as applicable:

(A) Set up the regulated area, enclosure, or containment;

(B) Ensure the integrity of the enclosure or containment;

(C) Control entry to and exit from the enclosure and/or area;

(D) Supervise all employee exposure monitoring required by this section and ensure that it is conducted as required by paragraph (f);

(E) Ensure that employees working within the enclosure and/or using glove bags wear protective clothing and respirators as required by paragraphs (h) and (i) of this section;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section;

(H) Ensure that engineering controls are functioning properly; and,

(I) Ensure that notification requirement in paragraph (f)(6) are met.

(ii)(A) The competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite handling relevant to the specific work involved, including abatement, installation, removal and handling; the contents of this standard; the identification of asbestos, tremolite, anthophyllite, or actinolite; removal procedures, where appropriate; and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, certified by the EPA or a State, or an equivalent course.

(B) For small-scale, short-duration operations, the competent person shall be trained in aspects of asbestos removal appropriate for small-scale, short-duration work, to include procedures for setting up glove bags and mini-enclosures, practices for reducing asbestos exposures, use of wet methods, the contents of this standard, and the identification of asbestos, anthophyllite, or actinolite. Such training shall be obtained in an appropriate course, such as a course conducted by an EPA Asbestos Training Center for supervisors of small-scale, short-duration work, or an equivalent course.

(p) *Notification to OSHA*—(1) *General.* Before engaging in demolition, renovation, or removal of materials containing asbestos, tremolite, anthophyllite, or actinolite which do not meet the definition of small-scale, short-duration operations, the employer shall provide the OSHA Area Office with written notice of intention to demolish, renovate, or remove asbestos-containing material.

(2) *Method of notification.* The employer shall ensure that OSHA receives written notice at least 10 working days before removal, demolition, or renovation, or other related activities such as site preparation which would disturb asbestos will begin.

(3) *Content.* The employer shall include the following in the notice:

(i) Name, address, and telephone number of employer;

(ii) Type of operation: demolition, renovation, or removal;

(iii) Description of the facility including the size (square feet) and number of floors, age, and present or prior use of the facility;

(iv) Procedure employed to detect the presence of materials containing asbestos;

(v) Estimate of the amount of materials containing asbestos, including separately identified non-friable material, to be affected by the demolition, renovation, or removal, in linear feet or area (square feet);

(vi) Location and address of the facility where demolition, renovation, or removal will occur;

(vii) Scheduled starting and completion date;

(viii) Description of planned demolition, renovation, or removal work to be performed and methods to be employed including demolition, renovation, or removal techniques to be used and description of affected facility components;

(ix) Description of work practices and engineering controls to be used to comply with the requirements of this standard;

(x) A certification that only a competent person trained as required by paragraph (o)(2)(ii)(A) of this section will supervise the demolition, renovation, or removal activity described in this notification; and

(xi) Description of procedures to be followed in the event that unexpected asbestos is found.

(4) *Compliance with EPA reporting.* An employer reporting to the Environmental Protection Agency's National Emissions Standards for Hazardous Air Pollutants for Asbestos (40 CFR part 61.146) may satisfy the notification requirements contained in this paragraph by forwarding a copy of the EPA notification to the OSHA area office.

(q) *Dates.*

* * * * *

(4) The requirements of paragraphs (c)(1), (d), (e) (1) and (6), (g)(2)(iv), (o) and (p) shall be complied with by (insert date 60 days from publication of final rule in **Federal Register**).

* * * * *

(r) *Appendices.* (1) Appendices A, C, D, E, and G to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

* * * * *

§ 1926.58 Appendix G [Amended]

5. Appendix G, to § 1926.58 would be revised by changing its heading to "Mandatory;" by removing the introductory paragraph; in the section under the heading "Glove Bags" by replacing the phrase "action level" with "PEL" in the first and third sentences; removing the sections entitled "Enclosure," "Maintenance Program" and "Prohibited Activities"; and by revising the section under the heading "Definition of Small-Scale, Short Duration Activities" to read as follows:

Small-scale, short-duration operations means only those demolition, renovation, repair, maintenance, and removal operations which are non-repetitive, affect small surfaces or volumes of material containing asbestos, tremolite, anthophyllite, or actinolite, and will be completed within one work day, and are not expected to expose bystanders to significant amounts of asbestos. The following operations are included within the definition of small-scale, short duration: Repair or removal of asbestos on pipes that is less than 21 linear feet; repair or removal of asbestos panel that is less than 9 square feet; pipe valve repair or replacement of pipe valves containing asbestos gaskets or electrical work that disturbs asbestos that is completed by one worker in less than four hours; removal of drywall which is completed for the facility within an eight-hour workday; renovation projects involving endcapping of pipes and tile removal that is completed in less than four hours; and installation of conduits that is completed within an eight-hour work shift."

* * * * *

[FR Doc. 90-16687 Filed 7-13-90; 1:27 pm]

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Friday,
July 20, 1990

Part III

Department of Transportation

Federal Aviation Administration

14 CFR Part 25

Special Review; Transport Category Airplane Airworthiness Standards; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. 24344; Amendment No. 25-72]

RIN 2120-AA47

Special Review: Transport Category Airplane Airworthiness Standards

AGENCY: Federal Aviation Administration, Transportation.

ACTION: Final rule.

SUMMARY: These amendments to the Federal Aviation Regulations (FAR) update the standards for type certification of transport category airplanes for clarity and accuracy, and ensure that the standards are appropriate and practicable for the smaller transport category airplanes common to regional air carrier operation.

EFFECTIVE DATE: August 20, 1990.

FOR FURTHER INFORMATION CONTACT: Gary L. Killion, Manager, Regulations Branch (ANM-114), Transport Standards Staff, Transport Airplane Directorate, Aircraft Certification Service, FAA Northwest Mountain Region, 17900 Pacific Highway South, C-68966, Seattle, Washington 98168; telephone (206) 431-2112.

SUPPLEMENTARY INFORMATION:

Background

These amendments are based on Notice of Proposed Rulemaking (NPRM) 84-21 which was published in the **Federal Register** on December 3, 1984, (49 FR 47358). The notice was based on a review of part 25 which was originally initiated to ensure that the type certification standards contained in that part remain appropriate and practicable for the smaller transport category airplanes. After the review was begun, the scope was expanded to include relieving the regulatory burden wherever possible without compromising the existing standards and to update part 25 for clarity and accuracy. As noted in the notice, relatively few changes were found to be warranted with respect to type certification of the smaller transport category airplanes or relieving the regulatory burden. Consequently, updating part 25 for clarity and accuracy became the dominant reason for the changes proposed in the notice.

Interested persons have been given an opportunity to participate in this rulemaking and due consideration has been given to all matters presented. The proposals and comments are discussed below. Substantive changes and changes of an editorial nature have been made to the proposed rules based on relevant comments received and further review within the FAA. Since the time Notice 84-21 was prepared, the following amendments to part 25 have been adopted:

25-58 (49 FR 43182; October 26, 1984) Floor Proximity Emergency Escape Path Marking.
25-59 (49 FR 43188; October 26, 1984) Flammability Requirement for Aircraft Cushions.
25-60 (51 FR 18236; May 16, 1986) Airworthiness Standards; Fire Protection Requirements for Cargo or Baggage Compartments.
25-61 (51 FR 26206; July 21, 1986) Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins.
25-62 (52 FR 43152; November 9, 1987) Standards for Approval of an Automatic Takeoff Thrust Control System (ATTCS).
25-63 (53 FR 16360; May 6, 1988) Standards Governing the Noise Certification of Aircraft.
25-64 (53 FR 17640; May 17, 1988) Improved Seat Safety Standards.
25-65 (53 FR 26134; July 11, 1988) Cockpit Voice Recorder (CVR) and Flight Recorders.
25-66 (53 FR 32564; August 25, 1988) Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins.
25-67 (54 FR 26688; June 23, 1989) Location of Passenger Emergency Exits in Transport Category Airplanes.
25-68 (54 FR 34284; August 18, 1989) Revision of General Operating and Flight Rules.
25-69 (54 FR 40352; September 29, 1989) Design Standards for Fuel Tank Access Covers.
25-70 (54 FR 43822; October 27, 1989) Independent Power Source for Public Address System in Transport Category Airplanes.

A number of editorial changes have been made for compatibility with the text of these recently adopted amendments. Except for these editorial changes and other minor editorial and clarifying changes and the substantive changes discussed below, these amendments and the reasons therefore are the same as those contained in Notice 84-21.

Discussion of Comments

General

A number of commenters suggest further changes that go beyond the scope of the notice. Because interested persons have not been given the opportunity to comment on these further changes, they can not be considered at this time. Those that are deemed to have merit will, however, be considered for future rulemaking proposals.

Two commenters express disappointment that the proposed changes would not result in significant relief in the type certification of smaller transport category airplanes. As noted in the preamble to the notice, no change considered to adversely affect the level of safety of any transport category airplane was proposed. Further changes were considered; however, they were not proposed because it was considered that they would have adversely affected the level of safety of certain transport category airplanes. One commenter requests that the FAA reopen the comment period, alleging that the explanations contained in this NPRM misinformed its members as to the effects of the proposals. The commenter further alleges that many of the proposals would impose substantial new criteria on manufacturers which would ultimately be borne by the airlines who buy the airplanes. The commenter fails, however, to cite specific examples. The FAA does not agree with the commenter; the explanations do accurately reflect the intent of the proposals. Reopening the comment period is, therefore, not considered justified.

The notice contained numerous printing errors that were noted by commenters. These errors have been corrected accordingly.

Comments on specific proposals. The following discussion corresponds to like-numbered proposals contained in the notice.

Proposal 1. Section 25.2 would be amended for clarity. Two commenters believe that the reference to § 25.721(d) in proposed § 25.2(a)(1) is in error because § 25.721(d) does not currently exist. Proposed § 25.2 is correct because the reference is to paragraph (d) of the rules in effect on October 24, 1967, rather than to current rules. Except for certain editorial changes resulting from the recent adoption of Amendment 25-67, § 25.2 is amended as proposed.

Proposal 2. Two commenters agree with the proposed deletion of § 25.21(b). These commenters also agree with the proposed new wording of § 25.21(d) and remind the FAA that they have offered extensive comments on this same subject in regard to Advisory Circular (AC) 25-7, Flight Test Guide for Certification of Transport Category Airplanes.

Another commenter states deletion of § 25.21(b) in itself is not objectionable, but expresses concern about the FAA explanation given for this change. The commenter's concern is that the explanation "seems to indicate that the FAA's philosophy is such that testing done at forward center of gravity (c.g.) stalling speeds is sufficient for

certification," and "that § 25.21(b) *unnecessarily* requires the testing of airplanes * * * to be based on the rearward c.g. stalling speeds." It appears by the commenter's remarks that there is confusion about testing of an airplane at forward and aft c.g. with the trim speed and possible speed range criteria for these tests. There is no intent to change the requirement of § 25.21(a) to show that all flight requirements can be met at each appropriate combination of weight and c.g. within the range of loading conditions for which certification is requested.

One commenter states an objection to the proposal on the grounds that it would remove provisions to simplify flight testing. He also states that it removes the option to reduce flight testing by accepting performance penalties, and removes a well established system of tolerances for flight testing. The FAA does not agree. The removal of a requirement that could force duplicate stall-speed and flying qualities testing is, in itself, considered a simplification. Removal of § 25.21(b) leaves only one stall speed (the forward c.g. stall speed) to serve as the reference basis for trim and speed range factors that are flown at speeds down to 110 percent of the stalling speed.

No other comments concerning this proposal were received. Section 25.21 is, therefore, adopted as proposed.

Proposal 3. The sole commenter agrees with this proposal. Section 25.29(a)(3)(iii) is, therefore, revised to refer to "* * * fluids intended for injection in the engine," as proposed.

Proposal 4. One commenter agrees with the proposal to amend § 25.33 to include terminology appropriate for turbopropeller engines, and to clarify the wind conditions.

Another commenter notes a typographical error in the third line of § 25.33(c)(3). The word "power" has been changed to "powered" accordingly.

One commenter objects to insertion of the words "or maximum takeoff torque limit for turbopropeller engine powered airplanes" in § 25.33(c)(3). The commenter asserts that the propeller flight fine (low) pitch stop setting on turbine engine powered airplanes normally is such that an increase in propeller speed during a go-around is not necessary. The commenter further states that the previous version of this requirement originated during the era of reciprocating-engined airplanes and was not applied to turbine-engined airplanes when § 25.101 and subsequent sections were introduced. In addition, the commenter states that it would be difficult, in practice, to ensure symmetrical propeller speed for a multi-engined airplane under this requirement. The FAA does not agree with the commenter since the basic purpose of § 25.33 is to limit the maximum propeller speed at maximum power with the governor inoperative. It has no bearing on the propeller/governor rigging or matching the engine/propeller combination in normal operational situations. Contrary to the commenter's assertion, this regulation has been applied to turbine-engine powered airplanes, and the proposed change reflects accepted practice. The adoption of § 25.101 is not relevant, as it refers to airplane performance determinations, not to propeller speed and pitch limits.

Another commenter objects to the "no wind" condition of § 25.33(c)(2), saying that the requirement would severely limit weather conditions under which flight testing could be conducted. The commenter recommends that the test be conducted in as much as 5 knots of wind. The FAA does not concur with allowing a tolerance on wind, such as that proposed, because the results of the test could be adversely affected. It should be noted, however, that "no wind" would not mean that testing could only be conducted when there is no wind blowing. As has been past practice, test data obtained under limited wind conditions could be corrected to "no wind" conditions.

The commenter also states that experience has shown that the definition of propeller pitch limits is not significantly affected by using the maximum engine values available on the day of the test, as required by proposed § 25.33(c)(3). The commenter states that the proposal, which would require testing at maximum torque, implies that test conditions must include very low temperatures and/or very low altitudes. The commenter does not believe that the FAA intended to impose such limitations on testing or to impose the burden of finding such test conditions and suggests an alternative to the proposal. The FAA agrees with the commenter in that rewriting this paragraph was intended to specify the amount of power to be applied to the propeller, and testing under a wide variety of conditions was not intended. The objective of the proposal is to define the maximum torque limit. Consequently, there would be no requirement to perform the testing in cold air or at very low altitudes. Rather, the testing should be performed in ambient conditions where the maximum torque limit can be obtained without exceeding other engine limits. Maximum torque does not occur as a point condition but is a function of a range of temperature and altitude combinations. When ambient conditions preclude obtaining maximum torque without exceeding other engine limits, the other limits are sometimes exceeded for test purposes with the concurrence of the engine manufacturer.

There were no other comments concerning this proposal. Except for correcting the above noted typographical error, § 25.33 is adopted as proposed.

Proposal 5. The sole commenter agrees with this proposal. Section 25.111 is, therefore, amended to correct an editorial error as proposed.

Proposal 6. As proposed, § 25.121 would be amended to clarify the intent of the section and to reflect actual certification practice. One commenter suggests a change to the proposal to incorporate a requirement to account for turbopropeller operation that assumes the propeller to be in the position it takes automatically. The commenter states that this change should also be applied to § 25.121(a)(1). The commenter assumes the word "automatic" refers to an airplane system that produces an automatic function, such as autofeather. In the context of this section, the word "automatic" means without crew action, since the propeller pitch may automatically change from a takeoff to a windmill pitch (but not a feather position) because of the engine failure, aerodynamics, and the related hydromechanical operation of the propeller pitch control system.

The commenter also suggests that the FAA proposal should be changed to require consideration of a lesser power or thrust if the thrust reduction is due to the expiration of takeoff augmented power or thrust. This suggestion is consistent with the intent of the proposal, but it would not allow for other conditions that may cause significant power or thrust reductions. Two commenters state that the normal altitude/thrust lapse rate of turbine engines at fixed revolutions per minute (rpm) and ambient temperature is approximately 1.4 percent per 1000 feet. In the opinion of those commenters, the −0.5 percent thrust change criterion is inappropriate since it would seem to require consideration of normal thrust lapse with altitude, which as stated in the FAA explanation, is not the intent of the proposal. The FAA policy concerning acceptable means of compliance with § 25.121(b)(1) is stated in AC 25–7. A rule change is, therefore, not needed for that purpose. The proposal is, therefore, withdrawn.

Proposal 7. Two commenters favor the proposal to amend § 25.125(a)(2) to substitute the word "stabilized" for

"steady gliding." They state that in their view, however, the amendment does not go far enough toward the real need, which is a fundamental reappraisal of the existing requirement for determining landing distances. The lack of a stated, operationally realistic, approach path angle is cited as an example. The FAA recognizes that there is interest in reevaluating the landing regulations and changes of this nature to the existing regulations have been discussed in the past. Such changes, would, however, be beyond the scope of the notice and could not be considered at this time. It is noted that AC 25-7 contains policy information, including approach path angles that are acceptable to the FAA.

Another commenter agrees with the proposed word change, but suggests an additional change to include specific approach path angles that would be a function of the short takeoff and landing characteristics of the airplane. A change of this nature could not be considered at this time because it too would be beyond the scope of this notice. It should be noted that a definition of short takeoff and landing characteristics would be required before this suggestion could be adopted. This would require consideration of many factors that would result in a long-term rulemaking process. Section 25.125 is, therefore, adopted as proposed.

Proposal 8. As proposed, the wording of § 25.147(a) would reflect the intent of the rule more accurately and would conform to actual type design certification practice. Three commenters note a typographical error in that proposed § 25.147(a) refers to yaw into the inoperative engine. As noted in the explanation for Proposal 8, the intent of § 25.147(a) is to "ensure that some directional control toward the operative engine remains." The intention is to require yaw into the operative engine. This typographical error has been corrected in the final rule.

Two commenters state that reference to c.g. position appears in at least 12 separate places in part 25, subpart B. They suggest that a single all-inclusive statement would be preferable. The FAA will consider this suggestion for possible incorporation in a future revision to part 25.

One commenter suggests that the FAA refer to § 25.147 of Joint Airworthiness Requirements-25 (JAR-25) for guidance. (Joint Airworthiness Requirements-25 is a document developed jointly and accepted by the airworthiness authorities of various European countries for type certification of large airplanes. Joint Airworthiness Requirements-25 is based on part 25 of the FAR; however, there are differences in the requirements of the two documents. Those differences are specified in JAR-25.) The FAA did consider § 25.147 of JAR-25 in making this proposal; however, the resulting proposal more closely reflects the FAA intent regarding this requirement.

One commenter states that the requirement should be for "wings approximately level" rather than "wings level," since there are no indicated tolerances on the latter. The FAA recognizes that literal compliance with a requirement to hold the wings absolutely level would be a most difficult task. The FAA intent in this test requirement is to hold the airplane in the most wings-level flight possible. It is not considered necessary or desirable to introduce a "relaxation factor" by adding "approximately." The policy material contained in AC 25-7 recognizes that wings cannot be held exactly level; however, the regulation encourages the most wings-level flight possible.

No other comments concerning this proposal were received. Except for correction of the above noted typographical error, § 25.147 is amended as proposed.

Proposal 9. As proposed, changes would be made to § 25.149 to clarify the actual intent of the rule. One commenter suggests deleting the words "maintain" and "of" in § 25.149(b) to avoid misinterpretation. The FAA does not consider "maintain control" likely to be misinterpreted, nor that "control" would provide any improvement in that regard.

The same commenter recommends that existing § 25.149(e) be rewritten to delete the words "recover," "of," and the parenthetical statement "without the use of nose-wheel steering." The commenter states that the proposal as written could be interpreted to mean that the demonstration would always be required on a critical runway surface, eliminating the alternative of demonstrating on a dry runway with nose-wheel rudder pedal steering inoperative. In addition, the commenter states there is no accepted definition of critical runway surface. The FAA agrees with the commenter's statement regarding the runway condition, but believes that clarification on the use of controls will resolve this concern. The rule has been rewritten to clarify these points.

The same commenter also proposes a revision to § 25.173. While this would be beyond the scope of the notice, the FAA will take the suggestion under advisement for possible future rulemaking action.

Two commenters suggest that V_{MC} should be the generic term, and that the term V_{MCA} should be used to describe the condition when airborne after takeoff. The FAA will also take these suggestions under advisement for possible future rulemaking action.

The same two commenters state there is no reason to disallow use of lateral control in V_{MCG} demonstrations. The FAA position to allow lateral control only to the extent of keeping the wings level is intended to prevent the use of arbitrary and unnatural pilot inputs, which could produce results that are misrepresentative and unconservative.

Five commenters question the proposed wording of § 25.149(e) with regard to the runway surface, saying that a critical runway surface is not defined. As stated above, the FAA agrees, and the current prohibition on the use of nose-wheel steering has been retained.

One commenter states that the word "recover" should be retained in § 25.149 (b), (f), and (g). The FAA does not agree. The word "recover" is removed because it incorrectly implies that the airplane would be allowed to go out of control before corrective action is taken. Two commenters question the statement in the explanation that the term "sideslip" would be used in lieu of "yaw." This was merely an inadvertent statement that did not reflect the final proposal.

Except as noted above, § 25.149 is amended as proposed.

Proposal 10. As proposed, § 25.177 would be revised to eliminate the requirement for testing that has been found to be unnecessary. It is considered unnecessary to define directional and lateral stability parameters as separate entities to determine whether an airplane has satisfactory directional-lateral stability. One commenter suggests deleting the words "* * * provide positive stability and * * *" in the first sentence of § 25.177(c) because the proposed language infers that the control movements produce positive stability. The FAA agrees, and the proposal has been amended accordingly. This commenter also notes that most airplanes are aileron-control limited and will reach the lateral control stops prior to the application of maximum rudder. The commenter notes, therefore, that the proposed rule, as written, would impose a control power requirement. The FAA does not concur. There is no intent to impose an additional burden. The FAA considers that the proposed regulation is sufficient to preclude misunderstanding in this regard.

One commenter objects to the proposed use of "positive" instead of "not negative" as contained in the

present rule. This commenter's concern is addressed by the change described above.

Two commenters state that the 180 pound rudder pedal force should be changed to 150 pounds. One states that the FAA inadvertently referred to the wrong force limit, and the other states that it should be changed to be consistent with the requirement of § 25.143(c). The FAA does not agree. The force limit in § 25.143(c) is 150 pounds because the intent of that section is to show that the airplane is safely controllable and maneuverable during certain probable operating conditions by a pilot who is capable of applying only 150 pounds of force to the rudder pedals. In § 25.177(c), the force limit is 180 pounds to demonstrate that the airplane remains stable if a stronger pilot applies up to 180 pounds of rudder pedal force.

Two commenters suggest a change to the proposal because the language infers that the control movements produce positive stability. The change described above should satisfy these commenters' concern.

The same two commenters also discuss the proposal and its meaning in considerable detail. The commenters suggest that interpretive material should be incorporated into AC 25-7. The FAA will consider this suggestion for a future revision of the AC.

The same two commenters suggest transposing V_{FC}/M_{FC} and V_{MO}/M_{MO} in § 25.177(d). The FAA agrees, as this would correspond to the sequence in which these speeds occur.

As amended, § 25.177 no longer relates to directional and lateral stability parameters as separate entities. Accordingly, the section title has been changed to "Static lateral-directional stability."

Except as noted above, § 25.177 is amended as proposed.

Proposal 11. Two commenters concur with the proposal to amend § 25.181 (a) and (b) by removing the words "stalling speed" and inserting "1.2 V_s" in their place. They do not, however, share the FAA view that flying qualities between stalling speed and 1.2 V_s are covered in §§ 25.143 and 25.203. The commenters suggest that interpretive material should be added to AC 25-7. The FAA will consider this suggestion for a future revision of the AC.

One commenter is opposed to the proposal because, according to the commenter, it would essentially extend the stalling characteristics out to 1.2 V_s. The FAA does not agree. If dynamic stability is satisfactory at 1.2 V_s it probably would not deteriorate to the extent of being described as "stall onset characteristics" immediately below 1.2 V_s. Dynamic V_{MCA} and stall demonstration tests would uncover undesirable dynamic features. These tests include stalls limited by changes in pitch, roll, abrupt change in control motion, or aerodynamic warning of a magnitude and severity to deter further speed reduction.

No other comments concerning this proposal were received. Section 25.181 is, therefore, amended as proposed.

Proposal 12. One commenter is opposed to the proposal to remove § 25.205 which requires demonstration of stall recovery from a pilot-induced sideslip with asymmetrical thrust and resultant large control deflections. The commenter does not agree with the FAA explanation that this is an unrealistic test. The commenter makes a comparison between the flight test environment, where the events are caused by deliberate actions, and in-service flight where events that result in a critical maneuver must be immediately recognized and corrected by the pilot. The FAA agrees with the commenter's statement. The arguments presented, however, do not indicate that the conditions required by the current regulation are applicable to the scenario the commenter creates. Although not an airworthiness requirement per se, except via interpretation of § 25.143, a "tameness maneuver" is conducted during flight testing, by delaying recovery from an engine cut at takeoff power and takeoff speed. Although not a stall, this maneuver, plus VMC testing, provides a more realistic test of sudden engine-out controllability than the current requirement for moderate asymmetry stalls.

Two commenters favor the proposal. An argument presented as justification for this proposal by one commenter, which is worthy of noting here, is as follows: "The requirement to demonstrate stalls with the critical engine inoperative is restricted to the en-route configuration and to a level or power asymmetry with which the airplane is controllable with wings level at the stalling speed. As a result, the power on the operating engines at the stall is normally fairly low, and thus neither the configuration nor the power setting are representative of the conditions most likely to accompany an inadvertent stall in service. Reduction of the power of the operating engines during the recovery is also permitted, and it is questionable whether such action would be taken promptly in the case of an inadvertent stall in service. Experience shows that stalls with significant power asymmetry can result in a spin; even on airplanes which are certificated to the present requirement. It is thus apparent that the requirement for demonstrating one-engine-inoperative stalls is not effective in ensuring that inadvertent stalls in service with one engine inoperative will have satisfactory characteristics or be recoverable.

"Despite the ineffectiveness of the present requirement as a means of ensuring airworthiness, the accident record does not show that modern transport category airplanes suffer a loss of airworthiness as a result of substandard stalling qualities with asymmetric power. It is considered that sufficient protection against the hazard of stalling with one-engine-inoperative is provided by the one-engine-inoperative performance requirements and operating speed margins, coupled with the requirements for determination of V_{MC} and demonstration of stalling characteristics with symmetric power." The FAA concurs with this comment. Section 25.205 is, therefore, removed as proposed.

Proposal 13. As proposed, § 25.251(e) would be revised to require a determination of the positive maneuvering load factors at which the onset of perceptible buffeting occurs only for faster airplanes or those which operate at higher altitudes. Two commenters support the proposal; however, they believe that it would be more appropriate to express the speed discriminant in terms of an appropriate operational value (e.g., M_{MO}) rather than M_D which is a design value. The FAA does not concur because this would be the basis for deciding whether a test will be conducted rather than determining an in-service operational limit. Furthermore, M_{MO} might not be established at the time this determination is made. Section 25.251 is, therefore, amended as proposed.

Proposal 14. One commenter states that the proposal to revise § 25.253(a)(3) to clarify the intent of the term "control reversal" should be withdrawn because it would require a stable slope of the elevator control force to V_{DF}/M_{DF}, whereas the present rule permits reversal of the stick force gradient from V_{FC}/M_{FC} to V_{DF}/M_{DF}. The FAA does not agree. The intent of the proposal is solely to clarify the term "control reversal" and not to impose more stringent requirements.

Two commenters support the intent of the proposal and suggest an editing change to achieve further clarification. The FAA agrees and has adopted the commenters' suggestion accordingly.

Except as noted above, § 25.253 is amended as proposed.

Proposal 15. As proposed, § 25.307 (b) and (c) would be removed because they contain only redundant references to §§ 25.571, 25.573 and 25.601. One commenter suggests that the proposed removal of paragraph 25.307(c) would create the impression that an analysis conforming to paragraph 25.307(a) would be acceptable for control surfaces which must always be tested in accordance with § 25.561. The FAA does not concur that removing this redundancy would create such an erroneous impression. Section 25.307 is, therefore, amended as proposed.

Proposal 16. No comments within the scope of the notice were received. Section 25.331 is, therefore, amended as proposed to correct existing editorial errors.

One commenter erroneously believes that A_1 and A_2 should be at V_A passing through Point A because V_A is defined in § 25.33S(c) as not less than V_{S1} N. The maneuvering envelope was revised in part 4b of the Civil Air Regulations (CAR) (the predecessor of part 25 of the FAR) in 1962 to reflect the actual C_N MAX curve. The calculation of $V_A = V_{S1}$ N assumes a constant value of C_N MAX from V_{S1} to V_A. The actual C_N MAX usually varies due to compressibility effects. Point A is the intersection of the actual C_N MAX curve with the maneuvering load factor line. Points A_1 and A_2 are, therefore, correctly defined in § 25.333.

Proposal 17. No comments concerning this proposal were received, therefore, § 25.341 is amended as proposed to correct existing editorial errors. Since the time Notice 84–21 was issued, two additional typographical errors have been noted in some printings of § 25.341(b)(3). In some printings, the numerator of the formula for the gust alleviation factor contains the lower Greek letter "mu" with the subscript "n" in lieu of the correct subscript "g." The denominator of the formula correctly contains "mu" with the subscript "g." In the formula for airplane mass ratio, the airplane mass ratio is incorrectly defined as "g." The correct definition is the Greek letter "mu" with the subscript "g." Section 25.341 is also amended to correct these printing errors as well.

Proposal 18. No comments concerning this proposal were received; therefore, § 25.345 is amended as proposed.

Proposal 19. One commenter supports the correction of § 25.361 to ensure application of the limit engine torque factor of 1.25 to the takeoff power condition as well as to the maximum continuous power condition. The commenter is, however, concerned that the application of this factor in combination with the 1.6 propeller malfunction factor of § 25.361(a)(3) would constitute a double failure. The FAA does not agree. The 1.25 factor is intended to account for expected torsional excursions and is, therefore, considered as a limit torque factor. The overall factor for the propeller malfunction is the product of the 1.25 factor and the 1.6 factor, which results in an overall factor of 2.0. This 2.0 factor is the worst case dynamic amplification factor to be used in the absence of a rational analysis of the propeller malfunction condition. Part 4b of the CAR, the predecessor of part 25, originally specified a factor of 2.0 for the propeller malfunction condition; however, this was later reduced to 1.6 to give an overall load factor of 2.0 when both factors are applied simultaneously. Another commenter suggests that the propeller malfunction condition should be considered as an ultimate condition. The FAA does not agree. From its initial inception as a special condition and subsequent adoption in part 4b of the CAR, this condition has been considered to be a limit design condition. It is an attempt to account for an actual load condition that can be expected to occur at the time of failure and is not analogous to maneuver and gust load conditions where the probability of obtaining the limit design load after the failure is unlikely. In the case of propeller malfunction where the loads result from the failure condition itself, a design margin is essential. Although it is true that the 1.6 factor may be conservative, it is a simplified load condition which may be used in lieu of a rational analysis. Section 25.361 is, therefore, amended as proposed.

Proposals 20 and 21. No comments concerning these proposals were received; therefore, §§ 25.365 and 25.373 are amended for clarity as proposed.

Proposal 22. One commenter generally supports the replacement of the words "rugged system" in § 25.395 with the requirement to meet the minimum pilot effort forces of § 25.397(c). No other comments concerning this proposal were received. Section 25.395 is, therefore, amended as proposed.

Proposal 23. As proposed, an editorial error in Footnote 3 of § 25.397 would be corrected. No comments concerning the proposed correction were received; however, two commenters believe that the referenced footnote should be 1, not 3. This discrepancy is due to the fact that the footnote in question has been identified as 1 in some printings of part 25 and as 3 in others. Regardless of which printing is used, the footnote should read, "The unsymmetrical forces must be applied at one of the normal handgrip points on the periphery of the control wheel," and § 25.397 is corrected accordingly.

Proposal 24. No comments were received concerning the proposal to reidentify the control surface area aft of the hinge line as S_s and add the parenthetical definition of W/S in § 25.415. Several commenters did, however, note that the formula in the equation should have read "$H = KcS_sq$." This printing error has been corrected, and § 25.415 is amended accordingly.

Proposal 25. As proposed, § 25.459 would be amended to specifically refer to slats, as well as to slots and spoilers, in order to ensure that slats are not overlooked in determining compliance with this section. One commenter does not believe that this section would be improved by giving an "exhaustive" list of examples of special devices using aerodynamic surfaces. The FAA does not concur. The inclusion of "slots, slats, and spoilers" is considered to clarify the intent of the rule. There were no other comments within the scope of the notice. Section 25.459 is, therefore, amended as proposed.

Proposal 26. Section 25.563 merely cross-references § 25.801(e) and would be removed for simplicity. One commenter believes that it is useful to retain § 25.563 even though it does serve only as a reference to § 25.801(e). The FAA concurs that this reference, which is located in Subchapter C—Structure, may be useful as § 25.801(e) requires a loads evaluation and is contained in Subchapter D—Design and Construction which does not generally contain loads evaluation criteria. The proposed removal of § 25.563 is, therefore, withdrawn.

Proposal 27. One commenter objects to the proposed deletion of the parenthetical expression "fail-safe" from the heading of § 25.571(b) because it would imply that compliance with the damage-tolerance requirements of that section, when combined with inspection provisions, does not result in a fail-safe structure. Fail-safe and damage-tolerance are not synonymous terms. Fail-safe generally means a design such that the airplane can survive the failure of an element of a system or, in some instances one or more entire systems, without catastrophic consequences. Fail-safe, as applied to structures prior to Amendment 25–45, meant complete element failure or obvious partial failure of large panels. It was assumed that a complete element failure or partial failure would be obvious during a general area inspection and would be corrected within a very short time. The probability of detecting damage during routine inspections before it could

progress to catastrophic limits was very high. Damage-tolerance, on the other hand, does not require consideration of complete element failures or obvious partial failures, although fail-safe features may be included in structure that is designed to damage-tolerance requirements. A part may be designed to meet the damage-tolerance requirements of § 25.571(b) even though cracks may develop in that part. In order to ensure that such cracks are detected before they grow to critical lengths, damage-tolerance requires an inspection program tailored to the crack progression characteristics of the particular part when subjected to the loading spectrum expected in service. Damage-tolerance places a much higher emphasis on these inspections to detect cracks before they progress to unsafe limits, whereas fail-safe allows the cracks to grow to obvious and easily detected dimensions. Deletion of the term "fail-safe" from the heading of § 25.571(b) is, therefore, considered appropriate.

One commenter is concerned that the proposed requirement of § 25.571(e) concerning a bird strike at "V_c at sea level" in lieu of "likely operational speeds up to 8,000 feet" would not be conservative for airplanes for which a variation of V_c versus altitude with a low value at sea level is defined. The FAA concurs that the proposed change would be unconservative for some airplanes which have a rapidly increasing V_c with altitude between sea level and 8,000 feet. The amended § 25.571(e), therefore, specifies impact with a 4-pound bird at V_c up to 8,000 feet.

One commenter believes that it would be more appropriate and consistent with previous compliance findings to replace "V_c" with "V_{mo} at sea level" and that this would assure that applicants may select and establish slower speeds as limitations at those altitudes where the airplane is considered more vulnerable to bird strikes. The commenter believes that this would confirm that V_c should be a single value function for use in basic loads determination. This comment goes beyond the scope of the notice; however, the FAA notes that the bird strike requirements of §§ 25.571(e)(1), 25.631 and 25.775 are structural requirements. V_{mo} is an operating speed rather than a structural design speed and is, therefore, not appropriate for structural design.

One commenter suggests that § 25.631 should be deleted as it would be unnecessary in view of the proposed change to § 25.571(e)(1) and would cause conflicting interpretations as to which section would apply. This comment goes beyond the scope of the notice; however, the FAA notes that the section should not cause any confusion because the former section requires consideration of an 8-pound bird while the latter concerns a 4-pound bird.

Two commenters are concerned about the proposal to require evaluation of the Power Spectral Density (PSD) gust loads on the damaged structure. They state that such analyses are not applicable to short time failure situations and would be costly. The PSD load level is determined using a frequency of exceedance of once per 50,000 flight hours. This is not considered frequent, but is on the order of frequency associated with other limit load conditions used in the damage-tolerance analysis. The FAA believes that certain types of structures, especially truss types, will experience significant changes in stiffness with failed elements. This may allow coalescence of modal response in the frequency regime which can result in a significant increase in loads. One commenter estimated that this would result in approximately $300,000 in additional costs to type certificate a new design transport category airplane; however, the commenter presented no data to support this estimation. Because no supporting data was presented, § 25.571 is amended as proposed in this regard.

No comments concerning other proposed changes to § 25.571 were received. Except as noted above, § 25.571 is amended as proposed.

Proposals 28 and 29. The probability bases contained in MIL–HDBK–5 for establishing materials strength allowables are currently incorporated by reference in §§ 25.613 and 25.615. As proposed, § 25.613 would be changed to state these bases explicitly, and the nonredundant portion of § 25.615 would be transferred to § 25.613. One commenter suggests that §§ 25.613 and 25.615 should provide two different approaches to establishing allowables, with § 25.615 allowing a simplified approach. The FAA does not agree. Section 25.613 requires the use of design values established on a probability basis so that the probability of materials being understrength is extremely remote. Section 25.615 provides for the use of design values from MIL–HDBK–5 which have already been established on probability bases. Under the proposed amendment, § 25.613 would be consolidated with some of the criteria from § 25.615. The remaining portions of § 25.615 would serve only to provide an acceptable means of compliance and would be deleted, accordingly. One commenter supports the consolidation of the two sections, but suggests that the reference to military handbooks be included in an AC. Another commenter is concerned that removing the reference to MIL–HDBK–5 would indicate that design criteria for materials and fasteners contained is this document would no longer be acceptable. On the contrary, the values of MIL–HDBK–5 would remain acceptable means of compliance because they are established by the same probability bases as those of proposed § 25.613. Section 25.613 is therefore amended, and § 25.615 is removed as proposed. There does not appear to be any need for an AC that references military handbooks, as suggested; however, the FAA will develop an AC of this nature if the need arises in the future.

Proposal 30. This would be a conforming change to § 25.625(d) necessitated by the proposed deletion of § 25.1413 (Proposal 80). No adverse comments concerning either proposal were received; however, one commenter does correctly note that the word "factors" in § 25.625(d) should be singular. Except for that correction, § 25.625(d) is revised as proposed.

Proposal 31. As proposed, § 25.629 would be amended by correcting an editorial error. One commenter objects to the use of the word "other" in proposed § 25.629(d)(ii). The word "other" is used to exclude the failure conditions specifically identified in the rule, which must be considered under the provisions of § 25.629(b)(1)(i) regardless of probability. The same commenter believes that proposed § 25.629(b)(1) should be reworded to reflect the stated intent. The FAA concurs with the latter comment, and § 25.629(b)(1) is changed to read, "* * * except that the envelope may be limited to a maximum Mach number of 1.0 when M_D is less than * * *." Except for this change, § 25.629 is amended as proposed.

Proposal 32. No comments concerning this proposal to remove redundant and possibly confusing § 25.673 were received. Section 25.673 is, therefore, removed as proposed.

Proposal 33. No comments concerning this proposal were received; therefore, § 25.693 is amended to remove the erroneous reference to MIL–HBDK–5 as proposed.

Proposal 34. This proposed amendment to § 25.697 was made in Amendment 25–57; therefore, no further action with regard to this proposal is necessary.

Proposal 35. As proposed, § 25.701 would be amended to ensure that the

consequences of asymmetrical slat retraction are not overlooked. One commenter suggests changing the title of § 25.701 to "Flap and slat interconnection" as the proposal applies to interconnecting elements as well as to the flap and slat surfaces. The FAA concurs that this addition would be a more descriptive title and has amended this section accordingly.

Two commenters suggest adding the words "or equivalent means" to § 25.701(b) for consistency with § 25.701(a). The FAA concurs that this addition would clarify that any equivalent means must also prevent flap movement under the prescribed loading conditions of this section. Section 25.701(b) is, therefore, amended accordingly.

One commenter prefers the word "asymmetrical" to "unsymmetrical"; however, "unsymmetrical" is retained for consistency with other usage in part 25.

One commenter suggests changing § 25.701(d) to read "* * * when interconnected flap or slat surfaces on one side * * *." The strength requirement for interconnections should apply to each interconnected set separately. The FAA concurs that this would clarify the requirements of this section. Section 25.701(d) is, therefore, amended accordingly.

Except as noted above, § 25.701 is amended as proposed.

Proposal 36. Section 25.723 would be amended to provide more latitude in the use of analyses in determining landing gear energy absorption characteristics. One commenter suggests using the expression "similar design characteristics" in lieu of "identical" since similar energy absorption characteristics could be obtained using different energy absorption methods which would not be valid for comparison analysis. In order to achieve the intent, the following wording, which is more explicit, has been adopted: "This must be shown by energy absorption tests except that analyses based on earlier tests conducted on the same basic landing gear system which has similar energy absorption characteristics may be used for increases in previously approved takeoff and landing weights." Except for this change in wording, § 25.723 is amended as proposed.

Proposal 37. No comments concerning this proposal were received. Section 25.731 is, therefore, amended to refer to maximum weight in lieu of takeoff weight, as proposed.

Proposal 38. As proposed, the requirement to consider the effects of engine thrust on tire loading would be deleted from § 25.733(a)(1).

One commenter objects to the proposed deletion and states that inertia loading should be taken into consideration notwithstanding that it is transient at the initiation of taxi. The commenter believes that tire inertia loading is a rational requirement and that safety considerations outweigh any regulatory burden. According to information available to the FAA, the inertial effects are less than three percent of the design static tire load. They are transient and occur at the initiation of or early in taxi where safety has not been an issue due to the low speeds involved. Furthermore, the inertial effects are insignificant when compared to the effects that taxi distance at maximum loads or the high energies associated with a rejected takeoff (RTO) have on tire design and safety. Technical Standard Order (TSO) TSO–C62c for aircraft tires specifies eight 35,000 feet taxi tests at the rated load and two 35,000-feet taxi tests at 1.2 times the rated load. In addition, the TSO specifies one overload takeoff cycle at 1.5 times the rated load. These tests, together with the taxi and RTO tests conducted for airplane type certification, provide more than ample margins to cover any tire load considerations due to engine thrust.

Another commenter suggests that the term "maximum ramp weight" should be replaced with the term "maximum weight" to account for those airplanes for which another condition, e.g., takeoff weight or taxi weight, is the maximum design weight. The FAA concurs, and the term "maximum weight" is used accordingly.

In addition to the proposed changes, one commenter suggests changes to § 25.733(b) (2) and (3) for clarification. According to the commenter, it is not clear whether vertical ground reactions are to be based on a deceleration of .31g due to braking or are to be based on a deceleration of .31 times the vertical load on the braked wheels. While the changes proposed by the commenter are beyond the scope of Notice 84–21 and cannot be considered at this time, the FAA notes that the vertical ground reactions are based on a deceleration of .31 times the vertical load. The commenter's suggested changes will be considered for future rulemaking if, as the commenter believes, the present wording of § 25.733(b) (2) and (3) is found to be causing confusion.

Except as noted above, § 25.733 is revised as proposed.

Proposal 39. One commenter supports the proposed clarification of § 25.735, but suggests that, in addition, the title should be changed to "Wheel brakes." The commenter correctly notes that there are other types of brakes to which this section does not apply, such as drag producing devices, propeller brakes, etc. The applicability of § 25.735 to only wheel brakes is, however, self evident because that section falls, in turn, under the heading "LANDING GEAR."

No other comments concerning this proposal were received. Section 25.735 is, therefore, amended as proposed.

Proposal 40. As proposed, § 25.772 would be amended to apply to an airplane with any lockable door between the pilot compartment and the passenger compartment, not just to one with a lockable door installed to comply with § 121.313 of this chapter. One commenter expressed a concern that a lockable door installed between the pilot compartment and the passenger compartment should be openable from the passenger compartment with a key. A requirement of this nature would, however, clearly be beyond the scope of the notice. No other comments concerning this proposal were received. Section 25.772 is, therefore, revised as proposed.

Proposal 41. As proposed, § 25.773(b)(1)(i) would be revised to specify that the means to maintain a clear portion of the windshield must be designed to function with all lift and drag devices, e.g., slats and spoilers as well as flaps, retracted. In addition, § 25.773(b)(2) would be amended to allow alternate means of maintaining clear vision in lieu of an openable window.

Three commenters address the proposed requirement of § 25.773(b)(2) to consider the probable damage due to a severe hail encounter. One concurs with the intent of the proposal, but believes that the term "severe hail" and the test condition should be defined. Another commenter asserts that the requirement to consider a severe hail encounter should be deleted because the term is not defined. Another asserts that the proposed requirement might be interpreted to permit no obstruction of any kind on any portion of the window. The commenter also asserts that the requirement of a severe hail encounter should be deleted since (according to the commenter) the intent of the provision for sufficient view, which is to permit continued safe flight and landing, is covered under § 25.775(e).

The FAA does not concur that the requirement to consider the effects of a severe hail encounter could be deleted without a possible degradation of safety. The purpose of the long-standing requirement of this section for an

openable window is to enable the flightcrew to make a safe landing in the event the windshield is obscured due to climatic conditions, insect encounters, or damage. One possible cause of obscuration is the pitting and crazing of the windshield that could result from a severe hail encounter. A nonopenable window would preclude the flightcrew from making a safe landing under these circumstances if the window were subjected to the same obscuration as the windshield. It is, therefore, essential that a nonopenable window used in lieu of the traditional openable window be capable of sustaining a severe hail encounter without obscuration.

As noted in the explanation of this proposal contained in the preamble to Notice 84–21, means of compliance other than an openable window have been found acceptable previously under the equivalent safety provisions of § 21.21(b)(2) of this chapter. The FAA is not aware of any difficulties with the definition of "severe hail encounter" that were experienced when each finding of equivalent safety was made. The FAA will, however, review the matter further to determine whether guidance concerning acceptable means of compliance is needed. If such guidance is needed, it will be published as an AC.

In regard to the commenters' concern that the requirement might be interpreted to permit no obstruction of any kind on any portion of the window, it must be noted the proposed rule would require a "means," not a window, per se. If the entire window were needed to safely land the airplane with the windshield obscured, the entire window would constitute the "means" and would have to be free from obstruction accordingly. If, on the other hand, a certain portion of the window were found to be sufficient to safely land the airplane with the windshield obscured, only that portion would have to be free from obstruction. In the latter case, whether other areas of the window were free from obstruction would be irrelevant insofar as compliance with the proposed rule would be concerned.

There were no comments concerning the proposed changes to § 25.773(b)(1)(i).

In view of the above, § 25.773 is amended as proposed.

Proposal 42. As proposed, § 25.779 would be amended to refer to "power or thrust" in lieu of "throttles," which is a misnomer when applied to turbine powered airplanes. One commenter recommends the use of the term "throttles/thrust" in lieu of "power or thrust." The FAA does not concur with this recommendation. Although "throttle" is an appropriate term for reciprocating-powered airplanes and "thrust" is appropriate for turbojet-powered airplanes, neither term is appropriate for turbopropeller-powered airplanes. "Power or thrust," on the contrary, is appropriate for all types of transport category airplanes. There were no other comments concerning this proposal. Section 25.779 is, therefore, amended as proposed.

Proposal 43. As proposed, § 25.781 would be amended to refer to "POWER OR THRUST CONTROL KNOB" in lieu of "THROTTLE CONTROL KNOB" and to "PROPELLER CONTROL KNOB" in lieu of "RPM CONTROL KNOB" in the diagram. The sole commenter recommends that the terms "THROTTLE" and "RPM" be retained for consistency with a proposal the commenter made on another occasion with regard to part 23 of this chapter. "THROTTLE" is a term appropriate to reciprocating-powered airplanes; but, as noted in the notice, it is a misnomer when applied to turbine-powered airplanes. "POWER or THRUST," on the contrary, are terms applicable to all transport category airplanes. Current industry practice is to refer to these controls as "power levers" or "thrust levers," as appropriate for the airplane involved. "RPM" is an ambiguous term in this context since there are, in some instances, engine speeds that are not proportional to the propeller speed. In other instances, the control in question may control propeller pitch rather than propeller speed, which is directly controlled by an engine governor. The term "PROPELLER" is, therefore, more accurate technically and, as noted in the notice, consistent with the terminology used in § 25.779. Section 25.781 is, therefore, amended as proposed.

Proposal 44. As noted in the explanation, the purpose of the proposed change to § 25.783(g) was to replace the reference to paragraph (f) that was inadvertently deleted during a previous revision. Unfortunately, the notice contained a printing error that left the incorrect impression that § 25.783(g) would also be changed substantively. No comments concerning the change actually intended were received; therefore, § 25.783(g) is amended as described in the explanation.

Proposal 45. As proposed, a number of changes would be made to § 25.785 for clarity. In addition, the requirement presently contained in § 25.1307 to provide a seat for each occupant would be transferred to this section for ease of reference and relaxed to allow the use of a berth in lieu of a seat for a nonambulant person. The requirement would also be clarified by specifically stating that it applies only to persons that are two years of age or older. Section 25.785(h) would be amended to permit placing a flight attendant seat at a location other than near a floor level emergency exit if the emergency egress of passengers would be enhanced by that location. The strength requirements presently contained in § 25.1413 (b) and (c) for safety belts and harnesses would be transferred to § 25.785 and combined with the corresponding requirements for seats and berths. The contents of § 25.1413(d) concerning belts with metal to metal latching devices would also be transferred to § 25.785 for ease of reference.

One commenter believes that the expression "* * * has reached his or her second birthday" in proposed § 25.785(a) would be confusing. The FAA does not concur. This expression has been used in corresponding § 121.311 of this chapter for some time without confusion. Another commenter believes that this expression could lead to the implied inclusion of operating rule criteria for child restraint wear when determining the maximum occupancy for certification purposes. As discussed in Notice 84–21, the change was proposed to reflect actual type certification practice and for consistency with the operating rule of § 121.311. The FAA, therefore, does not concur that any implication of additional requirements would result from this wording.

Three commenters express concern that the requirements of proposed § 25.785(h) for seats designated for the use of flight attendants would also be applied to seats for flight attendants not required by operating rules, e.g., "deadheading" flight attendants, flight attendants in excess of the minimum number required by operating rules, or a "barman" on an executive type transport. As one of the commenters correctly notes, § 121.311(f)(3) specifically states that "the requirements of § 25.785(h) do not apply to passenger seats occupied by flight attendants not required by § 121.391." Section 25.785(h) is revised to clarify the applicability in this regard.

One commenter brings to the attention of the FAA a discrepancy between proposed § 25.785(f)(1) and current § 25.561. As the commenter correctly notes, § 25.561 requires the structure of the airplane to be designed to protect the occupant from serious injury when the occupant experiences an upward ultimate inertia force as well as forces in other directions. (At the time Notice 84–21 was issued, the upward ultimate inertia force specified in § 25.561 was 2.0 g. Due to the recent adoption of

Amendment 25–64 (53 FR 17640; May 17, 1988), the upward ultimate inertia force has been increased to 3.0 g.) "Structure," in this context, includes seats, berths, and their attachments. Proposed § 25.785(f)(1), which would contain the requirements of current § 25.785(i)(1)(i), would require consideration of forward, sideward, downward, and rearward loads in the analysis and testing of seats, berths, and their supporting structure. Unlike § 25.561, proposed § 25.785(f)(1) and current § 25.785(i)(1)(i) do not specify consideration of upward loads. This omission resulted from an inadvertent error that occurred during the recodification of § 4b.358 of the CAR into § 25.785 of the FAR. To avoid confusion and for consistency with the requirements of § 25.561, § 25.785(f)(1) is changed to specify consideration of upward loads in addition to those in the other directions.

Another commenter states that proposed § 25.785(f)(1) should read, "* * * acts separately or using selected combinations * * *." The use of the word "and" in lieu of the word "or" has also been traced to an error that occurred during the codification of § 4b.358 into § 25.785. This section has been amended to correct that error.

One commenter notes a discrepancy in the expression " * * * items dislodged from service areas or service equipment * * * " in proposed § 25.785(h)(4) and the corresponding expression " * * * items dislodged in a galley, or from a stowage compartment or serving cart * * * " in current § 25.785(j). As the commenter correctly notes, stowage compartments, other than those in galley areas, would be exempt. Section 25.785(h)(4), therefore, specifies, " * * * service areas, stowage compartments, or service equipment."

No comments concerning the other proposed changes were received. Except as noted above, § 25.785 is amended as proposed.

Proposal 46. As proposed, the requirements of § 25.853 concerning "no smoking" signs, and signs indicating that disposal of cigarettes in receptacles intended for flammable waste is prohibited, would be transferred to § 25.791. In addition, § 25.791(e) would be added to allow the use of acceptable symbols in lieu of letters. One commenter questions whether the use of the word "either" in proposed § 25.791 (a) and (b) would mean that the passenger information signs must be operable from both pilot seats. The intent of the proposal is that the signs be operable by one member of the flightcrew, not by each member. In order to ensure that there will be no confusion in this regard, the phrase, " * * * operable from either pilot seat * * * " is replaced with the phrase, " * * * operable by a member of the flightcrew * * * " in both § 25.791(a) and (b). Another commenter objects to the proposed transfer from § 25.853 to § 25.791 of the requirement for "no smoking" signs and signs indicating that disposal of cigarettes in receptacles intended for flammable waste is prohibited. The commenter believes that this requirement would be obscured by the proposed transfer. The FAA does not concur with the commenter. Section 25.853 deals primarily with qualification standards for interior materials. The transfer of this requirement to § 25.791, which deals specifically with passenger information signs and placards, will actually make the requirement less likely to be overlooked. The same commenter notes that the present requirements for placards containing the specific words "no smoking" (in the lavatory) and "no cigarette disposal" are widely used and well understood in the industry and that substitution of corresponding objective requirements would lead to considerable variation in placard wording. The FAA concurs that the present requirements are well understood by the aviation industry (and, of equal importance, by the travelling public) and that the proposed substitution of objective requirements might prove to be counterproductive. The present requirements for specific placard wording will, therefore, be retained. This, of course, will not preclude acceptance of acceptable alternate wording under the equivalent safety provisions of § 21.21(b)(1) of this chapter, and acceptable symbols may be used in lieu of the specified wording under the provisions of § 25.791(e). Except as noted above, § 25.791 is revised as proposed.

Proposal 47. This is a conforming change necessitated by Proposal 50. Section 25.801(a) is, therefore, amended as proposed.

Proposal 48. As proposed, the emergency evacuation test criteria presently contained in § 25.803 would be transferred to new Appendix I for clarity and editorial consistency with part 121 of this chapter. One commenter suggests the addition of the words "using not more than 50 percent of the doors in the sides of the fuselage" at the end of the first sentence of proposed § 25.803(c). While this addition would not be incorrect, it reflects a test condition that is more properly presented in proposed appendix I with the other pertinent test conditions. The same commenter suggests the addition of the parenthetical expression "(full-scale or partial)" following the word "testing" in the second sentence of proposed § 25.803(c). Again, this addition would not be incorrect, but it is considered superfluous in the context of the sentence.

For reasons discussed below under Proposals 49–52, § 25.803(e) concerning emergency escape routes has been transferred to new § 25.810(c).

Except as noted, § 25.803 is amended and revised as proposed.

Proposals 49, 50, 51 and 52. As proposed, a number of related changes to §§ 25.805, 25.807, 25.809, and 25.813 would be made for consistency and clarity. The requirements for flightcrew exits would be transferred from § 25.805 to § 25.807. Ancillary requirements for Type A exits would be transferred to §§ 25.785, 25.809, or 25.813, as appropriate. The requirements of § 25.807(b) concerning exit accessibility would be transferred to § 25.813. The requirements of § 25.807(c) concerning uniform distribution of exits would also be transferred to § 25.813. Section 25.807 would provide for alternate emergency exit configurations. The provisions of § 25.803(b) concerning ventral and tail cone exits and other fuselage openings would be transferred to § 25.807 and combined with the related requirements of that section.

Two commenters suggest that § 25.807 should also define a door size that is larger than a Type I exit, but smaller than a Type A exit. The definition of this exit size, which is identified by the commenter as Type B, is beyond the scope of the notice. It, therefore, cannot be considered at this time because interested persons have not been given the opportunity to comment on its merits.

Separate emergency exits for flight crewmembers are not required for an airplane with a passenger capacity of 20 or less in which the proximity of passenger emergency exits offers a convenient and readily accessible means of evacuation for the flight crewmembers. One commenter believes that this exception should also be extended to airplanes with larger passenger capacities, such as 79. This comment is also beyond the scope of the notice; however, the FAA does not concur that adequate evacuation means would be provided for the flight crewmembers if this exception were extended to larger airplanes.

Since the time Notice 84–21 was prepared, considerable confusion has been noted regarding the requirements for means to assist passengers in egressing from nonoverwing exits to the

ground, means to assist passengers in egressing from overwing exits to the wing, and means to assist passengers in descending from the escape routes required by § 25.803(e). The requirements for escape routes are, in themselves, inappropriately contained in present § 25.803 which deals primarily with emergency evacuation demonstrations. In order to preclude further confusion and improve clarity, these requirements have been transferred to a new § 25.810 which deals specifically with emergency egress assist means and escape routes. This is an editorial change which does not affect the level of safety required or place any additional burden on any person.

Several commenters consider the phrase " * * * the most adverse anticipated wind conditions" in proposed § 25.809(h) to be too general and subject to varying interpretations. The FAA concurs, and this paragraph (which, as noted above, is now § 25.810(a)) has been changed to refer to " * * * 25-knot winds directed from the most critical angle," accordingly. This wording for escape route assist means is consistent with the corresponding wording of existing § 25.809(f)(1)(iv) for emergency exit assist means.

One commenter notes the inadvertent deletion from the proposal of the requirement that the assist means for escape routes leading from Type A exits "* * * must be automatically deployed and erected, concurrent with the opening of the exit, and self-supporting within 90 seconds [sic]." (Current § 25.807(a)(7)(ix) actually specifies 10 seconds rather than 90.) This inadvertent deletion has been corrected by placing the requirement in § 25.810(a).

Proposed § 25.807(d)(6)(ii) has been changed to read "door or exit" in lieu of "exit" for consistency with the present wording of § 25.803(d) and to clarify that any door that might be used by passengers for emergency egress must meet the applicable requirements, not just those designated by the applicant as "exits."

Section 25.813(b) is also revised to clarify that there must be adequate assist space next to each side of each Type A exit as required by current § 25.807(a)(7)(vii), and that such space is required for a Type A door regardless of whether it is located more than 6 feet from the ground.

Other editorial errors are noted by commenters. These are also corrected accordingly. Minor changes are made for compatibility with recently adopted Amendment 25–67.

Except as noted above, § 25.805 is removed, § 25.807 and § 25.809 are revised, § 25.810 is added, and § 25.813 is amended as proposed.

Proposal 53. No comments concerning this proposal were received. Section 25.833 is, therefore, revised to remove the redundant reference to engine exhaust heaters as proposed.

Proposal 54. The intent of this proposal was to correct the implication that the requirements of § 25.851(b) do not apply to fire extinguishing systems installed in addition to those required by the minimum standards of part 25. Although this intent was discussed in the Explanation for Proposal 54, the actual change to implement it was inadvertently omitted. Two commenters note this omission; however, no adverse comments concerning the stated intent were received. Section 25.851 is, therefore, amended as proposed except that § 25.851(b) reads, "Built-in fire extinguishers. If a built-in fire extinguisher is provided—* * *."

Proposals 55 and 56. As proposed, the test criteria presently contained in §§ 25.853, 25.855, and 25.1359 would be transferred to appendix F for editorial improvement and consistency. The requirement for "no smoking" signs and signs indicating that disposal of cigarettes in receptacles intended for flammable waste is prohibited would be transferred to § 25.791 for consistency with other passenger information sign requirements. The remaining nonredundant portions of § 25.855 for cargo or baggage compartments would be transferred to § 25.853 and combined with those for crew or passenger compartments. Section 25.853 would be amended to require lavatory entry ashtrays only if smoking is to be allowed in other areas of the airplane.

Since the time Notice 84–21 was issued, § 25.853 has been amended to include flammability requirements for seat cushions (Amendment 25–59; 49 FR 43188; October 26, 1984) and improved flammability standards for materials used in cabins (Amendment 25–61; 51 FR 26206; July 21, 1986 and Amendment 25–66; 53 FR 32564; August 25, 1988). Amendment 25–66 also includes a new requirement for smoke testing. In addition, § 25.855 has been amended to include new standards for cargo or baggage compartments (Amendment 25–60; 51 FR 18236; May 16, 1986). In view of these recent amendments, it is no longer considered advisable to combine the requirements for cargo or baggage compartments with those for crew or passenger compartments; therefore, those requirements proposed as § 25.853(a) remain in that section, and those proposed as § 25.853(b) are now identified as § 25.855. Other editorial changes are also made as necessary for compatibility with the recently adopted amendments.

As discussed under Proposal 46 above, one commenter objects to the proposed transfer of the requirement for "no smoking" signs and signs indicating that disposal of cigarettes in receptacles intended for flammable waste is prohibited to § 25.791. The FAA does not concur with the commenter's objection for the reasons discussed under Proposal 46.

The same commenter believes that the phrase, "If smoking is to be allowed," in proposed § 25.853(a)(2) may be misinterpreted to allow smoking in lavatories. The FAA concurs, and the phrase is changed to read, "Smoking is not to be allowed in the lavatories. If smoking is to be allowed in any other compartment occupied by the crew or passengers * * *." A corresponding change has also been made to retain the current requirement for ashtrays on lavatory doors regardless of whether smoking is allowed in any other part of the airplane.

The commenter notes that the phrase, "* * * or other approved equivalent methods," that formerly appeared in §§ 25.853 and 25.855 has been omitted from proposed § 25.853(a)(1) and (b)(1). This inadvertent error is corrected.

The commenter objects to the requirement in proposed § 25.853(a)(3) to demonstrate by test that receptacles have the capability to contain fires under all probable conditions of wear, misalignment, and ventilation expected in service. According to the commenter, this requirement, which is also contained in current § 25.853(e), is ambiguous and should be deleted. Any change of this nature would be beyond the scope of Notice 84–21; however, the FAA believes that this requirement is clearly stated as written.

Except as noted above, §§ 25.853 and 25.855 are amended as proposed.

Proposal 57. As proposed, § 25.867 would be removed on the assumption that § 25.1193(e) covers the same subject in a more comprehensive and objective manner. In light of the comments received, it appears that the requirements of § 25.867 are not entirely covered by those of § 25.1193(e). This proposal to remove § 25.867 is, therefore, withdrawn.

Proposal 58. As proposed, all fire protection requirements for systems would be combined and transferred to subpart D and designated as new § 25.869 for clarity. One commenter supports this proposal. Another states that the oxygen system fire protection

requirements should remain in § 25.1451 so that they are in close proximity to other safety considerations for oxygen systems. The ideal editorial structure for interrelated requirements is somewhat subjective. While this commenter's position has some merit, the FAA considers grouping fire protection requirements together to be more beneficial than grouping all oxygen system requirements together and, by doing so, placing fire protection requirements for the various systems in separate locations. The same commenter suggests adding the phrase "or other approved equivalent methods." This addition is unnecessary due to the provisions of existing § 21.21(b)(1) of this chapter which permit findings of an equivalent level of safety. Section 25.869 is, therefore, added as proposed.

Proposal 59. Section 25.901(c) would be revised to use the term "extremely improbable" in lieu of "extremely remote." While this proposed change is intended to merely substitute current terminology, several commenters believe that it would actually result in a change in the level of safety and present additional burden. The proposal is, therefore, withdrawn for further study.

Proposal 60. One commenter supports the change proposed to clarify the present requirement for qualification of the auxiliary power unit (APU). Another opposes the proposed § 25.903(f) as being ambiguous and failing to clearly state the requirement or intent of the rule. In lieu of stating that each APU must be approved, the commenter proposes a requirement that the APU be "* * * certified to TSO–C77 or FAA approved equivalent * * *" As noted in the explanation for Proposal 53, the term "approved," when used in part 25 in this context, means that the product must comply with an applicable Technical Standard Order (TSO) or, in lieu thereof, be approved in conjunction with the type certification process for the airplane on which it is to be installed. Because TSO–C77 is the TSO applicable to an APU, the proposed use of the term "approved" meets the intent of the commenter's proposal. It is also noted that the term "certified" (or the related term "certificated") is a misnomer with respect to products authorized under the TSO system. The commenter also proposes adding the parenthetical expression "essential or non-essential" following the word "category;" however, it does not appear that this addition would add clarity to the rule. Accordingly, § 25.903(f) is added as proposed.

Proposal 61. Under this proposal, which is related to Proposal 27, the following requirement would be added to § 25.905, "Design precautions must be taken to minimize the hazards to the airplane in the event a propeller blade fails or is released by a hub failure." One commenter suggests that the expression "design precautions" be replaced with the expression "practical design precautions." The FAA considers this change to be unnecessary, because these, like any other means of meeting type certification requirements, must be practical. Current § 25.571(e)(2), which would be replaced in part by § 25.905(d), requires consideration of damage only to structure due to the impact of a failed or released propeller blade. As noted in the preamble to Notice 84–21, the hazards that would have to be considered for compliance with § 25.905(d) also include damage to vital systems due to blade impact and unbalance due to the loss of a blade. In order to ensure that the expanded scope does not cause any confusion, § 25.905(d) has been amplified in this regard. Except for this clarification, new § 25.905(d) is adopted as proposed.

Proposal 62. No adverse comments were received concerning this proposal to clarify the applicability of § 25.925 to airplanes with dual wheels. Section 25.925 is, therefore, amended as proposed.

Proposal 63. As discussed in Notice 84–21, unwanted deployments of thrust reversing systems that were designed only for ground operation have occurred in flight on turbojet powered airplanes, sometimes with catastrophic results. Section 25.933 currently requires an applicant to show that the reverser can be restored to the forward flight position or that the airplane is capable of continued safe flight and landing under any possible position of the thrust reverser. An unwanted, inflight deployment is generally accompanied by damage to the reversing system due to the dynamic nature of the deployment, particularly at high speed. Although it might be possible to demonstrate that an undamaged reverser could be restored to the forward thrust position, there is no assurance that the reverser could be restored following an actual unwanted, inflight deployment due to the possibility of unpredictable damage. It is, therefore, essential that the airplane be capable of continued safe flight and landing with any possible position of the reverser. Conversely, it is also essential that an operable reverser be restored to the forward thrust position whenever possible. The word "or" would, therefore, be replaced with the word "and" to require showing that the reverser can be restored to the forward thrust position, if undamaged, and that the airplane is capable of continued safe flight and landing under any possible position of the thrust reverser. In addition, § 25.933 would be changed to clarify the applicability of the requirements of this section to other types of reversing systems, such as reversible pitch propellers.

As noted above, the applicant would have to show that the reverser can be restored to the forward thrust position, if undamaged, and that the airplane is capable of continued safe flight and landing under any possible position of the thrust reverser. Three commenters believe that this proposed requirement is unnecessary. One of the three commenters further speculates that safe flight cannot be assured should a reverser be deployed at liftoff. The FAA does not concur that showing both conditions is unnecessary. As discussed in Notice 84–21, an unwanted, inflight deployment is generally accompanied by damage to the reversing system due to the dynamic nature of the deployment, particularly at high speed. Although it might be demonstrated that an undamaged reverser could be restored to the forward thrust position, there is not assurance that the reverser could be restored in an actual unwanted, inflight deployment due to the possibility of unpredictable damage. It is, therefore, essential that the airplane be capable of continued safe flight and landing under any possible position of the thrust reverser. Conversely, it is also essential that an operable reverser be restored to the forward thrust position whenever possible. The FAA is aware of at least four incidents in which the thrust reversers of transport category airplanes could not be restowed following unwanted, inflight deployment. Each of the airplanes involved was landed safely with the reverser unstowed, because it had the capability for making a safe landing under such circumstances. Notwithstanding the option provided by current § 25.933(a), the manufacturers of transport category airplanes have recognized the need to show that the airplanes can be landed safely under these circumstances. The manufacturers of most, if not all, transport category, turbojet-powered airplanes certificated under part 25 have demonstrated this capability. The commenter's speculation that safe flight cannot be assured in the event a reverser is deployed at lift off is

inconsistent with past certification experience.

The capability of restowing an undamaged reverser in flight is considered to be equal in importance to having the capability for safe landing with an unstowed reversed. Inflight deployment of a reverser designed only for ground operation generally results in drag, buffeting, and possibly hazardous aerodynamic loads. Although initially undamaged, a deployed reverser may sustain damage from prolonged exposure to such buffeting and aerodynamic loads. It is, therefore, essential that a deployed reverser be restowed whenever possible so that the airplane can resume normal, hazard-free operation. One commenter suggests that § 25.933(a)(1) should read "* * *during inadvertent or deliberate reversal* * *" in lieu of "* * *during any reversal* * *." The FAA does not consider that this change would serve any purpose because any reversal is either inadvertent or deliberate.

Another commenter suggests that § 25.933(a)(1)(i) should contain the provision "if undamaged" for consistency with the explanation given in Notice 84–21. This change is also considered unnecessary because the requirement pertains to each operable reverser.

As discussed under Proposal 59 above, several commenters believe that the proposed use of the term "extremely improbable" would actually result in a change in the level of safety and present an additional burden. This aspect of the proposal is, therefore, withdrawn for further study.

One commenter suggests that § 25.933(a) (1) and (3) should refer to "* * *producing no more than reverse* * *" in lieu of "* * *producing no more than idle* * *." In addition to this suggested change being beyond the scope of the notice, the FAA does not agree with the change because it would represent a significant degradation in the established level of safety.

Another commenter suggested three editorial changes that are considered to be beyond the scope of the notice and unnecessary.

Except as noted above, § 25.933 is amended as proposed.

Proposal 64. Section 25.937 would be amended to use the word "improbable" in lieu of "remote." While this proposed change is intended to merely substitute current terminology, several commenters believe that it would actually result in a change in the level of safety and increased burden. The proposal is, therefore, withdrawn for further study.

Proposals 65 and 66. One commenter supports the proposed transfer of the requirement for marking the augmentation system tank filler openings from § 25.945 to § 25.1557 and removal of the redundant reference to § 25.1557(c) from § 25.973. Another commenter opposes deletion of marking requirements based on the rationale that the requirements are redundant. The commenter notes that, in other sections of part 25, the FAA proposes to add reference to requirements to ensure that important requirements are not overlooked and states that this policy is preferable from an airworthiness standpoint. The FAA concurs that references are appropriate, in some instances, to ensure that important requirements are not overlooked. In other instances, however, references are unnecessary and merely serve to obscure other requirements. The FAA does not concur that the transfer of the marking requirements of § 25.945(b)(4) to § 25.1557 and the elimination of the cross reference in § 25.979 will adversely affect airworthiness since the requirement continues to exist in another section appropriately identified as a marking section. Sections 25.945(b)(4) and 25.973(a) are, therefore, removed as proposed.

Proposal 67. One commenter supports the proposal to clarify the intent of the term "desired level" in § 25.979. Another makes a comment which, although it appears to be beyond the scope of the notice, may indicate a misunderstanding. Because there seems to be some misunderstanding of the intent of this section, the following clarification is provided. Each fuel tank must have an expansion space of 2 percent of the tank capacity, as required by § 25.969, to allow for thermal expansion of the fuel that might occur after the tank is filled. In order to clarify the intent of the term "desired level" in § 25.979, i.e., that this expansion space is not filled during refueling, each tank must have a corresponding maximum fuel quantity that does not include the expansion space. The purpose of § 25.979(b)(2) is to require a means to alert personnel when this maximum fuel quantity is exceeded so that corrective action may be taken before a hazardous situation develops. Exceeding a chosen intermediate quantity of fuels, as suggested by the commenter, is, therefore, not relevant to this requirement. The FAA has reviewed the comments and has determined that the proposal will eliminate the confusion that currently exists concerning the intent of this rule. Section 25.979 is, therefore, amended as proposed.

Proposal 68. One commenter supports the proposed removal of an unnecessary reference to § 25.1557(b)(2) from § 25.1013(c)(2). The commenter that opposes Proposal 66 opposes this proposal for the same reason. Again, the FAA does not consider that the deletion of the marking cross reference will adversely affect airworthiness since the requirement continues to exist in another section appropriately identified as a marking standard. Accordingly, § 25.1013(c) is amended as proposed. One commenter noted an editorial error in § 25.1013(a) as amended by Amendment 25–36. The preamble to Amendment 25–36 stated that the last sentence of § 25.1013(a) concerning a reciprocating engine with an integral oil sump was removed and placed in § 25.1183(a). The requirement was placed in § 25.1183(a); however, due to an inadvertent error, it was not removed from § 25.1013(a). As this is a correction and the change has previously been offered for public comment, § 25.1013(a) is amended to delete the last sentence.

Proposal 69. Two commenters respond to the proposal to correct an editorial error in § 25.1093(b)(1) concerning induction system anti-ice provisions. One commenter supports the proposal. The other commenter opposes the proposed change because, according to the commenter, it could be interpreted to require full ice protection at idle power conditions. The commenter further explains that this would impose undue limitations on induction system design and excessive economic operational penalties. The commenter also states that requirements for engine operation in icing conditions down to idle rpm should be specified in part 33 of this chapter. The commenter continues by disagreeing that the phrase, "* * * within the limitations established for the airplane," was introduced by an editorial error; finally, the commenter objected to "* * * the implication made in the notice that an operational limitation implies lack of providing the capability to operate the engines safely in icing conditions."

The FAA is concerned that the current regulatory wording implies that an operating limitation may be accepted in lieu of a design having the capability to operate the engines safely in icing conditions. For example, a statement such as, "Do not operate in icing conditions," would provide an operating limitation whereby no anti-icing provisions would need to be incorporated into the airplane design. This is considered unacceptable because airplanes do encounter

unexpected icing conditions during flight.

Certain engines and engine inlet configurations may be prone to ingesting snow in quantities sufficient to adversely affect engine operation, especially during ground operations. In contrast to icing conditions, snow can be detected visually. An airplane limitation prohibiting operation in falling and blowing snow would, therefore, be satisfactory in lieu of induction system redesign.

The FAA disagrees with the comment that anti-icing provisions should be specified in part 33. At the time of engine type certification, the engine manufacturer may not know the type of installations that will be made and the amount of engine bleed air or power extraction that will be necessary to protect the engine, as installed in the airplane, from icing. It is, therefore, inappropriate to address the issue in part 33.

The commenter is correct in the interpretation that "* * * full ice protection is required at idle power conditions." Some recent airplane designs have incorporated a conditional inflight idle setting that is activated when the flightcrew selects "anti-ice on." This feature increases the normal idle engine speed to a level sufficient to supply adequate engine bleed air for complete ice protection. Systems designed to incorporate a conditional in-flight idle setting would not suffer undue limitations on system design and excessive economic operational penalties.

The commenter is also correct in stating that the phrase "* * * within the limitations established for the airplane" was not introduced as an editorial error by Amendment 25–40; however, previous to Amendment 25–40, that phrase applied only to operation in snow. Amendment 25–40 addressed a minor change that made it clear that the engine air inlet system was also included with the engine under the deicing requirements. Inadvertently, the phrase "* * * within the limitations established for the airplane" was misplaced so that it appears to refer to the methods used to comply with the icing conditions specified in appendix C. This was never intended.

The commenter suggests that operation at idle engine power in icing conditions should be discouraged because, according to the commenter, the proposed regulatory change, which removes operating limitations as a means for finding compliance with appendix C, implies a lack of capability to operate safely in icing conditions. The suggestion is considered impractical because modern fuel-efficient airplanes are so streamlined that idle or near idle power is necessary for descent from cruise altitude.

In view of the above, § 25.1093(b)(1) is amended as proposed.

Proposal 70. As proposed, § 25.1141(e) would be added to require that the critical powerplant controls in the engine compartment be at least fire resistant. One commenter supports the proposal. Another suggests that the term "in a designated fire zone" should be used in lieu of "in the engine compartment." The FAA concurs that the former term would be more descriptive. Except for this change, § 25.1141(e) is amended as proposed.

Proposal 71. Section 25.1165 would be amended by adding a new paragraph which specifies that turbine engine ignition systems must be considered essential electrical loads. One commenter concurs with the proposal. Another commenter suggests that since each engine has dual ignition systems, the wording should be changed to, "At least one ignition system per engine * * *." The FAA does not concur with this commenter. Because most ignition system designs either require or allow selection of both ignitor systems (which would normally be the selection for certain flight conditions, such as icing), the complete ignition system should be considered an essential electrical load. Section 25.1165 is, therefore, amended as proposed.

Proposal 72. Section 25.1181(b) currently refers incorrectly to "* * * the requirements of §§ 25.1185 through 25.1205." Section 25.1205 was previously recodified as § 25.867, and § 25.1181(b) should have been amended to read, "* * * the requirements of § 25.867 and §§ 25.1185 through 25.1203," at that time. Section 25.867 was proposed to be removed (Proposal 57), and the wording proposed for § 25.1181(b) reflected that proposed removal. Because § 25.867 is not being removed as proposed, § 25.1181(b) is changed to refer to "* * * the requirements of § 25.867, and § 25.1185 through § 25.1203."

Proposal 73. Section 25.1305(e) currently requires both a means to indicate when the propeller blade angle is below the flight low-pitch position (Beta) and to indicate when the propeller is in reverse. No comments were received concerning this proposal to remove the requirement for indication of reverse pitch. Section 25.1305 is, therefore, amended as proposed.

Proposal 74. Section 25.1307 would be amended by transferring the contents of paragraph (a) to § 25.785, and removing paragraphs (f), (g), and (h). No comments concerning this proposal were received; therefore, § 25.1307 is amended as proposed.

Proposal 75. No comments concerning this proposal to clarify § 25.1351 were received. Section 25.1351 is, therefore, amended as proposed.

Proposal 76. No comments concerning this specific proposal were received; however, it is related to Proposals 58 and 98. In light of the disposition of those proposals, § 25.1359 is removed as proposed.

Proposal 77. Section 25.1381 would be clarified by indicating that sufficient illumination must be provided to make each instrument, switch, and other device necessary for safe operation easily readable, not just those arbitrarily chosen for illumination.

The sole commenter believes that it is not necessary to provide illumination for every control and instrument required for safe operation. The commenter cites power levers, landing gear levers, and flap controls where the size, location, and shape are sufficient (according to the commenter) for ready location of the control in the dark.

The FAA concurs that the shape and location of some items may be such that minimal illumination would be sufficient and that other lighting in the area may, in fact, provide sufficient illumination. Section 25.1381(a) has been changed to clarify that other available lighting may be acceptable in this regard. Nevertheless, the FAA does not concur that such items should be excluded without evaluation to determine that available lighting is sufficient. Except as noted above, § 25.1381 is amended as proposed.

Proposal 78. As proposed, the present requirements of § 25.1403 would be transferred to § 25.1419. This proposal is withdrawn for the reason discussed in Proposal 82 below.

Proposal 79. This proposal is withdrawn for the reason discussed in Proposal 81 below.

Proposal 80. No comments concerning this proposal were received. Section 25.1413 is, therefore, removed as proposed.

Proposal 81. The provisions of § 25.1411(d) through (g) were proposed to be transferred and combined with those of § 25.1415 for consistency and clarity. One commenter correctly notes that the applicability of these provisions would be changed by the proposal. As proposed, life rafts and life preservers would be required for all transport category airplanes approved with provisions for ditching. Current §§ 25.1411 and 25.1415, on the other hand merely provide standards for such equipment when the equipment is

required by operating rules, e.g., § 121.339 or § 125.209. Because this change in applicability was not intended, this proposal, along with related Proposal 79, is withdrawn. The present wording of § 25.1415(a) also appears to be somewhat misleading in this regard. It is, therefore, revised for clarity to read, "Ditching equipment used in airplanes to be certificated for ditching under § 25.801, and required by the operating rules of this chapter, must meet the requirements of this section."

A number of other comments were received; however, these are no longer relevant because the proposal is withdrawn.

Proposals 82 and 83. As proposed, §§ 25.1403, 25.1416, and 25.1455 pertaining to operation in icing conditions would be transferred to § 25.1419 for clarification and editorial improvement. In addition, the contents of present § 25.1416(c) would be revised to allow use of the "dark cockpit" concept, i.e., a warning when failure occurs rather than continual pilot monitoring of a healthy system.

One commenter objects to the proposed transfer of the contents of present § 25.1455 pertaining to the drainage of fluids subject to freezing to § 25.1419. As the commenter notes, present § 25.1455 deals primarily with design and installation of systems while present § 25.1419 basically contains test requirements. Although the commenter did not include § 25.1403 in the comment, the same observation could be made with respect to the proposed transfer of the standards for wing icing detection lights from § 25.1403 to § 25.1419. The best method of combining or grouping interrelated requirements is subjective. It is noted, in this regard, that §§ 25.1403 and 25.1455, as well as § 25.1419, contain requirements pertinent to protection from icing hazards. There is, therefore, merit to grouping the requirements in one section. The FAA does note, however, that present § 25.1419 contains test requirements that are applicable only if certification with ice protection provisions is desired. Section 25.1455, on the other hand, requires means to prevent the formation of hazardous quantities of ice on the airplane as a result of drainage regardless of whether certification with ice protection provisions is desired and whether the airplane is, in turn, approved for operation in icing conditions. Similarly, § 25.1403 requires wing icing detection lights unless operations at night in known or forecast icing conditions are prohibited. Section 25.1403 is, therefore not related to certification for daytime operation with ice protection provisions. In view of these circumstances, Proposals 78 and 88, and this aspect of this proposal, are withdrawn.

Two commenters suggest that minor editorial changes should be made to proposed § 25.1419(b)(2) for consistency with AC 20–73. One of the two notes that the term "* * * as found necessary * * *" could be incorrectly interpreted to apply to all of the testing required by proposed § 25.1419(b)(2) and not just to "* * * one or more of the following tests * * *" Accordingly, this paragraph is revised to read "* * * must be flight tested in the various operational configurations in measured natural atmospheric icing conditions and, as found necessary, by one or more of the following means * * *."

One commenter objects to the proposed requirement to test the airplane or its components in the various operational configurations. In this regard, the commenter notes that this could lead to conducting natural icing tests over a range of airplane and engine speeds, flight attitudes, altitudes, flap settings, etc. The commenter contends that the present wording of § 25.1419 allows flexibility in demonstrating only the most critical airplane operational configurations. The proposed wording does not reduce the latitude of the rule in this regard; however, the commenter's concern is moot. Due to the widely differing icing conditions that may be encountered in service and the subtle differences in airplane design, it would be extremely difficult to predict the effects of icing that would be experienced with different airplane configurations. Consequently, it is impossible in most instances to predict which configuration will be the most critical from an icing standpoint. Contrary to the commenter's contention, it is generally necessary to conduct icing tests over a range of configurations under the present wording of § 25.1419. The proposed wording does not change the scope of testing required. Instead, it merely clarifies the existing requirement.

One commenter suggests that the requirement of proposed § 2S.1419(b)(3) for flightcrew caution indication is unnecessary as system failure indication requirements are adequately covered in § 25.1309(c). The FAA concurs that such indication would be required by current § 25.1309(c) in the absence of a specific rule, such as proposed § 25.1419(b)(3). The general nature of § 25.1309(c), however, introduces a degree of uncertainty as to its applicability to specific airplane systems. It is, therefore, considered appropriate to retain the specific requirement of proposed § 25.1419(b)(3).

Another commenter objects to the proposed requirement for flightcrew caution information because, according to the commenter, it implies that adding an annunciator is the only acceptable means of compliance. Contrary to the commenter's belief, the proposed requirement is for flightcrew caution information, not for a caution light, per se. While the proposed rule does cite a caution light as one means of providing the necessary cautionary information, it would permit other equivalent means of providing this information to the flightcrew.

One commenter suggests that if the "warning when failure occurs" concept is adopted, it should be readily possible to determine, under all lighting conditions, that correct or intended switching has been selected. This determination is accomplished during the evaluation of the cockpit for compliance with current §§ 25.1309, 25.1381, 25.1541, and 25.1543; therefore, no further action is needed in this regard.

Except as noted above, § 25.1416 is removed, and § 25.1419 is amended as proposed.

Proposal 84. As proposed, § 25.1421 would be removed in order to remove a redundancy. In light of the comment received, it appears that the requirements of § 25.1421 are not entirely duplicated by those of § 25.561(b)(3). This proposal is, therefore, withdrawn.

Proposal 85. No comments concerning this specific proposal were received; however, it is related to Proposal 58. In light of the disposition of that proposal, § 25.1433 is amended by removing § 25.1433 (b) and (c) as proposed.

Proposal 86. As proposed, the provisions of § 25.1435(a)(2) pertaining to crew indication of hydraulic system pressure and quantity would be deleted because such requirements are covered by the provisions of § 25.1309. In addition, the provisions of § 25.1435(a)(4) (i) and (ii), which presently establish hydraulic system pressure limits expressed in terms of pump discharge pressure, would be replaced with a requirement that limits be established to meet the safety requirements of § 25.1309. Other changes would also be made to clarify this section.

Several commenters disagreed with the proposed deletion of § 25.1435(a)(2), noting that there is no requirement for indication of normal system pressure or quantity in § 25.1309. One commenter

believes that this deletion would be inconsistent with the retention of similar requirements for electrical systems.

As discussed in the preamble to Amendment 25–41 (42 FR 36960; July 18, 1977), Proposal 5–32, the FAA does not consider that pressure and quantity gauges are needed for all hydraulic systems. Indicating means other than gauges, including warning lights, are considered adequate for some hydraulic systems. Generally, indication of normal operation is necessary only for systems for which trends must be monitored by the flightcrew, e.g., fuel quantity and pressure, engine oil temperature and pressure, etc. The warning information required by the provisions of § 25.1309 is, therefore, considered appropriate and adequate for the hydraulic system.

One commenter generally concurs with the proposed changes to § 25.1435, but believes that proposed § 25.1435(b)(1) should be deleted in its entirety. According to the commenter, the test of the complete hydraulic system to 1.5 times the design operating pressure would be unnecessary in view of the requirement in proposed § 25.1435(a)(2) to test each component to 1.5 times the design operating pressure. This comment is beyond the scope of the notice, as it was not proposed to delete this requirement. The FAA does not, however, concur. Proposed § 25.1435(a)(2) contains a design requirement for elements of the hydraulic system. Proposed § 25.1435(b)(1), on the other hand, would require a proof test of the complete system to verify the integrity and function of the complete system. For example, the proof test would verify that deformation would not preclude the system from performing its intended function, that adequate clearance with structural members is maintained and that there are no leaks or weaknesses. One commenter believes that § 25.1435(b)(2)(ii) implies that a test rig must be vibrated in a representative fashion. In this regard, the commenter notes that vibration is normally accounted for on a component qualification basis and by flight experience. The FAA concurs that vibration testing can be completed on a component basis and supplemented with flight test surveys. The FAA does not concur, however, that the proposed wording implies that a test rig must be vibrated.

Another commenter suggests that policy and guidance concerning this section should be published in the form of an AC. The FAA will review this subject to determine whether an AC is warranted.

In view of the above, § 25.1435 is amended as proposed.

Proposal 87. No comments concerning this specific proposal were received; however, it is related to Proposal 58. In light of the disposition of that proposal, § 25.1451 is removed as proposed.

Proposal 88. As proposed, the present requirements of § 25.1455 would be transferred to § 25.1419. This proposal is withdrawn for the reason discussed under Proposal 82 above.

Proposal 89. The only commenter on this proposal to clarify the powerplant limitations of § 25.1521 states that the phrase "* * * and do not exceed the values on which compliance with any other requirements of this part is based" is unnecessary and too general. The commenter further notes that compliance with certain requirements (e.g., § 25.175) is based on less than rated power or thrust. The FAA does not concur with the commenter's assessment of the proposed clarification. The limitations of the powerplant, as installed, have been, by definition, the corresponding limits for which the engines and propellers have been type certificated under parts 33 and 35 of this chapter (or predecessor regulations) or, in the case of derated engine installations, lesser values on which compliance with other requirements of part 25 is based. The use of derated engine installations in transport category airplanes is becoming more prevalent. It is therefore necessary that the basis for establishing powerplant limitations be well understood. The commenter correctly notes that compliance with certain requirements is based on less than rated power or thrust; however, by definition, compliance with those requirements would have no bearing on compliance with proposed § 25.1521(a). The same commenter recommends the use of the phrase "* * * must be established * * *" in lieu of the phrase "* * * established * * *" in proposed § 25.1521 (b) and (c). The FAA concurs that the former phrase is preferable. Except for this change, § 25.1521 is revised as proposed.

Proposal 90. The only commenter on this proposal is in support of the proposed change to clarify the requirements for APU limitations. Section 25.1522 is, therefore, amended as proposed.

Proposal 91. There were no comments on this proposal within the scope of the notice. Section 25.1533 is, therefore, revised to correct an existing editorial error as proposed.

Proposal 92. No comments were received on this proposal concerning the visibility of instrument markings. Section 25.1543 is, therefore, revised as proposed.

Proposal 93. No comments were received concerning this proposal. Section 25.1551 is, therefore, revised to clarify the requirements for oil quantity indication as proposed.

Proposal 94. No adverse comments were received concerning this proposal to transfer the requirement for marking the augmentation system tank filler openings from § 25.945 to § 25.1557. Section 25.1557 is, therefore, amended as proposed.

Proposal. 95. Under this proposal, § 25.1581 would be amended to specify that the Airplane Flight Manual must contain any limitation established as a condition of compliance with the applicable noise standards of part 36 of this chapter. The sole commenter recommends insertion of the word "airworthiness" between "any" and "limitation," asserting that the insertion would clearly delineate other aspects of noise findings from part 25 certification. The FAA does not concur with this recommendation because it would negate the intent of the proposal. The limitations in question are those established for noise certification purposes, not those established for airworthiness.

Since the time Notice 84–21 was issued, it has been noted that § 36.1581 also specifies that the Airplane Flight Manual (AFM) must also contain procedures and other information approved under § 36.1501. Section 25.1581 is, therefore, amended as proposed, except that paragraph(a)(3) reads, "Any limitation, procedure, or other information established * * *," for consistency with § 36.1581. This addition presents no additional burden as § 36.1581 already contains the same requirement.

Proposal 96. As proposed, § 25.1583 would be amended to add a reference to § 25.1522 in § 25.1583(b)(1). In addition, § 25.1583(b)(3), which contains the requirement to furnish information concerning instrument markings in the AFM would be removed; and § 25.1583(f) would be revised to delete the requirement to explain the altitude limiting factors in the AFM. The sole commenter believes that it is necessary to furnish information concerning instrument markings in the AFM so that the pilot will have access to such information. The FAA concurs, and § 25.1583(b)(3) is retained accordingly. Except for the retention of § 25.1583(b)(3), § 25.1583 is amended as proposed.

Proposal 97. As discussed in Notice 84–21, the parenthetical phrase, "* * * including §§ 25.115, 25.123, and 25.125 for the weights, altitudes, temperatures, wind components, and runway gradients, as applicable," presently contained in § 25.1587(b) has created confusion because some of the items cited are inconsistent with those mentioned in the specified sections. The parenthetical phrase would, therefore, be deleted. The sole commenter objects to this proposed deletion and asserts that, although there may be confusion, the parameters listed are legitimate performance criteria. The FAA concurs, and paragraph (b) is amended to exclude only the reference to particular sections.

Proposal 98. As proposed, the test criteria presently contained in §§ 25.853, 25.855, and 25.1359 would be transferred to appendix F for editorial improvement and accuracy. In addition, the term "acrylic" would be replaced by the generic term "clear plastic." One commenter recommends extensive changes to appendix F to reflect current industry practices and standards. While these recommendations may have merit, they go beyond the scope of the notice and cannot be considered at this time. They will, however, be considered for future rulemaking action. Another commenter states that a sentence in proposed appendix F is redundant; however, the cited location of the redundancy does not exist in the text of the proposal. It is also noted that appendix F was redesignated as appendix F, part I, subsequent to issuance of Notice 84–21. Appendix F, part I, is, therefore, amended as proposed.

Proposal 99. No comments were received concerning this proposal. Appendix G is, therefore, amended to correct an error as proposed.

Proposal 100. Subsequent to issuance of Notice 84–21, emergency evacuation demonstrations became the subject of considerable public interest. As a result, a public technical conference on that subject was held by the FAA in Seattle, Washington, on September 3 through 6, 1985. In light of the further study being given to emergency evacuation demonstrations, any substantive changes to the requirements for emergency evacuation demonstration will be deferred for future rulemaking action. The existing test criteria and procedures are, however, transferred from § 25.803 to new appendix J, as proposed, for editing improvement. (Subsequent to the issuance of Notice 84–21, Amendment 25–62 was adopted to include standards for automatic takeoff thrust control systems. Because those standards became appendix I, the standards for evacuation demonstrations have been redesignated appendix J accordingly.)

Correction of miscellaneous editing and typographical errors. Since the time Notice 84–21 was issued, a number of editing and typographical errors have been brought to the attention of the FAA.

Prior to Amendment 25–38, the performance requirements for reciprocating engine-powered airplanes were contained in §§ 25.45 through 25.75. With the adoption of that amendment, those sections were removed, and the performance requirements for reciprocating engine-powered airplanes were combined with those for turbine engine-powered airplanes contained in §§ 25.101 through 25.125. Although § 25.49(c)(2)(i) no longer exists, § 25.145 erroneously refers to that section as well as the correctly referenced § 25.103(b)(1). Similarly, § 25.729 erroneously refers to "* * * when the wing flaps are extended beyond the maximum approach position determined under § 25.67(e) * * *." (Actually, the reference was inaccurate prior to Amendment 25–38, as well, because the maximum approach flap position was used for compliance with, not determined by, § 25.67(e).) As these are corrections and the substance of the changes has already been offered for public comment in conjunction with Amendment 25–38, § 25.145 and § 25.729 are amended to delete the references to § 25.49 and § 25.67, respectively.

At the time Amendment 25–57 (49 FR 6848; February 23, 1984) was adopted, paragraphs (h) and (i) of § 25.1001 were redesignated (e) and (f), respectively. Due to an inadvertent error, an existing reference in § 25.343(a) to § 25.1001 (e) and (f) was not changed to conform to the redesignation. This error is corrected accordingly.

In some printings of paragraph (b) of § 25.351, the air density is erroneously denoted by the lower case letter "p" in lieu of the Greek letter "rho." In some printings of this paragraph, the superscript "2" has been omitted from the expression

$$\frac{\text{"(K)"}}{\text{"(lt)"}}$$

in the formula for lateral mass ratio. In addition, the word "ration" incorrectly appears in lieu of the word "ratio." These typographical errors in § 25.351 are corrected accordingly.

Regulatory Evaluation

This Regulatory Evaluation analyzes the cost and benefit of the amendments. A more detailed Regulatory Evaluation has been placed in the docket. The majority of the amendments contain numerous changes to clarify rules that have been shown to be confusing, to correct editing errors, to reflect current terminology, and to update the rules to reflect actual certification practices. The administrative savings associated with such clarifications cannot be readily determined and benefits are not estimated. There are nine amendments, addressed below, which relieve manufacturers of certain costly current requirements. None of the amendments impose additional costs. As discussed below, in some cases the benefits are not quantifiable. The total benefit of all the changes is more than $100,000 for type certification of smaller transport category airplanes and exceeds $400,000 for type certification of larger transport category airplanes.

Section 25.21 Proof of Compliance

The change to § 25.21 deletes current § 25.21(b) and changes § 25.21(d) to delete specific tolerances specified in the current regulation. Section 25.21(b) is to be deleted to simplify the regulation. It has no applicability to existing or envisioned airplanes, and it incorrectly implies that specific testing is required to meet the conditions of the section.

Benefits

The FAA does not require the tests that § 25.21(b) might be interpreted to require. Thus, there is no specific test eliminated by this portion of the amendment.

Section 25.21(d) is changed to make it more objective. This may generate savings in future applications because placing the specific tolerance into advisory circular material provides for more flexibility in establishing a specific test program. Such flexibility will doubtless make future certification test programs more efficient and therefore less costly.

Based on FAA field estimates, the future savings would involve approximately two hours of airplane flight test time, and about two personweeks of associated analyses and reporting. The value of flight test time varies greatly with the size and type of airplanes being certificated. FAA field estimates set the approximate range as between $20,000 per hour for smaller turbopropeller-driven or business jet airplanes to $100,000 for larger turbojet airplanes. In addition to flight test time, this proposal involves a saving of

engineering time for reduced analysis and test reporting. The FAA estimates an average engineer's daily salary and overhead at $400, or approximately $4,000 for the two-person weeks of time saved. The range of total saving, therefore, is from $44,000 to $204,000, depending on the size of the airplane. This saving occurs during each certification program.

Section 25.177 Static lateral-directional stability

This amendment to § 25.177 clarifies and simplifies the regulations involving certain stability testing. The purpose of the amendment is to relieve certain test burdens, and simplify the current regulation. The practical impact of the amendment is a change in the test procedures for each Part 25 certification approval program. There will be reduced airplane test time, because the amendment will enable the applicants to restructure their stability test programs. The value of potential savings is based on a reduction in airplane test time of approximately 2 hours. Additionally, an estimated two weeks of engineering time would be eliminated because of reduced need for analysis and test reporting. Based on estimates discussed above, the amendment would save between $40,000 and $200,000 of the cost of airplane test time in each certification program. The two weeks of additional engineering time is valued at an estimated $4,000 based on the same assumptions as in the discussion above.

Section 25.181 Dynamic stability

This amendment to § 25.181 relieves applicants from having to test between stalling speed and 1.2 times stalling speed. The purpose of the amendment is to eliminate one or two specific conditions and thus release the test airplane for other tests. It is anticipated that the equivalent of 10 minutes of test time will be saved. Using the range established above for an hour of test time, the benefit for each certification program will be in the range of $3,300 for smaller airplanes to $16,700 for larger airplanes.

Section 25.205 Stalls; Critical engine inoperative

This amendment deletes § 25.205, which requires demonstration of stall recovery with the critical engine inoperative. The purpose of the amendment is to reduce the testing required. The practical impact of the amendment is to eliminate approximately one hour of test time. In addition, the change would reduce engineering time by eliminating an estimated two weeks of analysis and test reporting. Based on the estimates discussed above under § 25.21, adopting this change would save between $20,000 and $100,000 for airplane test time in a certification program, and $4,000 in engineering time.

Section 25.251 Vibration and buffeting

This amendment to § 25.251 relieves certain applicants from particular test burdens. The practical impact of the amendment is to eliminate a test program for airplanes which fit the characteristics outlined. Certain turbopropeller-driven airplanes and slower turbojet-powered airplanes, for example, would have a simpler test program under the amendment. The previously required test program is not justified for those airplanes, as the required tests have not been found critical. This amendment could save up to five hours of flight testing, and four weeks of associated engineering time for analysis and reporting. Using the factors developed above, the airplane test time is valued at up to $100,000. This analysis assumes that the airplane would probably be a smaller airplane. The engineering time is valued at $8,000. These savings apply to each certification program for affected airplanes.

Section 25.571 Damage-tolerance and fatigue evaluation of structure

There are four changes to § 25.571. One is editorial, two are clarifying changes that will not cause any additional costs to be incurred, and one is relieving an impracticable test.

The change to the heading of § 25.571(b) is editorial only.

The change to § 25.571(b)(2) is a clarification of the present rule. While this clarification appears to add conditions which must be met for damage-tolerance, any such testing is at no cost, since it can be accomplished at the same time as other damage-tolerance evaluation. Further, the FAA expects that there should be no design-cost difference resulting from this requirement.

The change to § 25.571(e)(1) clarifies the requirements of the bird impact test of the present rule. Confusion exists as a result of § 91.70(a) of the FAR, which limits operational speed to 250 knots within the continental U.S. Section 91.70(a) does not apply to operations outside the continental U.S., and the FAA has interpreted the current rule as meaning cruise velocity at sea level. The test criteria are similar, and it is expected that no redesign or testing changes will be required as a result of this proposal.

Service experience has shown compliance with a requirement for propeller-driven airplanes to be impossible. As a result of the granting of exemptions for good cause, no manufacturer has, in fact, been required to show compliance with the current requirement. The safety of propeller airplanes is not diminished, however, as a more practical means of compliance is required by new § 25.905(d). The benefits of the proposal are not quantifiable because the FAA cannot predict how many certification programs there will be for transport category propeller-driven airplanes.

Section 25.723 Shock, absorption tests

This amendment to § 25.723 allows the use of analysis in lieu of testing in more instances when there are changes in landing gears and in takeoff and landing weights. The purpose of the change is to relieve a regulatory burden and clarify the intent of the rule. Because of the use of the phrase "identical energy absorption characteristics" in the current rule, some testing could be required when increases are sought in previously approved takeoff and landing weights. The amendment allows for greater use of analysis in lieu of testing. In practice, considerable analysis is allowed today, so there is no quantifiable saving associated with the proposal. However, if it saves a future landing gear retest program, the potential savings are considerable.

Section 25.733 Tires

This amendment to § 25.733 deletes the requirement to consider the effects of inertia in tire ratings. The purpose of the change is to relieve a regulatory burden. For example, when engine thrust ratings are changed, an analysis must be completed under present regulations to evaluate the impact the change might have on tire ratings. Experience has shown that this impact is not significant. The relief from preparing an analysis saves approximately one day of engineering time whenever engine thrust ratings are increased. This is approximately $400, using the labor rate developed above.

Section 25.773 Pilot compartment view

This amendment to § 25.773 clarifies the current regulation and allows an alternative means of compliance with the requirement for an openable window. The purpose of the amendment is to relieve a current burden, and clarify the rules. There is no impact as a result of the change to § 25.773(b)(1)(ii) since this is the present certification

practice today. The change to § 25.733(b)(2) provides alternative means of achieving the objective of a clear view for the pilot under adverse conditions. Such alternative means have been approved as equivalent safety findings under the provision of § 21.21 in recent certification programs. Generally, these alternative means are additional windows which provide a clear view for the flight pilot and which, because of their design, will not be affected by severe weather situations, such as hailstorms. While hailstorms, for example, may fracture a forward-facing windshield, side windows are not harmed by hail. The potential benefit associated with this relief is considerable, and could amount to over $200,000 over the production life of a large transport category airplane. Not only is design and engineering complex for an openable window, but there are recurring production costs with each airplane. Pressure seals, special latching devices and waterproofing must all be incorporated in design and production of such openable windows. Also, there are occasional maintenance problems associated with openable windows which are eliminated with an alternative means of compliance. The actual benefit associated with this change is hypothetical, since equivalency has been granted in recent certification programs. However, it is not unreasonable to estimate that use of alternate means of compliance could easily save at least $200,000 over the production life of a large transport category airplane. This is a very general estimate covering both engineering and production costs.

Discussion of Comments

There were no comments which directly addressed the economic evaluation in the NPRM or the Regulatory Evaluation placed in the docket. Nor were there any comments relating to the Regulatory Flexibility Determination. In addressing each of the proposals there were some comments made relating to costs and these have been addressed in previous sections which discussed the comments relating to each of the proposals.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The Act requires agencies to review rules which may have "a significant economic impact on a substantial number of small entities." Since the Act applies to U.S. entities, only U.S. manufacturers of transport category airplanes will be affected.

In the United States, there are two manufacturers that specialize in commercial transport category airplanes, The Boeing Company and McDonnell Douglas Corporation. In addition, there are manufacturers that specialize in the manufacture of other transport category airplanes, such as those designed for executive transportation. These are Cessna Aircraft Corporation, Beech Aircraft Corporation, Gulfstream American Corporation and Gates Learjet Corporation.

The FAA size threshold for a determination of a small entity for U.S. airplane manufacturers is 75 employees; any manufacturer with more than 75 employees is considered not to be a small entity. Because none of the U.S. manufacturers of transport category airplanes is a small entity, this final rule will have no impact on any manufacturer that is a "small entity."

Because this final rule will not have a "significant economic impact on a substantial number of small entities," no review is required in this regard by the Act.

International Trade Impact Assessment

This rule is not expected to have an adverse impact on the trade opportunities of either U.S. manufacturers of transport category airplanes doing business abroad or foreign aircraft manufacturers doing business in the United States. Since the certification rules are applicable to both foreign and domestic manufacturers, which sell their products in the United States, there will be no competitive trade advantage to either.

Federalism Implications

The regulations adopted herein will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this final rule will not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

Because the regulations adopted herein are not expected to result in significant costs, the FAA has determined that this final rule is not major as defined in Executive Order 12291. For the same reason and because this is an issue that has not prompted a great deal of public concern, this final rule is not considered to be significant as defined in Department of Transportation Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). In addition, since there are no small entities affected by this rulemaking, it is certified, under the criteria of the Regulatory Flexibility Act, that this final rule will not have a significant economic impact, positive or negative on a substantial number of small entities. The regulatory evaluation prepared for this final rule remains has been placed in the docket. A copy of this evaluation may be obtained by contacting the person identified under the caption "**FOR FURTHER INFORMATION CONTACT.**"

List of Subjects in 14 CFR Part 25

Air transportation, Aircraft, Aviation safety, Safety, Tires.

Adoption of the Amendment

Accordingly, part 25 of the Federal Aviation Regulations (FAR) (14 CFR part 25) is amended as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); 49 CFR 1.47(a).

2. By revising § 25.2 to read as follows:

§ 25.2 Special retroactive requirements.

The following special retroactive requirements are applicable to an airplane for which the regulations referenced in the type certificate predate the sections specified below—

(a) Irrespective of the date of application, each applicant for a supplemental type certificate (or an amendment to a type certificate) involving an increase in passenger seating capacity to a total greater than that for which the airplane has been type certificated must show that the airplane concerned meets the requirements of:

(1) Sections 25.721(d), 25.783(g), 25.785(c), 25.803(c) (2) through (9), 25.803 (d) and (e), 25.807 (a), (c), and (d), 25.809 (f) and (h), 25.811, 25.812, 25.813 (a), (b), and (c), 25.815, 25.817, 25.853 (a) and (b), 25.855(a), 25.993(f), and 25.1359(c) in effect on October 24, 1967, and

(2) Sections 25.803(b) and 25.803(c)(1) in effect on April 23, 1969.

(b) Irrespective of the date of application, each applicant for a

supplemental type certificate (or an amendment to a type certificate) for an airplane manufactured after October 16, 1987, must show that the airplane meets the requirements of § 25.807(c)(7) in effect on July 24, 1989.

(c) Compliance with subsequent revisions to the sections specified in paragraph (a) or (b) above may be elected in accordance with § 21.101(a)(2) of this chapter or may be required in accordance with § 21.101(b) of this chapter.

3. By amending § 25.21 by removing paragraph (b) and marking it "reserved" and revising paragraph (d) to read as follows:

§ 25.21 Proof of compliance.

* * * * *

(b) [Reserved]

* * * * *

(d) Parameters critical for the test being conducted, such as weight, loading (center of gravity and inertia), airspeed, power, and wind, must be maintained within acceptable tolerances of the critical values during flight testing.

* * * * *

4. By amending § 25.29 by revising paragraph (a)(3)(iii) to read as follows:

§ 25.29 Empty weight and corresponding center of gravity.

(a) * * *

(3) * * *

(iii) Other fluids required for normal operation of airplane systems, except potable water, lavatory precharge water, and fluids intended for injection in the engine.

* * * * *

5. By amending § 25.33 by revising paragraph (c) to read as follows:

§ 25.33 Propeller speed and pitch limits.

* * * * *

(c) The means used to limit the low pitch position of the propeller blades must be set so that the engine does not exceed 103 percent of the maximum allowable engine rpm or 99 percent of an approved maximum overspeed, whichever is greater, with—

(1) The propeller blades at the low pitch limit and governor inoperative;

(2) The airplane stationary under standard atmospheric conditions with no wind; and

(3) The engines operating at the takeoff manifold pressure limit for reciprocating engine powered airplanes or the maximum takeoff torque limit for turbopropeller engine-powered airplanes.

§ 25.111 [Amended]

6. By amending § 25.111, paragraph (a)(1), by removing the regulatory reference "§ 25.101(c)" and inserting "§ 25.101(f)" in its place.

§ 25.125 [Amended]

7. By amending § 25.125, paragraph (a)(2), by removing the words "steady gliding" and inserting the word "stabilized" in their place.

8. By amending § 25.145 by revising paragraphs (a) and (a)(1) to read as follows:

§ 25.145 Longitudinal control.

(a) It must be possible at any speed between the trim speed prescribed in § 25.103(b)(1) and V_{y_1}, to pitch the nose downward so that the acceleration to this selected trim speed is prompt with—

(1) The airplane trimmed at the trim speed prescribed in § 25.103(b)(1).

* * * * *

9. By amending § 25.147, by revising paragraph (a) introductory text to read as follows and by removing and reserving paragraph (b)(2):

§ 25.147 Directional and lateral control.

(a) *Directional control; general.* It must be possible, with the wings level, to yaw into the operative engine and to safely make a reasonably sudden change in heading of up to 15 degrees in the direction of the critical inoperative engine. This must be shown at $1.4V_{s1}$ for heading changes up to 15 degrees (except that the heading change at which the rudder pedal force is 150 pounds need not be exceeded), and with—

* * * * *

(b) * * *

(2) [Reserved]

* * * * *

10. By amending § 25.149 by revising paragraph (b), and the introductory text of (e), (f) and (g) to read as follows:

§ 25.149 Minimum control speed.

* * * * *

(b) V_{mc} is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative and maintain straight flight with an angle of bank of not more than 5 degrees.

* * * * *

(e) V_{mcg}, the minimum control speed on the ground, is the calibrated airspeed during the takeoff run at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane using the rudder control alone (without the use of nosewheel steering), as limited by 150 pounds of force, and the lateral control to the extent of keeping the wings level to enable the takeoff to be safely continued using normal piloting skill. In the determination of V_{mcg}, assuming that the path of the airplane accelerating with all engines operating is along the centerline of the runway, its path from the point at which the critical engine is made inoperative to the point at which recovery to a direction parallel to the centerline is completed may not deviate more than 30 feet laterally from the centerline at any point. V_{mcg} must be established with—

* * * * *

(f) V_{mcl}, the minimum control speed during landing approach with all engines operating, is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative and maintain straight flight with an angle of bank of not more than 5 degrees. V_{mcl} must be established with—

* * * * *

(g) For airplanes with three or more engines, $V_{mcl\text{-}2}$, the minimum control speed during landing approach with one critical engine inoperative, is the calibrated airspeed at which, when a second critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with both engines still inoperative and maintain straight flight with an angle of bank of not more than 5 degrees. $V_{mcl\text{-}2}$ must be established with—

* * * * *

11. By revising § 25.177 to read as follows:

§ 25.177 Static lateral-directional stability.

(a) [Reserved]

(b) [Reserved]

(c) In straight, steady sideslips, the aileron and rudder control movements and forces must be substantially proportional to the angle of sideslip in a stable sense; and the factor of proportionality must lie between limits found necessary for safe operation throughout the range of sideslip angles appropriate to the operation of the airplane. At greater angles, up to the angle at which full rudder is used or a rudder force of 180 pounds is obtained, the rudder pedal forces may not reverse; and increased rudder deflection must be needed for increased angles of sideslip. Compliance with this paragraph must be demonstrated for all landing gear and flap positions and symmetrical power conditions at speeds from 1.2 V_{s1} to V_{fc}, V_{lc}, or V_{fc}/M_{fc}, as appropriate.

(d) The rudder gradients must meet the requirements of paragraph (c) at speeds between V_{mo}/M_{mo} and V_{fc}/M_{fc} except that the dihedral effect (aileron deflection opposite the corresponding rudder input) may be negative provided the divergence is gradual, easily recognized, and easily controlled by the pilot.

§ 25.181 [Amended]

12. By amending § 25.181, paragraphs (a) and (b), by removing the words "stalling speed" and inserting "1.2 V_s" in their place.

§ 25.205 [Removed]

13. By removing § 25.205.

14. By amending § 25.251 by revising paragraph (e) to read as follows:

§ 25.251 Vibration and buffeting.

* * * * *

(e) For an airplane with M_D greater than .6 or with a maximum operating altitude greater than 25,000 feet, the positive maneuvering load factors at which the onset of perceptible buffeting occurs must be determined with the airplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the airplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

15. By amending § 25.253 by revising paragraph (a)(3) to read as follows:

§ 25.253 High-speed characteristics.

(a) * * *

(3) With the airplane trimmed at any speed up to V_{MO} /M_{MO}, there must be no reversal of the response to control input about any axis at any speed up to V_{DF}/M_{DF}. Any tendency to pitch, roll, or yaw must be mild and readily controllable, using normal piloting techniques. When the airplane is trimmed at V_{MO}/M_{MO}, the slope of the elevator control force versus speed curve need not be stable at speeds greater than V_{FC}/M_{FC}, but there must be a push force at all speeds up to V_{DF}/M_{DF} and there must be no sudden or excessive reduction of elevator control force as V_{DF}/M_{DF} is reached.

* * * * *

§ 25.307 [Amended]

16. By amending § 25.307 by removing paragraphs (b) and (c) and marking them [Reserved].

§ 25.331 [Amended]

17. By amending § 25.331, paragraph(c)(2)(i), by removing the expression "A to D" following the word "Points" and inserting the expression "A_1 to D_1" in its place and, paragraph (c)(2)(ii), by removing the expression "A to D" following the word "Points" and inserting the expression. "A^2 to D^{2}" in its place.

18. By amending § 25.341, by revising paragraph (b)(1) as follows, and by redesignating existing paragraph (b)(3) as paragraph (c) and revising the text as follows:

§ 25.341 Gust loads.

* * * * *

(b) * * *

(1) The shape of the gust is

$$U = \frac{U_{de}}{2}\left(1-\cos\frac{2\pi s}{25C}\right)$$

where—

s=distance penetrated into gust (ft);
C=mean geometric chord of wing (ft); and
U_{de}=derived gust velocity referred to in paragraph (a) (fps).

(2) * * *

(c) In the absence of a more rational analysis, the gust load factors must be computed as follows:

$$n = 1 + \frac{K_g U_{de} V a}{498\,(W/S)}$$

where—

$$K_g = \frac{0.88\mu_g}{5.3+\mu_g} = \text{gust alleviation factor;}$$

$$\mu_g = \frac{2(W/S)}{\rho \overline{C}_{ag}} = \text{airplane mass ratio:}$$

U_{de}=derived gust velocities referred to in paragraph (a) (fps);
ρ=density of air (slugs cu. ft.);
W/S=wing loading (psf);
$\overline{C}$=mean geometric chord (ft);
g=acceleration due to gravity (ft/sec^2);
V=airplane equivalent speed (knots); and
a=slope of the airplane normal force coefficient curve C_{NA} per radian if the gust loads are applied to the wings and horizontal method. The wing lift curve slope C_{AL} per radian may be used when the gust load is applied to the wings only and the horizontal tail gust loads are treated as a separate condition.

§ 25.343 [Amended]

19. By amending § 25.343, paragraph (a), by removing the reference to § 25.1001 (h) and (i) and inserting a reference to § 25.1001 (e) and (f) in its place.

20. By amending § 25.345 by revising paragraph (c)(1) to read as follows:

§ 25.345 High lift devices.

* * * * *

(c) * * *

(1) Maneuvering to a positive limit load factor as prescribed in § 25.337(b); and

* * * * *

21. By amending § 25.351, by revising paragraph (b) as follows:

§ 25.351 Yawing conditions.

* * * * *

(b) *Lateral gusts.* The airplane is assumed to encounter derived gusts normal to the plane of symmetry while in unaccelerated flight. The derived gusts and airplane speeds corresponding to conditions B' through J' (in § 25.333(c)) (as determined by §§ 25.341 and 25.345(a)(2) or § 25.345(c)(2)) must be investigated. The shape of the gust must be as specified in § 25.341. In the absence of a rational investigation of the airplane's response to a gust, the gust loading on the vertical tail surfaces must be computed as follows:

$$L_t = \frac{K_{gg} U_{de} V_{ag} S_t}{498}$$

where—

L_t=vertical tail load (lbs.);

$$K_{gg} = \frac{0.88\mu_{gg}}{5.3+\mu_{gg}} = \text{gust alleviation factor;}$$

$$\mu_{gg} = \frac{=_{\rho}12W}{\overline{pC_t g a_t S_t}} \left(\frac{K_z}{l_t}\right)^2 = \text{lateral mass ratio;}$$

U_{de} = derived gust velocity (fps);
ρ = air density (slugs/cu. ft.);
W = airplane weight (lbs.);
S_t = area of vertical tail (ft.^{2});
$\overline{C_t}$ = mean geometric chord of vertical surface (ft.);
a_t = lift curve slope of vertical tail (per radian);
K = radius of gyration in yaw (ft).;
l_t = distance from airplane c.g., to lift center of vertical surface (ft.);
g = acceleration due to gravity (ft./sec.^{2}); and
V = airplane equivalent speed (knots).

22. By amending § 25.361 by revising paragraphs (a) introductory text, (a)(2) and (c) introductory text to read as follows:

§ 25.361 Engine torque.

(a) Each engine mount and its supporting structure must be designed for the effects of—

(1) * * *

(2) A limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of § 25.333(b); and

(3) * * *

* * * * *

(c) The limit engine torque to be considered under paragraph (a) of this section must be obtained by multiplying mean torque for the specified power and speed by a factor of—

* * * * *

§ 25.365 [Amended]

23. By amending the introductory sentence of § 25.365 by removing the words "for occupants."

24. By amending § 25.373 by revising paragraph (a), to read as follows:

§ 25.373 Speed control devices.

* * * * *

(a) The airplane must be designed for the symmetrical maneuvers and gusts prescribed in §§ 25.333, 25.337, and 25.341, and the yawing maneuvers and lateral gusts in § 25.351, at each setting and the maximum speed associated with that setting; and

* * * * *

25. By amending § 25.395 by revising paragraph (b) and adding a new paragraph (c) to read as follows:

§ 25.395 Control system.

* * * * *

(b) The system limit loads, except the loads resulting from ground gusts, need not exceed the loads that can be produced by the pilot (or pilots) and by automatic or power devices operating the controls.

(c) The loads must not be less than those resulting from application of the minimum forces prescribed in § 25.397(c).

§ 25.397 [Amended]

26. By amending Footnote 3 to § 25.397 by removing the word "most" and inserting the words "must be" in its place.

27. By amending § 25.415 by revising paragraph (a)(2), to read as follows:

§ 25.415 Ground gust conditions.

(a) * * *

(2) The control system stops nearest the surfaces, the control system locks, and the parts of the systems (if any) between these stops and locks and the control surface horns, must be designed for limit hinge moments H obtained from the formula, $H = KcS_sq$, where—

H = limit hinge moment (ft. lbs.);
c = mean chord of the control surface aft of the hinge line (ft.);
S_s = area of the control surface aft of the hinge line (sq. ft.);
q = dynamic pressure (p.s.f.) based on a design speed not less than $14.6(W/S)^{\frac{1}{2}} + 14.6$ (f.p.s.), except that the design speed need not exceed 88 f.p.s. (W/S is wing loading based on maximum airplane weight and wing area); and
K = limit hinge moment factor for ground gusts derived in paragraph (b) of this section.

* * * * *

§ 25.459 [Amended]

28. By amending § 25.459 by inserting the word "slats," after the word "slots," and before the word "and spoilers."

29. By amending § 25.571 by revising the heading of paragraph (b) and by revising paragraphs (b)(2), (e)(1), and (e)(2) to read as follows:

§ 25.571 Damage-tolerance and fatigue evaluation of structure.

* * * * *

(b) *Damage-tolerance evaluation.* * * *

(2) The limit gust condition specified in §§ 25.305(d), 25.341, and 25.351(b) at the specified speeds up to V_c, and in § 25.345.

* * * * *

(e) * * *

(1) Impact with a 4-pound bird at V_c at sea level to 8,000 feet;

(2) Uncontained fan blade impact;

* * * * *

30. By amending § 25.613 by revising paragraphs (b) and (e) to read as follows:

§ 25.613 Material strength properties and design values.

* * * * *

(b) Design values must be chosen to minimize the probability of structural failures due to material variability. Except as provided in paragraph (e) of this section, compliance with this paragraph must be shown by selecting design values which assure material strength with the following probability:

(1) Where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component, 99 percent probability with 95 percent confidence.

(2) For redundant structure, in which the failure of individual elements would result in applied loads being safely distributed to other load carrying members, 90 percent probability with 95 percent confidence.

* * * * *

(e) Greater design values may be used if a "premium selection" of the material is made in which a specimen of each individual item is tested before use to determine that the actual strength properties of that particular item will equal or exceed those used in design.

§ 25.615 [Removed]

31. By removing § 25.615.

32. By amending § 25.625, by revising paragraph (d), to read as follows:

§ 25.625 Fitting factors.

* * * * *

(d) For each seat, berth, safety belt, and harness, the fitting factor specified in § 25.785(f)(3) applies.

33. By amending § 25.629 by revising paragraphs (b)(1) and (d)(1)(ii) to read as follows:

§ 25.629 Flutter, deformation, and fail-safe criteria.

* * * * *

(b) * * *

(1) The airplane must be designed to be free from flutter and divergence (unstable structural distortion due to aerodynamic loading) for all combinations of altitude and speed encompassed by the V_D/M_D versus altitude envelope enlarged at all points by an increase of 20 percent in equivalent airspeed at both constant Mach number and constant altitude, except that the envelope may be limited to a maximum Mach number of 1.0 when M is less than 1.0 at all design altitudes and the following is established—

* * * * *

(d) * * *

(1) * * *

(ii) Any other combination of failures, malfunctions, or adverse conditions not shown to be extremely improbable.

* * * * *

§ 25.673 [Removed]

34. By removing § 25.673.

35. By revising § 25.693 to read as follows:

§ 25.693 Joints.

Control system joints (in push-pull systems) that are subject to angular motion, except those in ball and roller bearing systems, must have a special factor of safety of not less than 3.33 with respect to the ultimate bearing strength of the softest material used as a bearing. This factor may be reduced to 2.0 for joints in cable control systems. For ball or roller bearings, the approved ratings may not be exceeded.

36. By revising § 25.701 to read as follows:

§ 25.701 Flap and slat interconnection.

(a) Unless the airplane has safe flight characteristics with the flaps or slats retracted on one side and extended on the other, the motion of flaps or slats on opposite sides of the plane of symmetry must be synchronized by a mechanical interconnection or approved equivalent means.

(b) If a wing flap or slat interconnection or equivalent means is used, it must be designed to account for the applicable unsymmetrical loads, including those resulting from flight with the engines on one side of the plane of symmetry inoperative and the remaining engines at takeoff power.

(c) For airplanes with flaps or slats that are not subjected to slipstream conditions, the structure must be designed for the loads imposed when the wing flaps or slats on one side are carrying the most severe load occurring in the prescribed symmetrical conditions and those on the other side are carrying not more than 80 percent of that load.

(d) The interconnection must be designed for the loads resulting when interconnected flap or slat surfaces on one side of the plane of symmetry are jammed and immovable while the surfaces on the other side are free to move and the full power of the surface actuating system is applied.

37. By amending § 25.723 by revising paragraph (a) to read as follows:

§ 25.723 Shock absorption tests.

(a) It must be shown that the limit load factors selected for design in accordance with § 25.473 for takeoff and landing weights, respectively, will not be exceeded. This must be shown by energy absorption tests except that analyses based on earlier tests conducted on the same basic landing gear system which has similar energy absorption characteristics may be used for increases in previously approved takeoff and landing weights.

* * * * *

38. By amending § 25.729 by revising paragraph (e)(4) to read as follows:

§ 25.729 Retracting mechanism.

* * * * *

(e) * * *

(4) Landplanes must have an aural warning device that will function continuously, when the wing flaps are extended beyond the maximum approach position, if the gear is not fully extended and locked. There must not be a manual shutoff for this warning device. The flap position sensing unit may be installed at any suitable location. The system for this device may use any part of the system (including the aural warning device) for the device required in paragraph (e)(2) of this section.

* * * * *

§ 25.731 [Amended]

39. By amending § 25.731, paragraph (b)(1), by removing the word "takeoff" and inserting the word "maximum" in its place.

40. By amending § 25.733 by revising paragraphs (a)(1), (c), introductory text and (c)(1) to read as follows:

§ 25.733 Tires.

(a) * * *

(1) The loads on the main wheel tire, corresponding to the most critical combination of airplane weight (up to maximum weight) and center of gravity position, and

* * * * *

(c) When a landing gear axle is fitted with more than one wheel and tire assembly, such as dual or dual-tandem, each wheel must be fitted with a suitable tire of proper fit with a speed rating approved by the Administrator that is not exceeded under critical conditions, and with a load rating approved by the Administrator that is not exceeded by—

(1) The loads on each main wheel tire, corresponding to the most critical combination of airplane weight (up to maximum weight) and center of gravity position, when multiplied by a factor of 1.07; and

* * * * *

41. By amending § 25.735 by revising paragraph (b), to read as follows:

§ 25.735 Brakes.

* * * * *

(b) The brake system and associated systems must be designed and constructed so that if any electrical, pneumatic, hydraulic, or mechanical connecting or transmitting element (excluding the operating pedal or handle) fails, or if any single source of hydraulic or other brake operating energy supply is lost, it is possible to bring the airplane to rest under conditions specified in § 25.125, with a mean deceleration during the landing roll of at least 50 percent of that obtained in determining the landing distance as prescribed in that section. Subcomponents within the brake assembly, such as brake drum, shoes, and actuators (or their equivalents), shall be considered as connecting or transmitting elements, unless it is shown that leakage of hydraulic fluid resulting from failure of the sealing elements in these subcomponents within the brake assembly would not reduce the braking effectiveness below that specified in this paragraph.

* * * * *

42. By revising § 25.772 to read as follows:

§ 25.772 Pilot compartment doors.

For an airplane that has a maximum passenger seating configuration of more than 20 seats and that has a lockable door installed between the pilot compartment and the passenger compartment:

(a) The emergency exit configuration must be designed so that neither crewmembers nor passengers need use

that door in order to reach the emergency exits provided for them; and

(b) Means must be provided to enable flight crewmembers to directly enter the passenger compartment from the pilot compartment if the cockpit door becomes jammed.

43. By amending § 25.773, by revising paragraphs (b)(1)(i) and (b)(2), to read as follows:

§ 25.773 Pilot compartment view.

* * * * *

(b) * * *

(1) * * *

(i) Heavy rain at speeds up to 1.6 V_{s1} with lift and drag devices retracted; and

(ii) * * *

(2) The first pilot must have—

(i) A window that is openable under the conditions prescribed in paragraph (b)(1) of this section when the cabin is not pressurized, provides the view specified in that paragraph, and gives sufficient protection from the elements against impairment of the pilot's vision; or

(ii) An alternate means to maintain a clear view under the conditions specified in paragraph (b)(1) of this section, considering the probable damage due to a severe hail encounter.

* * * * *

§ 25.779 [Amended]

44. By amending § 25.779, paragraph (b)(1), by removing the word "Throttles" and inserting the words "Power or thrust" in its place.

45. By amending § 25.781 by revising the chart as follows:

* * * * *

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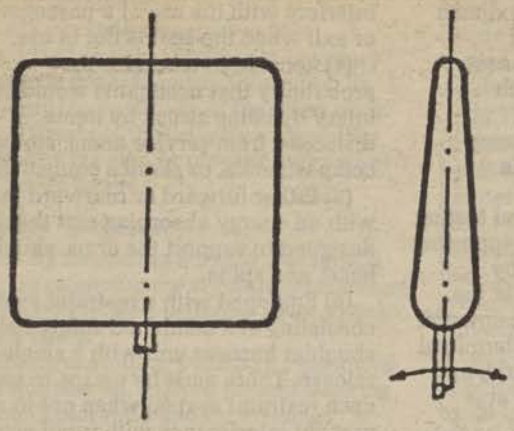
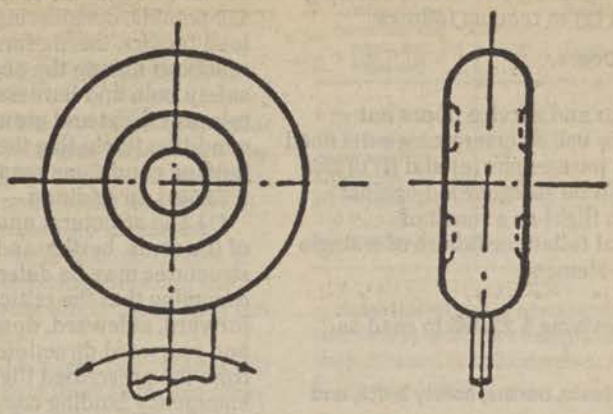
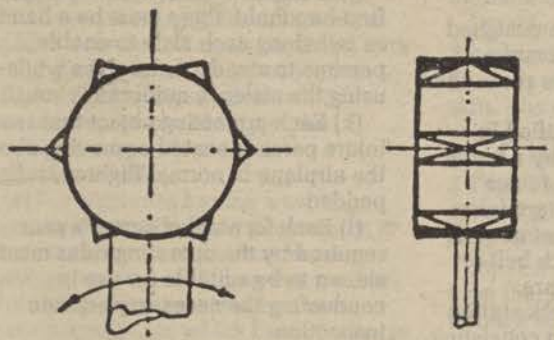


FLAP CONTROL KNOB



LANDING GEAR CONTROL KNOB



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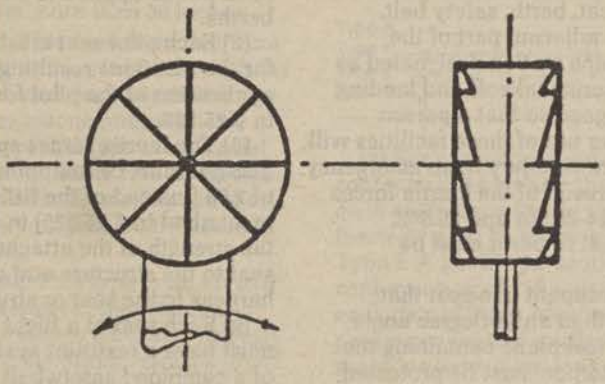
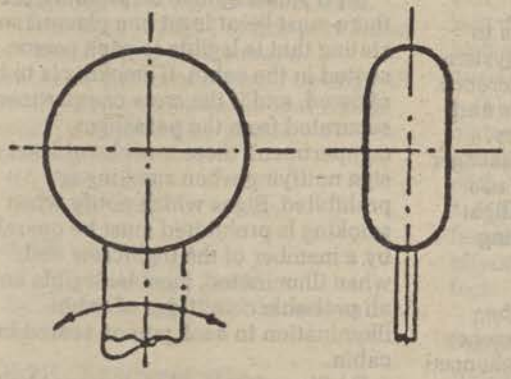


SUPERCHARGER CONTROL KNOB



POWER OR THRUST KNOB

PROPELLER CONTROL KNOB

BILLING CODE 4910-13-C

46. By amending § 25.783 by revising paragraph (g) to read as follows:

§ 25.783 Doors.

* * * * *

(g) Cargo and service doors not suitable for use as emergency exits need only meet paragraphs (e) and (f) of this section and be safeguarded against opening in flight as a result of mechanical failure or failure of a single structural element.

* * * * *

47. By revising § 25.785 to read as follows:

§ 25.785 Seats, berths, safety belts, and harnesses.

(a) A seat (or berth for a nonambulant person) must be provided for each occupant who has reached his or her second birthday.

(b) Each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in §§ 25.561 and 25.562.

(c) Each seat or berth must be approved.

(d) Each occupant of a seat that makes more than an 18-degree angle with the vertical plane containing the airplane centerline must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from head injury by a safety belt and, as appropriate to the type, location, and angle of facing of each seat, by one or more of the following:

(1) A shoulder harness that will prevent the head from contacting any injurious object.

(2) The elimination of any injurious object within striking radius of the head.

(3) An energy absorbing rest that will support the arms, shoulders, head, and spine.

(e) Each berth must be designed so that the forward part has a padded end board, canvas diaphragm, or equivalent means, that can withstand the static load reaction of the occupant when subjected to the forward inertia force specified in § 25.561. Berths must be free from corners and protuberances likely to cause injury to a person occupying the berth during emergency conditions.

(f) Each seat or berth, and its supporting structure, and each safety belt or harness and its anchorage must be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertia forces, and reactions among the occupant, seat, safety belt, and harness for each relevant flight and ground load condition (including the emergency landing conditions prescribed in § 25.561). In addition—

(1) The structural analysis and testing of the seats, berths, and their supporting structures may be determined by assuming that the critical load in the forward, sideward, downward, upward, and rearward directions (as determined from the prescribed flight, ground, and emergency landing conditions) acts separately or using selected combinations of loads if the required strength in each specified direction is substantiated. The forward load factor need not be applied to safety belts for berths.

(2) Each pilot seat must be designed for the reactions resulting from the application of the pilot forces prescribed in § 25.395.

(3) The inertia forces specified in § 25.561 must be multiplied by a factor of 1.33 (instead of the fitting factor prescribed in § 25.625) in determining the strength of the attachment of each seat to the structure and each belt or harness to the seat or structure.

(g) Each seat at a flight deck station must have a restraint system consisting of a combined safety belt and shoulder harness with a single-point release that permits the flight deck occupant, when seated with the restraint system fastened, to perform all of the occupant's necessary flight deck functions. There must be a means to secure each combined restraint system when not in use to prevent interference with the operation of the airplane and with rapid egress in an emergency.

(h) Each seat located in the passenger compartment and designated for use during takeoff and landing by a flight attendant required by the operating rules of this chapter must be:

(1) Near a required floor level emergency exit, except that another location is acceptable if the emergency egress of passengers would be enhanced with that location. A flight attendant seat must be located adjacent to each Type A emergency exit. Other flight attendant seats must be evenly distributed among the required floor level emergency exits to the extent feasible.

(2) To the extent possible, without compromising proximity to a required floor level emergency exit, located to provide a direct view of the cabin area for which the flight attendant is responsible.

(3) Positioned so that the seat will not interfere with the use of a passageway or exit when the seat is not in use.

(4) Located to minimize the probability that occupants would suffer injury by being struck by items dislodged from service areas, stowage compartments, or service equipment.

(5) Either forward or rearward facing with an energy absorbing rest that is designed to support the arms, shoulders, head, and spine.

(6) Equipped with a restraint system consisting of a combined safety belt and shoulder harness unit with a single point release. There must be means to secure each restraint system when not in use to prevent interference with rapid egress in an emergency.

(i) Each safety belt must be equipped with a metal to metal latching device.

(j) If the seat backs do not provide a firm handhold, there must be a handgrip or rail along each aisle to enable persons to steady themselves while using the aisles in moderately rough air.

(k) Each projecting object that would injure persons seated or moving about the airplane in normal flight must be padded.

(l) Each forward observer's seat required by the operating rules must be shown to be suitable for use in conducting the necessary enroute inspection.

48. By revising § 25.791 to read as follows:

§ 25.791 Passenger information signs and placards.

(a) If smoking is to be prohibited, there must be at least one placard so stating that is legible to each person seated in the cabin. If smoking is to be allowed, and if the crew compartment is separated from the passenger compartment, there must be at least one sign notifying when smoking is prohibited. Signs which notify when smoking is prohibited must be operable by a member of the flightcrew and, when illuminated, must be legible under all probable conditions of cabin illumination to each person seated in the cabin.

(b) Signs that notify when seat belts should be fastened and that are installed to comply with the operating rules of this chapter must be operable by a member of the flightcrew and, when illuminated, must be legible under all probable conditions of cabin illumination to each person seated in the cabin.

(c) A placard must be located on or adjacent to the door of each receptacle used for the disposal of flammable waste materials to indicate that use of

the receptacle for disposal of cigarettes, etc., is prohibited.

(d) Lavatories must have "No Smoking" or "No Smoking in Lavatory" placards conspicuously located on or adjacent to each side of the entry door.

(e) Symbols that clearly express the intent of the sign or placard may be used in lieu of letters.

§ 25.801 [Amended]

49. By amending § 25.801, paragraph (a), by removing the regulatory reference "§ 25.807(d)" and inserting "§ 25.807(e)" in its place.

50. By amending § 25.803 by removing paragraphs (b), (d) and (e) and marking them [Reserved], and by revising paragraphs (a) and (c) to read as follows:

§ 25.803 Emergency evacuation.

(a) Each crew and passenger area must have emergency means to allow rapid evacuation in crash landings, with the landing gear extended as well as with the landing gear retracted, considering the possibility of the airplane being on fire.

(b) [Reserved]

(c) For airplanes having a seating capacity of more than 44 passengers, it must be shown that the maximum seating capacity, including the number of crewmembers required by the operating rules for which certification is requested, can be evacuated from the airplane to the ground under simulated emergency conditions within 90 seconds. Compliance with this requirement must be shown by actual demonstration using the test criteria outlined in appendix J of this part unless the Administrator finds that a combination of analysis and testing will provide data equivalent to that which would be obtained by actual demonstration.

(d) [Reserved]

(e) [Reserved]

§ 25.805 [Removed]

51. By removing § 25.805.

52. By revising § 25.807 to read as follows:

§ 25.807 Emergency exits.

(a) *Type.* For the purpose of this part, the types of exits are defined as follows:

(1) *Type I.* This type is a floor level exit with a rectangular opening of not less than 24 inches wide by 48 inches high, with corner radii not greater than one-third the width of the exit.

(2) *Type II.* This type is a rectangular opening of not less than 20 inches wide by 44 inches high, with corner radii not greater than one-third the width of the exit. Type II exits must be floor level exits unless located over the wing, in which case they may not have a step-up inside the airplane of more than 10 inches nor a step-down outside the airplane of more than 17 inches.

(3) *Type III.* This type is a rectangular opening of not less than 20 inches wide by 36 inches high, with corner radii not greater than one-third the width of the exit, and with a step-up inside the airplane of not more than 20 inches. If the exit is located over the wing, the step-down outside the airplane may not exceed 27 inches.

(4) *Type IV.* This type is a rectangular opening of not less than 19 inches wide by 26 inches high, with corner radii not greater than one-third the width of the exit, located over the wing, with a step-up inside the airplane of not more than 29 inches and a step-down outside the airplane of not more than 36 inches.

(5) *Ventral.* This type is an exit from the passenger compartment through the pressure shell and the bottom fuselage skin. The dimensions and physical configuration of this type of exit must allow at least the same rate of egress as a Type I exit with the airplane in the normal ground attitude, with landing gear extended.

(6) *Tail cone.* This type is an aft exit from the passenger compartment through the pressure shell and through an openable cone of the fuselage aft of the pressure shell. The means of opening the tailcone must be simple and obvious and must employ a single operation.

(7) *Type A.* This type is a floor level exit with a rectangular opening of not less than 42 inches wide by 72 inches high with corner radii not greater than one-sixth of the width of the exit.

(b) *Step down distance.* Step down distance, as used in this section, means the actual distance between the bottom of the required opening and a usable foot hold, extending out from the fuselage, that is large enough to be effective without searching by sight or feel.

(c) *Over-sized exits.* Openings larger than those specified in this section, whether or not of rectangular shape, may be used if the specified rectangular opening can be inscribed within the opening and the base of the inscribed rectangular opening meets the specified step-up and step-down heights.

(d) *Passenger emergency exits.* Except as provided in paragraphs (d) (3) through (7) of this section, the minimum number and type of passenger emergency exits is as follows:

(1) For passenger seating configurations of 1 through 299 seats:

Passenger seating configuration (crewmember seats not included)	Emergency exits for each side of the fuselage			
	Type I	Type II	Type III	Type IV
1 through 9				1
10 through 19			1	
20 through 39		1	1	
40 through 79	1		1	
80 through 109	1		2	
110 through 139	2		1	
140 through 179	2		2	

Additional exits are required for passenger seating configurations greater than 179 seats in accordance with the following table:

Additional emergency exits (each side of fuselage)	Increase in passenger seating configuration allowed
Type A	110
Type I	45
Type II	40
Type III	35

(2) For passenger seating configurations greater than 299 seats, each emergency exit in the side of the fuselage must be either a Type A or Type I. A passenger seating configuration of 110 seats is allowed for each pair of Type A exits and a passenger seating configuration of 45 seats is allowed for each pair of Type I exits.

(3) If a passenger ventral or tail cone exit is installed and that exit provides at least the same rate of egress as a Type III exit with the airplane in the most adverse exit opening condition that would result from the collapse of one or more legs of the landing gear, an increase in the passenger seating configuration beyond the limits specified in paragraph (d) (1) or (2) of this section may be allowed as follows:

(i) For a ventral exit, 12 additional passenger seats.

(ii) For a tail cone exit incorporating a floor level opening of not less than 20 inches wide by 60 inches high, with corner radii not greater than one-third the width of the exit, in the pressure shell and incorporating an approved assist means in accordance with § 25.809(h), 25 additional passenger seats.

(iii) For a tail cone exit incorporating an opening in the pressure shell which is at least equivalent to a Type III emergency exit with respect to dimensions, step-up and step-down distance, and with the top of the opening not less than 56 inches from the passenger compartment floor, 15 additional passenger seats.

(4) For airplanes on which the vertical location of the wing does not allow the installation of overwing exits, an exit of at least the dimensions of a Type III exit must be installed instead of each Type IV exit required by subparagraph (1) of this paragraph.

(5) An alternate emergency exit configuration may be approved in lieu of that specified in paragraph (d) (1) or (2) of this section provided the overall evacuation capability is shown to be equal to or greater than that of the specified emergency exit configuration.

(6) The following must also meet the applicable emergency exit requirements of §§ 25.809 through 25.813:

(i) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits.

(ii) Any other floor level door or exit that is accessible from the passenger compartment and is as large or larger than a Type II exit, but less than 46 inches wide.

(iii) Any other passenger ventral or tail cone exit.

(7) For an airplane that is required to have more than one passenger emergency exit for each side of the fuselage, no passenger emergency exit shall be more than 60 feet from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the airplane's longitudinal axis between the nearest exit edges.

(e) *Ditching emergency exits for passengers.* Ditching emergency exits must be provided in accordance with the following requirements whether or not certification with ditching provisions is requested:

(1) For airplanes that have a passenger seating configuration of nine seats or less, excluding pilots seats, one exit above the waterline in each side of the airplane, meeting at least the dimensions of a Type IV exit.

(2) For airplanes that have a passenger seating configuration of 10 seats or more, excluding pilots seats, one exit above the waterline in a side of the airplane, meeting at least the dimensions of a Type III exit for each unit (or part of a unit) of 35 passenger seats, but no less than two such exits in the passenger cabin, with one on each side of the airplane. The passenger seat/exit ratio may be increased through the use of larger exits, or other means, provided it is shown that the evacuation capability during ditching has been improved accordingly.

(3) If it is impractical to locate side exits above the waterline, the side exits must be replaced by an equal number of readily accessible overhead hatches of not less than the dimensions of a Type III exit, except that for airplanes with a passenger configuration of 35 seats or less, excluding pilots seats, the two required Type III side exits need be replaced by only one overhead hatch.

(f) *Flightcrew emergency exits.* For airplanes in which the proximity of passenger emergency exits to the flightcrew area does not offer a convenient and readily accessible means of evacuation of the flightcrew, and for all airplanes having a passenger seating capacity greater than 20, flightcrew exits shall be located in the flightcrew area. Such exits shall be of sufficient size and so located as to permit rapid evacuation by the crew. One exit shall be provided on each side of the airplane; or, alternatively, a top hatch shall be provided. Each exit must encompass an unobstructed rectangular opening of at least 19 by 20 inches unless satisfactory exit utility can be demonstrated by a typical crewmember.

§ 25.809 [Amended]

53. By amending § 25.809 by removing paragraphs (f) and (h), and by redesignating existing paragraphs (d), (e), (i), (g) and (j) as paragraphs (f), (g), (d), (e) and (h), respectively.

54. By adding a new § 25.810 to read as follows:

§ 25.810 Emergency egress assist means and escape routes.

(a) Each nonoverwing landplane emergency exit more than 6 feet from the ground with the airplane on the ground and the landing gear extended and each nonoverwing Type A exit must have an approved means to assist the occupants in descending to the ground.

(1) The assisting means for each passenger emergency exit must be a self-supporting slide or equivalent; and, in the case of a Type A exit, it must be capable of carrying simultaneously two parallel lines of evacuees. In addition, the assisting means must be designed to meet the following requirements:

(i) It must be automatically deployed and deployment must begin during the interval between the time the exit opening means is actuated from inside the airplane and the time the exit is fully opened. However, each passenger emergency exit which is also a passenger entrance door or a service door must be provided with means to prevent deployment of the assisting means when it is opened from either the inside or the outside under nonemergency conditions for normal use.

(ii) It must be automatically erected within 10 seconds after deployment is begun.

(iii) It must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear.

(iv) It must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.

(v) For each system installation (mockup or airplane installed), five consecutive deployment and inflation tests must be conducted (per exit) without failure, and at least three tests of each such five-test series must be conducted using a single representative sample of the device. The sample devices must be deployed and inflated by the system's primary means after being subjected to the inertia forces specified in § 25.561(b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction must be corrected by positive means and after that, the full series of five consecutive deployment and inflation tests must be conducted without failure.

(2) The assisting means for flightcrew emergency exits may be a rope or any other means demonstrated to be suitable for the purpose. If the assisting means is a rope, or an approved device equivalent to a rope, it must be—

(i) Attached to the fuselage structure at or above the top of the emergency exit opening, or, for a device at a pilot's emergency exit window, at another approved location if the stowed device, or its attachment, would reduce the pilot's view in flight;

(ii) Able (with its attachment) to withstand a 400-pound static load.

(b) Assist means from the cabin to the wing are required for each Type A exit located above the wing and having a stepdown unless the exit without an assist means can be shown to have a rate of passenger egress at least equal to that of the same type of nonoverwing exit. If an assist means is required, it must be automatically deployed and automatically erected, concurrent with the opening of the exit and self-supporting within 10 seconds.

(c) An escape route must be established from each overwing emergency exit, and (except for flap surfaces suitable as slides) covered with a slip resistant surface. Except where a means for channeling the flow of evacuees is provided—

(1) The escape route must be at least 42 inches wide at Type A passenger emergency exits and must be at least 2

feet wide at all other passenger emergency exits, and

(2) The escape route surface must have a reflectance of at least 80 percent, and must be defined by markings with a surface-to-marking contrast ratio of at least 5:1.

(d) If the place on the airplane structure at which the escape route required in paragraph (c) of this section terminates, is more than 6 feet from the ground with the airplane on the ground and the landing gear extended, means to reach the ground must be provided to assist evacuees who have used the escape route. If the escape route is over a flap, the height of the terminal edge must be measured with the flap in the takeoff or landing position, whichever is higher from the ground. The assisting means must be usable and self-supporting with one or more landing gear legs collapsed and under a 25-knot wind directed from the most critical angle. The assisting means provided for each escape route leading from a Type A emergency exit must be capable of carrying simultaneously two parallel lines of evacuees. For other than Type A exits, the assist means must be capable of carrying simultaneously as many parallel lines of evacuees as there are required escape routes.

55. By amending § 25.813 by adding a new introductory paragraph and by revising paragraphs (a) and (b) to read as follows:

§ 25.813 Emergency exit access.

Each required emergency exit must be accessible to the passengers and located where it will afford an effective means of evacuation. Emergency exit distribution must be as uniform as practical, taking passenger distribution into account; however, the size and location of exits on both sides of the cabin need not be symmetrical. If only one floor level exit per side is prescribed, and the airplane does not have a tail cone or ventral emergency exit, the floor level exit must be in the rearward part of the passenger compartment, unless another location affords a more effective means of passenger evacuation. Where more than one floor level exit per side is prescribed, at least one floor level exit per side must be located near each end of the cabin, except that this provision does not apply to combination cargo/passenger configurations. In addition—

(a) There must be a passageway leading from each main aisle to each Type I, Type II, or Type A emergency exit and between individual passenger areas. If two or more main aisles are provided, there must be a cross aisle leading directly to each passageway between the exit and the nearest main aisle. Each passageway leading to a Type A exit must be unobstructed and at least 36 inches wide. Other passageways and cross aisles must be unobstructed and at least 20 inches wide. Unless there are two or more main aisles, each Type A exit must be located so that there is passenger flow along the main aisle to that exit from both the forward and aft directions.

(b) Adequate space to allow crewmember(s) to assist in the evacuation of passengers must be provided as follows:

(1) The assist space must not reduce the unobstructed width of the passageway below that required for the exit.

(2) For each Type A exit, assist space must be provided at each side of the exit regardless of whether the exit is covered by § 25.810(a).

(3) For any other type exit that is covered by § 25.810(a), space must at least be provided at one side of the passageway.

* * * * *

56. By revising § 25.833 to read as follows:

§ 25.833 Combustion heating systems.

Combustion heaters must be approved.

57. By amending § 25.851 by revising paragraphs (a), (b) introductory text, and (b)(1) to read as follows:

§ 25.851 Fire extinguishers.

(a) *Hand fire extinguishers.* (1) The following minimum number of hand fire extinguishers must be conveniently located in passenger compartments:

Passenger capacity	Number of extinguishers
7 through 30	1
31 through 60	2
61 or more	3

(2) At least one hand fire extinguisher must be conveniently located in the pilot compartment.

(3) A readily accessible hand fire extinguisher must be available for use in each Class A or Class B cargo compartment.

(4) Each hand fire extinguisher must be approved.

(5) The types and quantities of each extinguishing agent used must be appropriate to the kinds of fires likely to occur where used.

(6) Each extinguisher for use in a personnel compartment must be designed to minimize the hazard of toxic gas concentration.

(b) *Built-in fire extinguishers.* If a built-in fire extinguisher is provided—

(1) The capacity must be adequate for any fire likely to occur in the compartment where used, considering the volume of the compartment and the ventilation rate; and

* * * * *

58. By revising § 25.853 to read as follows:

§ 25.853 Compartment interiors.

For each compartment occupied by the crew or passengers, the following apply:

(a) Materials (including finishes or decorative surfaces applied to the materials) must meet the applicable test criteria prescribed in part I of appendix F of this part or other approved equivalent methods.

(b) In addition to meeting the requirements of paragraph (a), seat cushions, except those on flight crewmember seats, must meet the test requirements of part II of appendix F of this part, or equivalent.

(c) For airplanes with passenger capacities of 20 or more, interior ceiling and wall panels (other than lighting lenses), partitions, and the outer surfaces of galleys, large cabinets and stowage compartments (other than underseat stowage compartments and compartments for stowing small items, such as magazines and maps) must also meet the test requirements of parts IV and V of appendix F of this part, or other approved equivalent method, in addition to the flammability requirements prescribed in paragraph (a) of this section.

(d) Smoking is not to be allowed in lavatories. If smoking is to be allowed in any compartment occupied by the crew or passengers, an adequate number of self-contained, removable ashtrays must be provided for all seated occupants, and

(e) Regardless of whether smoking is allowed in any other part of the airplane, lavatories must have self-contained removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if the ashtray can be seen readily from the cabin side of each lavatory served.

(f) Each receptacle used for the disposal of flammable waste material must be fully enclosed, constructed of at least fire resistant materials, and must contain fires likely to occur in it under normal use. The ability of the receptacle to contain those fires under all probable conditions of wear, misalignment, and

ventilation expected in service must be demonstrated by test.

59. By revising § 25.855 to read as follows:

§ 25.855 Cargo or baggage compartments.

For each cargo and baggage compartment not occupied by crew or passengers, the following apply:

(a) The compartment must meet one of the class requirements of § 25.857.

(b) Class B through Class E cargo or baggage compartments, as defined in § 25.857, must have a liner, and the liner must be separate from (but may be attached to) the airplane structure.

(c) Ceiling and sidewall liner panels of Class C and D compartments must meet the test requirements of part III of appendix F of this part or other approved equivalent methods.

(d) All other materials used in the construction of the cargo or baggage compartment must meet the applicable test criteria prescribed in part I of appendix F of this part or other approved equivalent methods.

(e) No compartment may contain any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operation, unless those items are protected so that—

(1) They cannot be damaged by the movement of cargo in the compartment, and

(2) Their breakage or failure will not create a fire hazard.

(f) There must be means to prevent cargo or baggage from interfering with the functioning of the fire protective features of the compartment.

(g) Sources of heat within the compartment must be shielded and insulated to prevent igniting the cargo or baggage.

(h) Flight tests must be conducted to show compliance with the provisions of § 25.857 concerning—

(1) Compartment accessibility,

(2) The entries of hazardous quantities of smoke or extinguishing agent into compartments occupied by the crew or passengers, and

(3) The dissipation of the extinguishing agent in Class C compartments.

(i) During the above tests, it must be shown that no inadvertent operation of smoke or fire detectors in any compartment would occur as a result of fire contained in any other compartment, either during or after extinguishment, unless the extinguishing system floods each such compartment simultaneously.

60. By adding a new § 25.869 as follows:

§ 25.869 Fire protection: systems.

(a) Electrical system components:

(1) Components of the electrical system must meet the applicable fire and smoke protection requirements of §§ 25.831(c) and 25.863.

(2) Electrical cables, terminals, and equipment in designated fire zones, that are used during emergency procedures, must be at least fire resistant.

(3) Main power cables (including generator cables) in the fuselage must be designed to allow a reasonable degree of deformation and stretching without failure and must be—

(i) Isolated from flammable fluid lines; or

(ii) Shrouded by means of electrically insulated, flexible conduit, or equivalent, which is in addition to the normal cable insulation.

(4) Insulation on electrical wire and electrical cable installed in any area of the fuselage must be self-extinguishing when tested in accordance with the applicable portions of part I, appendix F of this part.

(b) Each vacuum air system line and fitting on the discharge side of the pump that might contain flammable vapors or fluids must meet the requirements of § 25.1183 if the line or fitting is in a designated fire zone. Other vacuum air systems components in designated fire zones must be at least fire resistant.

(c) Oxygen equipment and lines must—

(1) Not be located in any designated fire zone,

(2) Be protected from heat that may be generated in, or escape from, any designated fire zone, and

(3) Be installed so that escaping oxygen cannot cause ignition of grease, fluid, or vapor accumulations that are present in normal operation or as a result of failure or malfunction of any system.

61. By amending § 25.903 by adding a new paragraph (f) to read as follows:

§ 25.903 Engines.

* * * * *

(f) *Auxiliary Power Unit.* Each auxiliary power unit must be approved or meet the requirements of the category for its intended use.

62. By amending § 25.905 by adding a new paragraph (d) to read as follows:

§ 25.905 Propellers.

* * * * *

(d) Design precautions must be taken to minimize the hazards to the airplane in the event a propeller blade fails or is released by a hub failure. The hazards which must be considered include damage to structure and vital systems due to impact of a failed or released blade and the unbalance created by such failure or release.

§ 25.925 [Amended]

63. By amending § 25.925, paragraph (a), by removing the word "tire" in the last sentence and inserting the word "tire(s)" in its place.

64. By revising § 25.933 to read as follows:

§ 25.933 Reversing systems.

(a) For turbojet reversing systems—

(1) Each system intended for ground operation only must be designed so that during any reversal in flight the engine will produce no more than flight idle thrust. In addition, it must be shown by analysis or test, or both, that—

(i) Each operable reverser can be restored to the forward thrust position; and

(ii) The airplane is capable of continued safe flight and landing under any possible position of the thrust reverser.

(2) Each system intended for inflight use must be designed so that no unsafe condition will result during normal operation of the system, or from any failure (or reasonably likely combination of failures) of the reversing system, under any anticipated condition of operation of the airplane including ground operation. Failure of structural elements need not be considered if the probability of this kind of failure is extremely remote.

(3) Each system must have means to prevent the engine from producing more than idle thrust when the reversing system malfunctions, except that it may produce any greater forward thrust that is shown to allow directional control to be maintained, with aerodynamic means alone, under the most critical reversing condition expected in operation.

(b) For propeller reversing systems—

(1) Each system intended for ground operation only must be designed so that no single failure (or reasonably likely combination of failures) or malfunction of the system will result in unwanted reverse thrust under any expected operating condition. Failure of structural elements need not be considered if this kind of failure is extremely remote.

(2) Compliance with this section may be shown by failure analysis or testing, or both, for propeller systems that allow propeller blades to move from the flight low-pitch position to a position that is substantially less than that at the normal flight low-pitch position. The analysis may include or be supported by the analysis made to show compliance with the requirements of § 35.21 of this

chapter for the propeller and associated installation components.

§ 25.945 [Amended]

65. By amending § 25.945 by removing paragraph (b)(4) and marking it:

* * * * *

(b) * * *

(4) [Reserved].

* * * * *

§ 25.973 [Amended]

66. By amending § 25.973 by removing paragraph (a) and marking it:

* * * * *

(a) [Reserved].

* * * * *

67. By amending § 25.979 by revising paragraph (b)(2), to read as follows:

§ 25.979 Pressure fueling system.

* * * * *

(b) * * *

(2) Provide indication at each fueling station of failure of the shutoff means to stop the fuel flow at the maximum quantity approved for that tank.

* * * * *

68. By amending § 25.1013 by revising paragraphs (a) and (c), to read as follows:

§ 25.1013 Oil tanks.

(a) *Installation.* Each oil tank installation must meet the requirements of § 25.967.

(b) * * *

(c) *Filler connection.* Each recessed oil tank filler connection that can retain any appreciable quantity of oil must have a drain that discharges clear of each part of the airplane. In addition, each oil tank filler cap must provide an oil-tight seal.

* * * * *

69. By amending § 25.1093 by revising paragraph (b)(1) to read as follows:

§ 25.1093 Induction system deicing and anti-icing provisions.

* * * * *

(b) *Turbine engines.* (1) Each turbine engine must operate throughout the flight power range of the engine (including idling), without the accumulation of ice on the engine, inlet system components, or airframe components that would adversely affect engine operation or cause a serious loss of power or thrust—

(i) Under the icing conditions specified in appendix C, and

(ii) In falling and blowing snow within the limitations established for the airplane for such operation.

* * * * *

70. By amending § 25.1141 by adding a new paragraph (e) to read as follows:

§ 25.1141 Powerplant controls: general.

* * * * *

(e) The portion of each powerplant control located in a designated fire zone that is required to be operated in the event of fire must be at least fire resistant.

* * * * *

71. By amending § 25.1165 by adding a new paragraph (h) to read as follows:

§ 25.1165 Engine ignition systems.

* * * * *

(h) Each engine ignition system of a turbine powered airplane must be considered an essential electrical load.

72. By amending § 25.1181 by revising paragraph (b) to read as follows:

§ 25.1181 Designated fire zones; regions included.

(a) * * *

(b) Each designated fire zone must meet the requirements of §§ 25.867, and 25.1185 through 25.1203.

§ 25.1305 [Amended]

73. By amending § 25.1305 by removing paragraph (e)(3).

§ 25.1307 [Amended]

74. By amending § 25.1307 by removing paragraph (a) and marking it [Reserved], and by removing paragraphs (f), (g) and (h).

75. By amending § 25.1351 by revising paragraphs (d) (1) and (2) to read as follows and by removing paragraph (d)(3):

§ 25.1351 General.

* * * * *

(d) * * *

(1) A single malfunction, including a wire bundle or junction box fire, cannot result in loss of both the part turned off and the part turned on; and

(2) The parts turned on are electrically and mechanically isolated from the parts turned off.

§ 25.1359 [Removed]

76. By removing § 25.1359.

77. By amending § 25.1381 by revising paragraph (a)(1) to read as follows:

§ 25.1381 Instrument lights.

(a) * * *

(1) Provide sufficient illumination to make each instrument, switch and other device necessary for safe operation easily readable unless sufficient illumination is available from another source; and

* * * * *

§ 25.1413 [Removed]

78. By removing § 25.1413.

79. By amending § 25.1415 by revising paragraph (a) to read as follows:

§ 25.1415 Ditching equipment.

(a) Ditching equipment used in airplanes to be certificated for ditching under § 25.801, and required by the operating rules of this chapter, must meet the requirements of this section.

* * * * *

§ 25.1416 [Removed]

80. By removing § 25.1416.

81. By revising § 25.1419 to read as follows:

§ 25.1419 Ice protection.

If certification with ice protection provisions is desired, the airplane must be able to safely operate in the continuous maximum and intermittent maximum icing conditions of appendix C. To establish that the airplane can operate within the continuous maximum and intermittent maximum conditions of appendix C:

(a) An analysis must be performed to establish that the ice protection for the various components of the airplane is adequate, taking into account the various airplane operational configurations; and

(b) To verify the ice protection analysis, to check for icing anomalies, and to demonstrate that the ice protection system and its components are effective, the airplane or its components must be flight tested in the various operational configurations, in measured natural atmospheric icing conditions and, as found necessary, by one or more of the following means:

(1) Laboratory dry air or simulated icing tests, or a combination of both, of the components or models of the components.

(2) Flight dry air tests of the ice protection system as a whole, or of its individual components.

(3) Flight tests of the airplane or its components in measured simulated icing conditions.

(c) Caution information, such as an amber caution light or equivalent, must be provided to alert the flightcrew when the anti-ice or de-ice system is not functioning normally.

(d) For turbine engine powered airplanes, the ice protection provisions of this section are considered to be applicable primarily to the airframe. For the powerplant installation, certain additional provisions of subpart E of this part may be found applicable.

§ 25.1433 [Amended].

82. By amending § 25.1433 by removing paragraphs (b) and (c) and by redesignating paragraph (a) as the whole of § 25.1433.

83. By amending § 25.1435 by revising paragraphs (a) and (b) to read as follows:

§ 25.1435 Hydraulic systems.

(a) *Design.* (1) Each element of the hydraulic system must be designed to withstand, without deformation that would prevent it from performing its intended function, the design operating pressure loads in combination with limit structural loads which may be imposed.

(2) Each element of the hydraulic system must be able to withstand, without rupture, the design operating pressure loads multiplied by a factor of 1.5 in combination with ultimate structural loads that can reasonably occur simultaneously. Design operating pressure is maximum normal operating pressure, excluding transient pressure.

(b) *Tests and analysis.* (1) A complete hydraulic system must be static tested to show that it can withstand 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

(2) Compliance with § 25.1309 for hydraulic systems must be shown by functional tests, endurance tests, and analyses. The entire system, or appropriate subsystems, must be tested in an airplane or in a mock-up installation to determine proper performance and proper relation to other aircraft systems. The functional tests must include simulation of hydraulic system failure conditions. Endurance tests must simulate the repeated complete flights that could be expected to occur in service. Elements which fail during the tests must be modified in order to have the design deficiency corrected and, where necessary, must be sufficiently retested. Simulation of operating and environmental conditions must be completed on elements and appropriate portions of the hydraulic system to the extent necessary to evaluate the environmental effects. Compliance with § 25.1309 must take into account the following:

(i) Static and dynamic loads including flight, ground, pilot, hydrostatic, inertial and thermally induced loads, and combinations thereof.

(ii) Motion, vibration, pressure transients, and fatigue.

(iii) Abrasion, corrosion, and erosion.

(iv) Fluid and material compatibility.

(v) Leakage and wear.

* * * * *

§ 25.1451 [Removed].

84. By removing § 25.1451.

85. By revising § 25.1521 to read as follows:

§ 25.1521 Powerplant limitations.

(a) *General.* The powerplant limitations prescribed in this section must be established so that they do not exceed the corresponding limits for which the engines or propellers are type certificated and do not exceed the values on which compliance with any other requirement of this part is based.

(b) *Reciprocating engine installations.* Operating limitations relating to the following must be established for reciprocating engine installations:

(1) Horsepower or torque, r.p.m., manifold pressure, and time at critical pressure altitude and sea level pressure altitude for—

(i) Maximum continuous power (relating to unsupercharged operation or to operation in each supercharger mode as applicable); and

(ii) Takeoff power (relating to unsupercharged operation or to operation in each supercharger mode as applicable).

(2) Fuel grade or specification.

(3) Cylinder head and oil temperatures.

(4) Any other parameter for which a limitation has been established as part of the engine type certificate except that a limitation need not be established for a parameter that cannot be exceeded during normal operation due to the design of the installation or to another established limitation.

(c) *Turbine engine installations.* Operating limitations relating to the following must be established for turbine engine installations:

(1) Horsepower, torque or thrust, r.p.m., gas temperature, and time for—

(i) Maximum continuous power or thrust (relating to augmented or unaugmented operation as applicable).

(ii) Takeoff power or thrust (relating to augmented or unaugmented operation as applicable).

(2) Fuel designation or specification.

(3) Any other parameter for which a limitation has been established as part of the engine type certificate except that a limitation need not be established for a parameter that cannot be exceeded during normal operation due to the design of the installation or to another established limitation.

(d) *Ambient temperature.* An ambient temperature limitation (including limitations for winterization installations, if applicable) must be established as the maximum ambient atmospheric temperature established in accordance with § 25.1043(b).

86. By revising § 25.1522 to read as follows:

§ 25.1522 Auxiliary power unit limitations.

If an auxiliary power unit is installed in the airplane, limitations established for the auxiliary power unit, including categories of operation, must be specified as operating limitations for the airplane.

87. By amending § 25.1533 by revising paragraph (a)(2) to read as follows:

§ 25.1533 Additional operating limitations.

(a) * * *

(2) The maximum landing weights must be established as the weights at which compliance is shown with the applicable provisions of this part (including the landing and approach climb provisions of §§ 25.119 and 25.121(d) for altitudes and ambient temperatures).

* * * * *

88. By amending § 25.1543 by revising paragraph (b) to read as follows:

§ 25.1543 Instrument markings: general.

* * * * *

(b) Each instrument marking must be clearly visible to the appropriate crewmember.

89. By revising § 25.1551 to read as follows:

§ 25.1551 Oil quantity indication.

Each oil quantity indicating means must be marked to indicate the quantity of oil readily and accurately.

90. By amending § 25.1557, by revising the heading of paragraph (b), and adding a new paragraph (b)(3) to read as follows:

§ 25.1557 Miscellaneous markings and placards.

* * * * *

(b) Powerplant fluid filler openings.

(1) * * *

(2) * * *

(3) Augmentation fluid filler openings must be marked at or near the filler cover to identify the required fluid.

* * * * *

91. By amending § 25.1581 by adding a new paragraph (a)(3) to read as follows:

§ 25.1581 General.

(a) * * *

(1) * * *

(2) * * *

(3) Any limitation, procedure, or other information established as a condition

of compliance with the applicable noise standards of part 36 of this chapter.

* * * * *

92. By amending § 25.1583, by revising paragraphs (b)(1), (f) and (i) to read as follows:

§ 25.1583 Operating limitations.

* * * * *

(b) * * *

(1) Limitations required by § 25.1521 and § 25.1522.

(2) * * *

(3) * * *

* * * * *

(f) *Altitudes.* The altitude established under § 25.1527.

* * * * *

(i) *Maneuvering flight load factors.* The positive maneuvering limit load factors for which the structure is proven, described in terms of accelerations, must be furnished.

93. By amending § 25.1587 by revising the introductory text of paragraph (b) to read as follows:

§ 25.1587 Performance information.

* * * * *

(b) Each Airplane Flight Manual must contain the performance information computed under the applicable provisions of this part for the weights, altitudes, temperatures, wind components, and runway gradients, as applicable, within the operational limits of the airplane, and must contain the following:

* * * * *

94. By revising appendix F, part I, to read as follows:

Appendix F to Part 25

Part I—Test Criteria and Procedures for Showing Compliance with § 25.853, or 25.855.

(a) *Material test criteria*—(1) *Interior compartments occupied by crew or passengers.* (i) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of part I of this appendix. The average burn length may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

(ii) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and nondecorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, liners of Class B and E cargo or baggage compartments, floor panels of Class B, C, D, or E cargo or baggage compartments, insulation blankets, cargo covers and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in subparagraph (iv) below, must be self-extinguishing when tested vertically in accordance with the applicable portions of part I of this appendix or other approved equivalent means. The average burn length may not exceed 8 inches, and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

(iii) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH1.25 (available from the American National Standards Institute, 1430 Broadway, New York, NY 10018). If the film travels through ducts, the ducts must meet the requirements of subparagraph (ii) of this paragraph.

(iv) Clear plastic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 2.5 inches per minute when tested horizontally in accordance with the applicable portions of this appendix.

(v) Except for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that would not contribute significantly to the propagation of a fire and for electrical wire and cable insulation, materials in items not specified in paragraphs (a)(1) (i), (ii), (iii), or (iv) of part I of this appendix may not have a burn rate greater than 4.0 inches per minute when tested horizontally in accordance with the applicable portions of this appendix.

(2) *Cargo and baggage compartments not occupied by crew or passengers.*

(i) Thermal and acoustic insulation (including coverings) used in each cargo and baggage compartment must be constructed of materials that meet the requirements set forth in paragraph (a)(1)(ii) of part I of this appendix.

(ii) A cargo or baggage compartment defined in § 25.857 as Class B or E must have a liner constructed of materials that meet the requirements of paragraph (a)(1)(ii) of part I of this appendix and separated from the airplane structure (except for attachments). In addition, such liners must be subjected to the 45 degree angle test. The flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.

(iii) A cargo or baggage compartment defined in § 25.857 as Class B, C, D, or E must have floor panels constructed of materials which meet the requirements of paragraph (a)(1)(ii) of part I of this appendix and which are separated from the airplane structure (except for attachments). Such panels must be subjected to the 45 degree angle test. The flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.

(iv) Insulation blankets and covers used to protect cargo must be constructed of materials that meet the requirements of paragraph (a)(1)(ii) of part I of this appendix. Tiedown equipment (including containers, bins, and pallets) used in each cargo and baggage compartment must be constructed of materials that meet the requirements of paragraph (a)(1)(v) of part I of this appendix.

(3) *Electrical system components.* Insulation on electrical wire or cable installed in any area of the fuselage must be self-extinguishing when subjected to the 60 degree test specified in part I of this appendix. The average burn length may not exceed 3 inches, and the average flame time after removal of the flame source may not exceed 30 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

(b) *Test Procedures*—(1) *Conditioning.* Specimens must be conditioned to 70±5 F., and at 50 percent ±5 percent relative humidity until moisture equilibrium is reached or for 24 hours. Each specimen must remain in the conditioning environment until it is subjected to the flame.

(2) *Specimen configuration.* Except for small parts and electrical wire and cable insulation, materials must be tested either as section cut from a fabricated part as installed in the airplane or as a specimen simulating a cut section, such as a specimen cut from a flat sheet of the material or a model of the fabricated part. The specimen may be cut from any location in a fabricated part; however, fabricated units, such as sandwich panels, may not be separated for test. Except as noted below, the specimen thickness must be no thicker than the minimum thickness to be qualified for use in the airplane. Test specimens of thick foam parts, such as seat cushions, must be ½-inch in thickness. Test specimens of materials that must meet the requirements of paragraph (a)(1)(v) of part I of this appendix must be no more than ⅛-inch in thickness. Electrical wire and cable specimens must be the same size as used in the airplane. In the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability condition. Specimens must be mounted in a metal frame so that the two long edges and the upper edge are held securely during the vertical test prescribed in subparagraph (4) of this paragraph and the two long edges and the edge away from the flame are held securely during the horizontal test prescribed in subparagraph (5) of this paragraph. The exposed area of the specimen must be at least 2 inches wide and 12 inches long, unless the actual size used in the airplane is smaller. The edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross-section of the material or part as

installed in the airplane. The specimen must be mounted in a metal frame so that all four edges are held securely and the exposed area of the specimen is at least 8 inches by 8 inches during the 45° test prescribed in subparagraph (6) of this paragraph.

(3) *Apparatus.* Except as provided in subparagraph (7) of this paragraph, tests must be conducted in a draft-free cabinet in accordance with Federal Test Method Standard 191 Model 5903 (revised Method 5902) for the vertical test, or Method 5906 for horizontal test (available from the General Services Administration, Business Service Center, Region 3, Seventh & D Streets SW., Washington, DC 20407). Specimens which are too large for the cabinet must be tested in similar draft-free conditions.

(4) *Vertical test.* A minimum of three specimens must be tested and results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The specimen must be exposed to a Bunsen or Tirrill burner with a nominal ⅜-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 °F. The lower edge of the specimen must be ¾-inch above the top edge of the burner. The flame must be applied to the center line of the lower edge of the specimen. For materials covered by paragraph (a)(1)(i) of part I of this appendix, the flame must be applied for 60 seconds and then removed. For materials covered by paragraph (a)(1)(ii) of part I of this appendix, the flame must be applied for 12 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, may be recorded. The burn length determined in accordance with subparagraph (7) of this paragraph must be measured to the nearest tenth of an inch.

(5) *Horizontal test.* A minimum of three specimens must be tested and the results averaged. Each specimen must be supported horizontally. The exposed surface, when installed in the aircraft, must be face down for the test. The specimen must be exposed to a Bunsen or Tirrill burner with a nominal ⅜-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 °F. The specimen must be positioned so that the edge being tested is centered ¾-inch above the top of the burner. The flame must be applied for 15 seconds and then removed. A minimum of 10 inches of specimen must be used for timing purposes, approximately 1½ inches must burn before the burning front reaches the timing zone, and the average burn rate must be recorded.

(6) *Forty-five degree test.* A minimum of three specimens must be tested and the results averaged. The specimens must be supported at an angle of 45° to a horizontal surface. The exposed surface when installed in the aircraft must be face down for the test. The specimens must be exposed to a Bunsen or Tirrill burner with a nominal ⅜-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1550 °F. Suitable precautions must be taken to avoid drafts. The flame must be applied for 30 seconds with one-third contacting the material at the center of the specimen and then removed. Flame time, glow time, and whether the flame penetrates (passes through) the specimen must be recorded.

(7) *Sixty degree test.* A minimum of three specimens of each wire specification (make and size) must be tested. The specimen of wire or cable (including insulation) must be placed at an angle of 60° with the horizontal in the cabinet specified in subparagraph (3) of this paragraph with the cabinet door open during the test, or must be placed within a chamber approximately 2 feet high by 1 foot by 1 foot, open at the top and at one vertical side (front), and which allows sufficient flow of air for complete combustion, but which is free from drafts. The specimen must be parallel to and approximately 6 inches from the front of the chamber. The lower end of the specimen must be held rigidly clamped. The upper end of the specimen must pass over a pulley or rod and must have an appropriate weight attached to it so that the specimen is held tautly throughout the flammability test. The test specimen span between lower clamp and upper pulley or rod must be 24 inches and must be marked 8 inches from the lower end to indicate the central point for flame application. A flame from a Bunsen or Tirrill burner must be applied for 30 seconds at the test mark. The burner must be mounted underneath the test mark on the specimen, perpendicular to the specimen and at an angle of 30° to the vertical plane of the specimen. The burner must have a nominal bore of ⅜-inch and be adjusted to provide a 3-inch high flame with an inner cone approximately one-third of the flame height. The minimum temperature of the hottest portion of the flame, as measured with a calibrated thermocouple pyrometer, may not be less than 1750 °F. The burner must be positioned so that the hottest portion of the flame is applied to the test mark on the wire. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with paragraph (8) of this paragraph must be measured to the nearest tenth of an inch. Breaking of the wire specimens is not considered a failure.

(8) *Burn length.* Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discolored, nor areas where material has shrunk or melted away from the heat source.

* * * * *

95. By adding a new appendix J to read as follows:

Appendix J to Part 25 Emergency Demonstration

The following test criteria and procedures must be used for showing compliance with § 25.803:

(a) The emergency evacuation must be conducted either during the dark of the night or during daylight with the dark of night simulated. If the demonstration is conducted indoors during daylight hours, it must be conducted with each window covered and each door closed to minimize the daylight effect. Illumination on the floor or ground may be used, but it must be kept low and shielded against shining into the airplane's windows or doors.

(b) The airplane must be in a normal attitude with landing gear extended.

(c) Stands or ramps may be used for descent from the wing to the ground, and safety equipment such as mats or inverted life rafts may be placed on the floor or ground to protect participants. No other equipment that is not part of the airplane's emergency evacuation equipment may be used to aid the participants in reaching the ground.

(d) Except as provided in paragraph (a) of this Appendix, only the airplane's emergency lighting system may provide illumination.

(e) All emergency equipment required for the planned operation of the airplane must be installed.

(f) Each external door and exit, and each internal door or curtain, must be in the takeoff configuration.

(g) Each crewmember must be seated in the normally assigned seat for takeoff and must remain in the seat until receiving the signal for commencement of the demonstration. Each crewmember must be a person having knowledge of the operation of exits and emergency equipment and, if compliance with § 121.291 is also being demonstrated, a member of a regularly scheduled line crew.

(h) A representative passenger load of persons in normal health must be used as follows:

(1) At least 30 percent must be females.

(2) At least 5 percent must be over 60 years of age with a proportionate number of females.

(3) At least 5 percent, but not more than 10 percent, must be children under 12 years of age, prorated through that age group.

(4) Three life-size dolls, not included as part of the total passenger load, must be carried by passengers to simulate live infants 2 years old or younger.

(5) Crewmembers, mechanics, and training personnel, who maintain or operate the airplane in the normal course of their duties, may not be used as passengers.

(i) No passenger may be assigned a specific seat except as the Administrator may require. Except as required by subparagraph (g) of this paragraph, no employee of the applicant may be seated next to an emergency exit.

(j) Seat belts and shoulder harnesses (as required) must be fastened.

(k) Before the start of the demonstration, approximately one-half of the total average amount of carry-on baggage, blankets, pillows, and other similar articles must be distributed at several locations in aisles and emergency exit access ways to create minor obstructions.

(l) No prior indication may be given to any crewmember or passenger of the particular exits to be used in the demonstration.

(m) The applicant may not practice, rehearse, or describe the demonstration for the participants nor may any participant have

taken part in this type of demonstration within the preceding 6 months.

(n) The pretakeoff passenger briefing required by § 121.571 may be given. The passengers may also be advised to follow directions of crewmembers but not be instructed on the procedures to be followed in the demonstration.

(o) If safety equipment as allowed by paragraph (c) of this appendix is provided, either all passenger and cockpit windows must be blacked out or all of the emergency exits must have safety equipment in order to prevent disclosure of the available emergency exits.

(p) Not more than 50 percent of the emergency exits in the sides of the fuselage of an airplane that meets all of the requirements applicable to the required emergency exits for that airplane may be used for the demonstration. Exits that are not to be used in the demonstration must have the exit handle deactivated or must be indicated by red lights, red tape, or other acceptable means placed outside the exits to indicate fire or other reason why they are unusable. The exits to be used must be representative of all of the emergency exits on the airplane and must be designated by the applicant, subject to approval by the Administrator. At least one floor level exit must be used.

(q) All evacuees, except those using an over-the-wing exit, must leave the airplane by a means provided as part of the airplane's equipment.

(r) The applicant's approved procedures must be fully utilized during the demonstration.

(s) The evacuation time period is completed when the last occupant has evacuated the airplane and is on the ground. Provided that the acceptance rate of the stand or ramp is no greater than the acceptance rate of the means available on the airplane for descent from the wing during an actual crash situation, evacuees using stands or ramps allowed by paragraph (c) of this Appendix are considered to be on the ground when they are on the stand or ramp.

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James B. Busey,

Administrator.

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