REFERENCE: FEDERAL REGISTER, "Environmental Protection Agency: Asbestos; Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions."

DATE: 1989

METHOD: Review of the literature and government regulations.

FINDINGS: Lists products containing asbestos that pose an unnecessary risk to the health of workers and their families. Requires labels be applied by manufacturers, importers and processors to these products. A military exemption is noted. Recognizes that high and low levels of exposure alike contribute to asbestosis, lung cancer and meso. States that OSHA's PEL does not solve for the risk to workers and their families. States that all types of asbestos fibers are associated with asbestosis, lung cancer and meso. States that asbestos is capable of causing lung cancer independent of smoking. Meso is unaffected by smoking. Finds that household exposure leading to meso has been documented. Believes that asbestos exposure causes gastrointestinal cancers. States that animal studies prove that chrysotile is as potent as amphiboles in inducing both meso and lung cancer. States that all fibers produce meso.

[redacted]

[OPTS-62036G; FRL-3476-2]

Asbestos; Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: EPA is issuing this final rule under section 6 of the Toxic Substances Control Act (TSCA) [redacted] is [redacted] The rule provides that exemptions from the rule's bans on manufacture, importation, processing, and distribution in commerce may be granted by EPA in very limited circumstances.

DATES: In accordance with 40 CFR 23.5, this rule shall be promulgated for purposes of judicial review at 1 p.m. eastern time on July 26, 1989. The effective date of this rule is August 25, 1989, except for the information collection requirements of 40 CFR 763.173, 763.178, and 763.179. These information collection requirements have not been approved by the Office of Management and Budget (OMB) and are not effective until OMB has approved them. EPA will issue a notice in the future establishing an effective date for the information collection requirements.

FOR FURTHER INFORMATION CONTACT: Michael M. Stahl, Director, TSCA Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, Rm. EB-44, 401 M Street SW., Washington, DC 20460, Telephone: (202-554-1404), TDD: (202-554-0551).

SUPPLEMENTARY INFORMATION: The preamble accompanying this final rule is divided into the following Units:

I. Authority
II. TSCA Actions to Date
III. Provisions of the Rule
A. General Provisions
B. Manufacture, Importation, and
E. Exemption Application Procedures
F. Military Exemptions
G. Recordkeeping
IV. Summary of Analysis Supporting this Final Rule
V. Regulatory Assessment
A. Health Effects and Magnitude of Exposure to Asbestos
B. Environmental Effects
C. Asbestos Substitutes
D. Economic Effects of the Rule
E. Other Options Considered
F. Summary of Individual Product Categories
VI. Other EPA Statutes
VII. Analysis under Section 9(a) of TSCA
A. Other Authorities Affecting Asbestos
B. EPA's Determination Under Section 9(a) of TSCA
VIII. Enforcement
IX. Confidentiality
X. Rulemaking Record
XI. References
XII. Regulatory Assessment Requirements
A. Executive Order 12291
B. Regulatory Flexibility Act
C. Paperwork Reduction Act

This rule prohibits the manufacture, import, processing, and distribution in commerce of certain asbestos-containing products. The rule also requires that asbestos-containing products that are subject to this rule be labeled to facilitate compliance with and enforcement of the rule.

Public reporting burden for this collection of information is estimated to average less than 2 hours annually per firm over the 3-year period reviewed for the analysis of regulatory burden. This burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This estimate of annual burden is a relatively low figure because of the small number of firms affected by the regulatory actions taken during the period reviewed for the analysis of regulatory burden. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, Attention: Desk Officer for EPA.

I. Authority

Section 6(a) of TSCA authorizes EPA to impose certain regulatory requirements on activities involving [redacted] processing, distribution in commerce, use, or disposal of the chemical substance, or any combination of such activities, presents or will present an unreasonable risk of injury to human health or the environment. Section 6(a)(1) authorizes EPA to prohibit or limit the manufacture, processing, or distribution in commerce of substances or mixtures if EPA finds that these activities pose an unreasonable risk. Section 6(a)(2) authorizes EPA to prohibit or limit such activities for a particular use of such substances or mixtures. Section 6(a)(3) authorizes EPA to require labels for such substances or mixtures. Sections 8 and 8(a) authorize EPA to require the maintenance of records related to enforcement of EPA actions under section 6. These sections of TSCA provide EPA the authority to issue this rule.

II. TSCA Actions to Date

EPA issued an Advance Notice of Proposed Rulemaking in the Federal Register of October 17, 1979 (44 FR 60061), announcing its intent to explore the use of section 6 of TSCA to reduce the risk to human health posed by exposure to asbestos. EPA then issued a reporting rule under section 8(a) of TSCA in the Federal Register of July 1982 (47 FR 33202; 40 CFR 763.80), to collect information on industrial and commercial uses of asbestos. Information collected under that rule as well as analyses developed by EPA and other organizations, were evaluated and used to support a proposed rule, published in the Federal Register of January 29, 1986 (51 FR 3738).

In the proposed rule EPA found that exposure to asbestos poses an unreasonable risk to human health and discussed regulatory options for prohibiting or restricting the mining and importation of bulk asbestos and the manufacturing, importation, and processing of asbestos-containing products as means of reducing the risk. The following options were discussed in the proposed rule:

1. Two options involving bans of [redacted] products soon after promulgation of the final rule and a phase out of others over 10 years by means of a permit system for asbestos use.

2. A 2-stage ban, with the first ban on asbestos construction products and clothing, to begin soon after promulgation of the final rule and the second ban, on friction products, to begin in 5 years, and after promulgation

promulgation of the final rule, and 5 years and 10 years after promulgation. Requiring labeling of asbestos-containing products was also discussed. EPA received over 200 comments in response to the proposed rule.

Prior to issuing the proposal, EPA received and granted two TSCA section 21 petitions (15 U.S.C. 2620). Under section 21 of TSCA, a citizen may petition EPA to initiate a proceeding for the issuance of a rule under various sections of TSCA. One petition requested the prohibition of the future use of asbestos in asbestos-cement pipe; this petition was granted in the **Federal Register** of October 18, 1979 (44 FR 60155). The other petition requested the prohibition of the future use of asbestos in motor vehicle brakes; this petition was granted in the **Federal Register** of December 18, 1984 (49 FR 49311). In granting these petitions, EPA stated that it would, as part of the rulemaking proceeding and the final rule, consider including prohibitions of the future use of asbestos in asbestos-cement pipe and in motor vehicle brakes. Both uses are prohibited by this final rule.

Pursuant to section 6(c)(2) of TSCA, EPA also provided interested parties opportunities to participate in a legislative hearing on the proposed rule in July 1986, and in extensive cross-examination of EPA personnel and contractors on factual issues relating to the rule in October 1986.

Since the end of cross-examination in October 1986, EPA has updated the data collections and regulatory analyses used to support the findings on which this rule is based. EPA believes that adequate data and analyses existed in the rulemaking record for the proposal to support the options discussed therein. The data collections and analyses were updated due to the passage of time since the publication of the proposal and in response to specific public comments that the data base supporting the proposed rule, gathered largely in 1982, was outdated.

EPA has gathered updated data relating to: (1) Asbestos consumption, (2) manufacturing, import, and processing volumes of asbestos-containing products, (3) trends in the development of non-asbestos substitutes, (4) costs of capital conversion to the production of non-asbestos products, (5) production, processing, use, and disposal practices for asbestos-containing products, and (6) occupational and non-occupational release and exposure from the manufacture, processing, installation, repair, removal, and disposal of asbestos-containing products. These data were drawn from ... sources, the 1987 EPA Asbestos Exposure survey, the 1987 EPA Asbestos Market survey, and 1987 Occupational Health and Safety Administration (OSHA) compliance data. EPA has also modified and updated its Asbestos Regulatory Cost Model (ARCM), Benefits Model, and asbestos exposure models which were used to evaluate the costs and benefits of various regulatory options. Additionally, EPA has bolstered its analysis of the availability and possible hazards posed by asbestos substitutes.

These updated data and analyses were reflected in documents released for public comment in notices published in the **Federal Register** of April 1, 1988 (53 FR 10546), and May 4, 1988 (53 FR 15857). EPA received over 40 public comments in response to these notices. In addition, EPA allowed further cross-examination of EPA personnel and contractors on factual issues related to the updated analytical data base in September 1988. The materials released for public comment contain the technical basis for the actions taken in this final rule. EPA afforded the opportunity for public comment on the updated documents and for further cross-examination as an exercise of its discretion and as a means of ensuring that any remaining disputed issues of material fact in the updated data and analyses could be identified and resolved before promulgation of this final rule. EPA has reviewed the comments received and the testimony elicited and has updated the record accordingly.

Pursuant to its procedural rules at 40 CFR 750.4(b), EPA also announced to interested parties in the **Federal Register** of September 16, 1988 (53 FR 36227), the opportunity to provide EPA with reply comments relating to the rulemaking proceeding. EPA received reply comments from three commenters.

The record which serves as the basis for the actions taken in this rule consists of over 45,000 pages of analyses, comments, testimony, correspondence, and other materials. The record for this rule also incorporates by reference the extensive record developed by OSHA in its rulemaking to lower its Permissible Exposure Level (PEL) for asbestos, published in the **Federal Register** of June 20, 1986 (51 FR 22612). EPA has fully considered these materials in developing this final rule. In addition, all significant testimony or public comments made on the proposed rule, in conjunction with the legislative hearing, cross-examination hearing, or reply comments, or in response to the materials announced in the ... above, were considered in the development of the final rule. EPA's responses to all significant comments are found either in this preamble or in a separate Response to Comments document that is available in the Public Docket (Ref. 20).

Based on the numerous detailed analyses performed by EPA in support of this rule and after careful consideration of the extensive public comments received, EPA has concluded that the continued commercial manufacture, import, processing, and distribution in commerce of the products identified in this rule poses an unreasonable risk of injury to human health under section 6 of TSCA.

III. Provisions of the Rule

A. General Provisions

Consistent with an option described in the proposal, this rule imposes a 3-stage ban on the manufacture, importation, processing, and distribution in commerce of various asbestos-containing products. The rule also contains a requirement that products subject to a manufacture, importation, and processing ban, but not yet subject to a ban on distribution in commerce be labeled in the manner described at § 763.171. In addition, the rule includes procedures for requesting an exemption from the rule's provisions.

The effective dates of the various bans are as follows (with exceptions as noted in Unit III.B of this preamble for some asbestos friction products):

Manufacture, Import, and Processing Ban:

Stage 1—August 27, 1990
Stage 2—August 25, 1993
Stage 3—August 26, 1996

Distribution in Commerce Ban:

Stage 1—August 25, 1992
Stage 2—August 25, 1994
Stage 3—August 25, 1997

B. Manufacture, Importation, and Processing Bans

As of the dates indicated below, the manufacture, importation, and processing of all asbestos-containing products within the categories listed must cease as follows for each stage:

Stage 1: [redacted]

Stage 2: Manufacture, importation, and processing of the following products must cease by 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 (OEM)) [1]
Disc Brake Pads for Light- and Medium-weight Vehicles (LMV) (OEM) [1]

Stage 3: Manufacture, importation, and processing of the following products must cease by August 26, 1996:

Commercial Paper
Corrugated Paper
Rollboard
Millboard
Specialty Paper
Roof Coatings
Non-Roof Coatings

In addition, [illegible] as of the effective date of Stage 1, unless EPA approves the use or product pursuant to an exemption application. In other words, if a person devises a new application for asbestos that is not covered by the product categories defined in this rule, and the person wishes to commence commercial manufacture, importation, and processing of the product after August 25, 1989, manufacture, importation, and processing of the product must cease by August 27, 1990, and distribution in commerce of the product must cease by August 25, 1992. These bans on manufacture, importation, processing, and distribution in commerce may be avoided only if a person applies to EPA for an exemption from the bans and the application is granted.

[1] These bans affect products used as original equipment in vehicles introduced in the 1994 model year. For example, if new model year products are introduced annually by a producer in October, asbestos brake products may be used in vehicles made by that producer before the introduction of

Pursuant to section 12(a)(2), EPA finds that the manufacture or processing for export of the asbestos-containing products that are subject to this rule will present an unreasonable risk of injury to human health. Therefore, the manufacture and processing of the asbestos-containing products for export is not exempted from this rule under section 12(a)(1), and is subject to this rule's bans on manufacture, processing, and distribution in commerce bans. Much of the life cycle and a significant portion of risk posed by export products occurs in the United States. The most significant source of exposure that could be quantified by EPA for this rule is primary and secondary manufacturing. During [illegible] asbestos fibers are introduced into the production process. During [illegible] an asbestos fiber-containing compound is used. E[illegible] ac[illegible] In light of the high individual [illegible] caused by exposure to asbestos [illegible]

EPA has not found that asbestos-containing products imported into the United States for the sole purpose of shipment to another country pose an unreasonable risk. Therefore, such activities are not subject to this rule's bans. However, for the reasons described above, imported products that are repackaged or otherwise processed in the United States before shipment to another country are subject to the rule's bans.

The proposal would have exempted the import of small quantities of otherwise banned asbestos-containing products for personal use from the rule's bans. EPA received comments indicating that many new automobiles are imported by individuals. However, EPA is uncertain about the extent of any risk reduction that would be achieved by a ban on these activities. Therefore, [illegible]

the United States border during the normal course of personal or busi[illegible]ss activities. The final rule bans the i[illegible]port of products that are purchased or otherwise acquired outside of the [illegible]ited States for the sole purpose of resal[illegible]

For example, after the effective [illegible]te of the ban on OEM brake pads, a 1[illegible]4 or later model year automobile conta[illegible]ing banned asbestos-containing parts cannot be purchased in Canada or another country and be transporte[illegible]by a person to the United States for res[illegible]e. However, the rule does not ban th[illegible] import by a person of such a vehic[illegible] for personal use in the United States. [illegible]or purposes of enforcing this provisio[illegible] EPA will consider a vehicle to be imported for personal use if the pe[illegible]on importing the vehicle imports no m[illegible]e than one vehicle containing banne[illegible] products every 5 years. If a person imports a vehicle more frequently, EPA will presume that the activity is su[illegible]ject to the rule's bans. Other activities [illegible]at are excluded from the definition o[illegible] import include driving across the U[illegible]S. border in a 1994 or later model ye[illegible] automobile containing banned pro[illegible]ucts during the course of transacting [illegible]ness or for recreational purpo[illegible]s, or purchasing a used (i.e., pre-1994 m[illegible]del year) vehicle containing asbestos [illegible]rakes in another country and transportin[illegible] it into the United States.

C. Bans on Distribution in Comm[illegible]e

Available evidence shows that [illegible]e release of asbestos fibers occurs n[illegible]t only in the manufacture and proce[illegible]sing of asbestos products, but also in t[illegible]ir use and maintenance. EPA propos[illegible]d to ban activities involving asbestos products because of this life cycle [illegible]sk. The proposed ban also implicitly [illegible]ould have prohibited the eventual distribution of these products in commerce because persons would[illegible]ot be permitted to manufacture, imp[illegible], or process asbestos products.

Consistent with the intent of the proposal, this final rule explicitly prohibits the distribution in comm[illegible]ce of asbestos products within the spe[illegible]ed timeframe after manufacture, importation, and processing bans [illegible]the products become effective. The ti[illegible] periods for distribution in comme[illegible] were established to afford affecte[illegible] parties sufficient time to sell exis[illegible] stocks and therefore limit the like[illegible] economic impact of the ban. This [illegible]as [illegible]e after balancing the likely ris[illegible]

products after manufacture, importation, and processing bans for the products become effective. The ban on distribution in commerce for products subject to the Stage 1 manufacture, importation, and processing ban will become effective on August 25, 1992. For Stage 2 products, the ban on distribution in commerce will become effective on August 25, 1994. For Stage 3 products, the ban on distribution in commerce will become effective on August 25, 1997.

Remaining "stock-on-hand" of an affected product must be disposed of within 6 months of the effective date of the ban on distribution in commerce. Remaining stocks include all units of the product in the possession or control of the person subject to the distribution in commerce ban. Disposal must be by means that are in compliance with applicable local, State, and Federal restrictions.

The rule's distribution in commerce ban does not cover all actions taken with respect to asbestos-containing products. For purposes of the rule, the term "distribution in commerce" does not cover end use activities, for example, sale, resale, holding, or delivery, with respect to asbestos products by persons who use the product after it is manufactured, imported, or processed. For example, the term "distribution in commerce" does not include the resale of homes or motor vehicles that contain asbestos-containing parts or products or the installation of asbestos-containing brake pads in a person's automobile after the distribution in commerce of such brake pads is banned. (However, it is a violation of this rule for a person to engage in selling brake pads to anyone.) This provision also does not cover the disposal of asbestos-containing products.

EPA recognizes that some asbestos-containing products which are excluded from the ban may be very similar in form to asbestos-containing products that are banned. For example, this rule's bans do not cover the manufacture, importation, processing, and distribution in commerce of high-grade electrical paper, a product which may be similar in some cases to millboard or other asbestos paper products. Persons might try to manufacture or distribute the excluded products for uses that are banned. Such activities would violate this rule's bans because this conversion which involve the conversion of excluded asbestos-containing products in this manner.

D. Labeling

Products that are subject to a current or future ban on manufacturing, processing, import, or distribution in commerce must be labeled as follows:

Notice—This product contains *ASBESTOS*. The U.S. Environmental Protection Agency has banned the distribution in U.S. commerce of this product under section 6 of the Toxic Substances Control Act (15 U.S.C. 2605) as of (insert the effective date of ban on distribution in commerce). Distribution of this product in commerce after this date and intentionally removing or tampering with this label are *violations of Federal law*.

The purpose of this labeling requirement is to facilitate efforts by manufacturers, importers, processors, and distributors to [illegible] efforts to enforce [illegible]

Products	Dates which products must be labeled
Products banned in Stage 1	Aug. 27, 1990
Products banned in Stage 2, plus aftermarket disc and drum brake products.	Aug. 25, 1992
All other products banned in Stage 3	Aug. 25, 1995

Therefore, a manufacturer, importer, or processor of a product banned in Stage 2 must label all stock-on-hand of the product as of August 25, 1992, as well as any further stock of that product manufactured, imported, or processed after that date. Products must be labeled at the times indicated to ensure that a substantial portion of the stock in the chain of distribution after the effective date of the manufacture, importation, or processing bans are labeled to facilitate enforcement and compliance efforts. Asbestos-containing brake pads, drum brake linings, and brake blocks must be labeled earlier than other products because of the relatively long potential shelf life of brake products and to facilitate compliance with the two-part ban of asbestos friction products.

still within the direction or control of the manufacturer, importer, or processor.

Manufacturers, importers, and processors must insert in the label they apply to their products the effective date of the ban on distribution in commerce for that product. Labels must be displayed prominently on product packaging, as described below. Labels must be either printed on product packaging or in the form of either a sticker or tag made of plastic, paper, metal, or another durable material and securely adhered or attached to product packaging. Labels must be securely attached so that they cannot be removed without being defaced or destroyed. They must be written in English in block letters and numerals. Text in other languages is permitted in addition to the English language text. The color of the text must contract with the background of the label. Labels must be applied in a visible location on the exterior of the immediate packaging in which a product is distributed in commerce. However, if the product packaging has no visible surfaces larger than 5 square inches, the person subject to the labeling requirement must either securely attach a tag containing the required language to the product packaging or must label the next outer container in which the smaller wrapped products are packed for storage, transport, or distribution. Labels must be applied directly onto products which are stored, shipped, or distributed in commerce without packaging or wrapping. However, if a product is otherwise properly labeled and is removed from the proper labeled packaging only when distributed to the end user, the product does not need to also be labeled directly.

Compliance with the labeling requirements of this rule does not fulfill labeling requirements established under the Federal Hazardous Substances Act (FHSA, 15 U.S.C. 1261).

E. Exemption Application Procedures

EPA believes that exemptions from the rule's bans on future manufacture, importation, processing, and distribution in commerce will fall into two different categories, those involving existing asbestos-containing products or existing uses of asbestos in products and those involving new uses of asbestos in products or new asbestos products. This rule provides two approaches to obtaining an exemption from the ban:

applications involving manufacture, importation, processing, and distribution in commerce of asbestos-containing products in categories identified in this rule or uses of asbestos in these products place the burden upon the applicant to show that he or she has made demonstrable good faith efforts to develop substitutes for its product and that granting the exemption will not result in an unreasonable risk of injury to human health.

EPA is uncertain about the facts and circumstances that will attend any potential exemption involving new asbestos-containing products or new uses of asbestos. In view of this uncertainty about these products or uses, EPA believes that it is appropriate to employ a different process for reviewing exemptions for new asbestos products or uses. Thus, requests for exemption for new products or uses will be treated as a petition to amend this rule pursuant to section 21 of TSCA. Such petitions should comply with the procedures of section 21 and contain, at a minimum, the type of information set forth in this final rule for exemption applications.

The remainder of this Unit discusses general exemption procedures for applications involving products identified in the rule. Exemptions for military uses are discussed in Unit III.F of this preamble.

1. *Information requirements.* This provision allows that EPA will exempt products from the rule's bans if an applicant can show that the activity described in the application will not result in an unreasonable risk of injury to human health and that the applicant has made demonstrable good faith efforts to develop substitutes that do not pose an unreasonable risk. EPA will balance the various information received in an exemption application in determining whether the applicant has met the criteria for granting an exemption. Applicants for exemptions must submit to EPA data or discussions addressing each of the following issues regarding their product:

a. Data demonstrating the exposure level over the life cycle of the product that is the subject of the application.

b. Data concerning:

i. The extent to which non-asbestos substitutes for the product that is the subject of the application fail significantly short in performance under necessary product standards or requirements, including laws or ordinances mandating product safety

case in which the product is a component of another product, the effect on the cost of the end use product of using the substitute component.

iii. The extent to which the product or use serves a high-valued use.

c. Evidence of demonstrable good faith attempts by the applicant to develop and use a non-asbestos substance or product which may be substituted for the asbestos-containing product or the asbestos in the product or use that is the subject of the application.

d. An explanation of why the continued manufacture, importation, processing, distribution in commerce, and use, as applicable, of the product will not present an unreasonable risk of injury to human health.

Exemption applications which do not contain these items of information and the other information required under § 763.173(d) will be considered incomplete and will be returned to the applicant without further action by EPA. Exemption applications that are returned as incomplete can be resubmitted with the additional required information. The resubmitted application will carry the resubmittal date as the date of receipt.

2. *Procedures for submitting exemption applications.* Exemption applications cannot be submitted for products subject to the following bans before the dates indicated, as follows:

Manufacture, Importation, and Processing

Stage 1—August 25, 1989
Stage 2—February 26, 1992
Stage 3—February 27, 1995

Distribution in Commerce

Stage 1—February 26, 1990
Stage 2—February 28, 1993
Stage 3—February 26, 1996

EPA believes that, because of the rapid development of asbestos substitutes, decisions on exemption applications made before these dates would be premature. However, EPA will consider, if appropriate, arguments made for an exemption from a ban on distribution in commerce for a product at the time and applicant submits an application for an exemption from a manufacture, importation, or processing ban.

Exemption applications must be addressed to: TSCA Document Processing Center (TS-790), Office of Toxic Substances, U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, ATTN: Asbestos Exemption.

3. *EPA review and decision.* EPA's

the data that is submitted. If a complete exemption application is submitted more than 1 year before the effective date of the applicable ban (or 9 months before the effective date of the ban in the case of Stage 1 manufacture, importation, and processing bans), EPA will complete its review of the application and issue its decision prior to the effective date of the ban. If EPA fails to meet this deadline, the applicant will be granted an automatic extension of up to 1 year, or until EPA decides whether to approve the application, during which the applicant can continue the activity that is the subject of the application. EPA will render its decision during the extension period.

For example, if a ban becomes effective on September 1, 1994, an exemption application for a product subject to that ban cannot be submitted to EPA before March 1, 1993. To ensure a decision by EPA on an application before the ban's effective date, the applicant must submit the application to EPA before September 1, 1993.

If an exemption application is submitted less than 1 year before the effective date of the applicable ban or after the ban, EPA will issue a decision as soon as is feasible. The submitter of this "late" application must cease the banned activity as of the effective date of the ban unless EPA grants the exemption.

For example, if a manufacture or importation ban becomes effective on September 1, 1994, and an application for a product subject to the ban is received by EPA on April 1, 1991, EPA will render its decision on the application as soon as is feasible. If EPA has not rendered a decision granting the exemption by September 1, 1994, the applicant must cease manufacture or importation of the product.

If EPA denies an exemption application before the effective date of a ban, the applicant must cease the activity as of the effective date of the ban, or within 30 days after receipt of the denial if it is issued less than 30 days before the effective date of the ban. If a denial is rendered during an extension period, the applicant must cease the banned activity within 30 days after the issuance of the denial.

For example, if the effective date of a ban is November 1, 1994, and EPA renders a denial on June 1, 1994, the activity must cease by November 1994. If the effective date of the ban is

A issues a denial on June 1, 1994, the ivity must cease by July 1, 1994.

The time frames discussed in the preceding paragraphs for EPA's review of exemption applications do not apply to applications pertaining to new uses of asbestos. Applications for new uses will be subject to the deadlines for EPA review and decision specified in section 21 of TSCA.

Upon receipt of a complete exemption application, EPA will issue a notice in Federal Register announcing receipt plication and inviting s. EPA will consider any ments received in determining whether to grant or deny the application. EPA may request further information from the applicant to assist in determining whether the exemption application meets the rule's criteria.

When denying an application, EPA will send the applicant a copy of the denial via registered mail. This written denial is a final Agency action for purposes of judicial review.

If EPA proposes to grant an application, EPA will issue a notice in the Federal Register requesting comments on its proposal or the submission of supplementary mation. EPA will consider any ments received when preparing its final decision. A final grant of an exemption application will be issued by Federal Register notice and, likewise, is a final Agency decision for purposes of judicial review. The notice will state the length of the exemption period granted by EPA. In addition, if an application is approved, EPA may notify the applicant that the labeling requirements of § 763.171 have been stayed until a later date indicated by EPA or otherwise modified in the exemption application approval.

Exemption renewal applications cannot be submitted earlier than 15 months before the end of the exemption period, unless so allowed in the notice granting the original exemption. Notices received between 15 months and 1 year before the end of the exemption period will be granted or denied before the end of the exemption period. Renewal applications received thereafter will be granted or denied by EPA as soon as is feasible. The activity that is the subject of the renewal application may not continue beyond the original exemption period unless EPA grants the renewal.

4. *Factors considered in evaluating ption applications.* EPA has luded that the future manufacture, these risks by banning the future use of asbestos in many products in U.S. commerce. Therefore, exemptions will be granted by EPA only in those nstances where a clear showing is made by an applicant that the activity described in the exemption application meets the criteria set out in this preamble and rule. The criteria require the applicant to demonstrate that the activity described in the application will not result in an unreasonable risk of injury to human health and that the applicant has made demonstrable good faith efforts to develop substitutes that do not pose an unreasonable risk. EPA believes that these criteria are consistent with the findings in this rule, yet provide applicants an opportunity to demonstrate that they are entitled to an exemption in certain non-routine circumstances.

EPA's evaluation of exemption applications will involve a balancing of a number of factors which go into determining whether the exemption criteria have been met. These factors include the availability of suitable substitutes and the feasibility of substituting for asbestos in the product, asbestos exposure risks posed by the continued use of the asbestos product, whether the asbestos use is a high-valued use, and the efforts of the applicant to develop substitutes. EPA will grant an exemption only after carefully balancing all the factors presented in an application. The paragraphs that follow provide guidelines which EPA will follow in applying the above-stated exemption criteria in making decisions on exemption applications.

Generally, EPA does not intend to grant exemptions to applicants who are merely seeking to avoid their share of the costs imposed by the actions taken in this rule. Also, EPA does not intend to grant exemptions that would indefinitely extend the use of asbestos in products.

EPA has concluded that exposure to asbestos during the life cycles of the products that are subject to this rule poses an unreasonable risk of injury to human health. Therefore, EPA does not intend to grant exemption applications that are based solely on the rationale that relatively low levels of exposure exist, because exposure levels may be only one of several factors balanced in determining whether the use described in an exemption application would pose an unreasonable risk. EPA has also found that suitable non-asbestos substitutes grant an exemption to one producer based on the cost or difficulty of modifying its production process or of setting up a supply system for obtainin the substitute. EPA has, in establishing the effective dates for the bans, afford sufficient time to allow producers and distributors to develop and implement transition plans. Therefore, EPA does not intend to grant an exemption because an applicant has yet to purchase the necessary equipment, to set up systems of supply for substitutes or to make other transition plans.

Also, EPA does not intend to grant or renew an exemption if the applicant has failed to make a tangible, documented effort to identify, develop, and use suitable non-asbestos substitutes for the product which is the subject of the exemption application.

In addition, EPA does not intend to grant an exemption merely because using a substitute is somewhat more costly in the production of a product than using asbestos. However, EPA may grant an exemption for an existing asbestos product if, in addition to other factors, a non-asbestos substitute for the product has not been developed or adapted, despite the best efforts of the requestor, or if available substitutes ar unreasonably expensive to purchasers.

F. Military Exemptions

EPA and the Department of Defense will develop a Memorandum of Understanding establishing mechanism for dealing with asbestos-containing products used for military purposes. Along with the criteria for consideratio of general exemptions described in the preceding Unit, consideration will be given to the military nature of such use and the mission of the Department of Defense. EPA and the Department of Defense will jointly develop procedure for exemptions from this rule for asbestos-containing products used for military purposes.

G. Recordkeeping

To ensure compliance with this rule, and to assist enforcement efforts, EPA requiring under the authority of sectio 6 and 8 of TSCA that all manufacturer importers, and processors of certain asbestos-containing products keep records. Section 8(a) provides broad authority for EPA to require manufacturers, importers, and processors to keep records. Section 8(

dy subject to rules under section 6 and is also subject to this one, the small business exemption of section 8(a) would not apply. EPA believes that these recordkeeping requirements represent very little burden and are necessary for the enforcement of this rule.

...lso has authority under section ...to require recordkeeping and reporting ...lated to the other regulatory ...ments imposed by EPA under ... In this case, section 6 provides the authority to apply the recordkeeping requirements to distributors of asbestos-containing products who are not also manufacturers, importers, or processors of these products subject to section 8(a). EPA has used this section 6 recordkeeping and reporting authority previously in its polychlorinated biphenyl and asbestos rules promulgated under TSCA section 6 in 40 CFR Parts 761 and 763.

1. *Inventory.* As of the effective date of a ban on manufacture, importation, or processing, all manufacturers, importers, and processors of products subject to the ban must take an inventory of their stock-on-hand of the banned products.

...inventory must consist of a count of ...number of product units in stock, in terms of the unit measure or form in which the product is used or sold, and the location of current stock. "Stock-on-hand" covers all stock owned or controlled by the manufacturer, importer, or processor. This includes stock in a storage location owned by the person, as well as stock in storage locations owned by others if the stock remains within the direction or control of the person. Results of this inventory must be retained by the manufacturer, importer, or processor for 3 years after the effective date of the ban. The purpose of this inventory is to serve as a baseline for EPA's enforcement of the rule's bans on manufacture, importation, processing, and distribution in commerce. Inventory results will be compared by EPA inspectors with the business records maintained under § 763.178(b)(1) to determine compliance with this rule.

2. *Records.* Manufacturers, importers, and processors must maintain a copy of all labels used in compliance with § 763.171 for 3 years after the effective date of the ban on distribution in commerce to which the label applies.

...example, if the label is required for a ...duct banned from distribution in ...normal business and sales records recording the dates and quantities purchased of all products subject to bans. These records must be maintained for transactions from the effective date of the manufacture, importation, or processing ban for a product until the effective date of the ban on distribution in commerce for the product. These records must be maintained for 3 years after the effective date of the ban on distribution in commerce for a product.

For example, if a manufacturer produces an asbestos-containing product that is subject to a manufacture ban that takes effect on September 1, 1993, the manufacturer must by that date, make an inventory of the stock-on-hand of the banned product as of that date. A record of the inventory must be maintained until September 1, 1996. The manufacturer must also keep records of all sales or transfers of the product between September 1, 1993, and the effective date of the ban on distribution in commerce (for purposes of this example, September 1, 1994). These records must be maintained by the manufacturer until at least September 1, 1997.

IV. Summary of Analysis Supporting This Final Rule

EPA's basis for this rule, as described in the proposal, remains largely unchanged. EPA's unreasonable risk findings under section 6 of TSCA are based on extensive data gathering, modeling, analysis, and review of public comments. EPA's findings are summarized briefly in this preamble. This preamble also addresses significant public comments raised during the course of this rulemaking. EPA has addressed other comments in a separate Response to Comments document, which is incorporated by reference in this preamble and is included in the public docket. The following documents are also contained in the public docket and serve as the primary, although not exclusive, basis for the actions taken in this rule.

1. *Regulatory Impact Analysis.* EPA, 1989. This document analyzes the costs and benefits of various options for regulating the risks of exposure to asbestos, and includes an analysis of available substitutes for asbestos-containing products, a regulatory flexibility analysis, and materials on the models and computational procedures

2. Three documents evaluating the magnitude of potential routes of human exposure to asbestos: (a) *Asbestos Exposure Assessment.* EPA, 1988. This document analyzes the occupational exposure to asbestos and asbestos releases from manufacturing plants and commercial operations in the U.S.

(b) *Asbestos Modeling Study.* EPA, 1988. This document analyzes the ambient exposure levels resulting from the release of asbestos to the atmosphere from industrial and commerical sources.

(c) *Non-occupational Asbestos Exposure Report.* EPA, 1988. This document analyzes the level of consumer and ambient exposures to asbestos.

3. Three reports evaluating the extensive data base on human health hazards posed by asbestos: (a) *Airborne Asbestos Health Assessment Update.* EPA, 1986. This document was prepared by EPA's Office of Research and Development and was reviewed, critiqued, and updated in response to peer review comments from the Environmental Health Committee of the EPA Science Advisory Board (SAB). The SAB advises the EPA Administrator on scientific matters.

(b) *Report to the U.S. Consumer Product Safety Commission by the Chronic Hazard Advisory Panel on Asbestos.* CPSC, 1983. This document was written by a panel of seven scientists selected by CPSC from a list of nominees by the National Academy of Sciences after a nationwide solicitation.

(c) *Asbestiform Fibers: Non-occupational Health Risks.* National Academy of Sciences, Committee on Non-occupational Health Risks of Asbestiform Fibers, 1984. This document was written by an expert panel of 13 members.

4. *Health Hazard Assessment of Non-Asbestos Fibers.* EPA, 1988. This document evaluated the potential hazard posed by major non-asbestos fiber substitutes for asbestos. This document was based in part on *Recent Epidemiological Investigations on Populations Exposed to Selected Non-Asbestos Fibers.* EPA, 1988.

Other materials used in the development of this rule are cited in the text of this preamble and listed in Unit XI of this preamble.

V. Regulatory Assessment

EPA finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of the chemical substance, or any combination of these activities, presents or will present an unreasonable risk of injury to human health or the environment.

Section 6(c)(1) of TSCA requires EPA to consider the following factors when determining whether a chemical substance presents an unreasonable risk:

1. The effects of such substance on human health and the magnitude of the exposure of human beings to such substance.

2. The effects of such substance on the environment and the magnitude of the exposure of the environment to such substance or mixture.

3. The benefits of such substance for various uses and the availability of substitutes for such uses.

4. The reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small businesses, technological innovation, the environment, and public health.

[redacted] EPA has considered these factors in conjunction with the extensive record gathered in the development of this rule. EPA has concluded that the continued manufacture, importation, processing, and distribution in commerce of most asbestos-containing products poses an unreasonable risk to human health. This conclusion is based on information summarized in the following paragraphs and discussed in the units that follow.

[redacted] EPA has also concluded that section 6 of TSCA is the ideal statutory authority to regulate the risks posed by asbestos exposure. This rule's pollution prevention actions under TSCA are both the preferable and the least burdensome means of controlling the exposure risks posed throughout the life cycle of asbestos-containing products. Findings supporting this conclusion include the following:

[redacted] epidemiological studies. If EPA had instead used an upper bound estimate, as is normally done by the scientific community and in EPA regulatory risk assessment when only data from animal studies is available to extrapolate human health risk [redacted]

2. People are frequently unknowingly exposed to asbestos and are rarely in a position to protect themselves [redacted]

[redacted] asbestos-containing products would contribute to the environmental loading of asbestos. This poses the potential for an increased risk to the general population of asbestos-related disease and an increased risk to future generations because of asbestos' longevity.

4. Asbestos fibers are released to the air at many stages of the commercial life of the products that are subject to this rule. Activities that migh lead to the release of asbestos include mining of the substance, processing asbestos fibers into products, and transport, installation, use, maintenance, repair, removal, and disposal of asbestos-containing products. EPA has found that the occupational and non-occupational exposure existing over the entire life cycles of each of the banned asbestos [redacted]

[redacted] low workplace PEL. In addition, according to the EPA Asbestos Modeling Study, millions of members of the general U.S. population are exposed to elevated levels of lifetime risk due to asbestos released throughout the life cycle of asbestos-containing products. EPA believes that the exposure quantified for the analyses supporting this rule represent an understatement of actual exposure.

5. Release of asbestos fibers from many products during life cycle activities can be substantial. OSHA stated in setting its PEL of 0.2 f/cc that remaining exposures pose a serious risk because of limitations on available exposure control technologies. Even with OSHA's controls, thousands of workers involved in the manufacture and processing of asbestos-containing products are exposed to a lifetime risk of 1 in 1,000 of developing cancer. Many other exposures addressed by this rule are not affected by engineering controls required by OSHA's PEL or by other government regulation. Because asbestos is a highly potent carcinogen, the uncontrolled high peak episodic exposures that are faced by large populations pose a significant risk.

6. Because of the life cycle or "cradle-to-grave" nature of the risk posed by asbestos, attempts by OSHA, the Consumer Product Safety Commission (CPSC), and other EPA offices to regulate the continued commercial use of asbestos still leave many persons unprotected from the hazards of asbestos exposure. Technological limitations inhibit the effectiveness of existing or possible exposure control actions under non-TSCA authorities. Many routes of asbestos exposure posed by the products subject to this rule are outside the jurisdictions of regulatory authorities other than TSCA. EPA has determined that the residual exposure to asbestos that exists despite the actions taken under other authorities poses a serious health risk throughout the life cycle of many asbestos-containing products. This residual exposure can only be adequately controlled by the exposure prevention actions taken in this rule.

7. Despite the proven risks of asbestos exposure and the current or imminent [redacted]

sumption of asbestos dropped from a 4 total of about 240,000 metric tons to s than 85,000 metric tons in 1987, according to the U.S. Department of Interior, Bureau of Mines data. This change suggests that the use of substitutes has increased markedly ...e the proposal. However, the 1987 ...nsumption total indicates that significant exposure due to the commercial use of asbestos and the resultant risks would continue for the foreseeable future absent the actions taken in this rule.

Evidence supports the conclusion that substitutes already exist or will soon exist for each of the products that are subject to the rule's bans. In scheduling products for the different stages of the bans, EPA has analyzed the probable availability of non-asbestos substitutes. In the rule, the various asbestos products are scheduled to be banned at times when it is likely that suitable non-asbestos substitutes will be available. However, the rule also includes an exemption provision to account for instances in which technology might not have advanced sufficiently by the time of a ban to produce substitutes for certain specialized or limited uses of ...bestos.

8. EPA has calculated that the product bans in this rule will result in the avoidance of 202 quantifiable cancer cases, if benefits are not discounted, and 148 cases, if benefits are discounted at 3 percent. The figures decrease to 164 cases, if benefits are not discounted, and 120 cases, if benefits are discounted at 3 percent, if analogous exposures are not included in the analysis. In all likelihood, the rule will result in the avoidance of a large number of other cancer cases that cannot be quantified, as well as many cases of asbestos-related diseases. Estimates of benefits resulting from the action taken in this rule are limited to mesothelioma and lung and gastrointestinal cancer-cases-avoided, and do not include cases of asbestosis and other diseases avoided and avoided costs from treating asbestos diseases, lost productivity, or other factors. EPA has estimated that the cost of this rule, for the 13-year period of the analyses performed, will be approximately $458.89 million, or $806.51 million if a 1 percent annual decline in the price of substitutes is not assumed. This cost will be spread over ...me and a large population so that the ...st to any person is likely to be ...gligible. In addition, the rule's ... of the rule's staged-ban of the identified asbestos-containing products will outweigh the resultant economic consequences to consumers, producers, and users of the products.

9. EPA has determined that, within the findings required by section 6 of TSCA, only the staged-ban approach employed in this final rule will adequately control the asbestos exposure risk posed by the product categories affected by this rule. Other options either fail to address significant portions of the life cycle risk posed by products subject to the rule or are unreasonably burdensome. EPA has, therefore, concluded that the actions taken in this rule represent the least burdensome means of reducing the risk posed by exposure to asbestos during the life cycles of the products that are subject to the bans.

10. Based on the reasons summarized in this preamble, this rule bans most asbestos-containing products in the U.S. because they pose an unreasonable risk to human health. These banned products account for approximately 94 percent of U.S. asbestos consumption, based on 1985 consumption figures. The actions taken will result in a substantial reduction in the unreasonable risk caused by asbestos exposure in the U.S.

A few minor uses of asbestos and asbestos products are not included in the ban. These uses, which account for less than 6 percent of U.S. asbestos consumption based on 1985 data, do not pose an unreasonable risk, based on current knowledge. For some product categories, EPA was unable to find that the products pose an unreasonable risk because asbestos exposure is minimal over the product's life cycle relative to the exposures posed by other products. In other instances EPA currently has insufficient information about either asbestos exposure attributable to the products or the future availability of suitable substitutes to make a finding of unreasonable risk. Exposure information was considered insufficient in cases where monitoring data was largely unavailable for most major stages of a product's life cycle and too little was known about exposures during these stages to estimate exposure by analogy to those posed by other products. Where no information is available for a product indicating that cost-effective substitutes exist, the estimated cost of a product's ban is very high. In all of these cases, the risk reduction potential that EPA could quantitatively or qualitatively

Human health effects of asbestos and EPA's cancer risk extrapolation are discussed in Units V.A.1 and V.A.2 of this preamble. The extent of human exposure to asbestos and the resulting risks are discussed in Unit V.A.3 of the preamble. Asbestos substitutes are discussed in Units V.C. and V.F. of the preamble. EPA's evaluation of the viability of other regulatory options under TSCA is discussed in Unit V.E. of this preamble. EPA's evaluation of the viability of actions under authorities other than TSCA to control the risk posed by asbestos exposure is discussed in Units VI and VII of this preamble. EPA's estimates of the costs and benefits of this rule are discussed in Unit V.D. of this preamble. EPA's evaluations of the risks posed by the different categories of asbestos-containing products are summarized in Unit V.F. of this preamble.

A. Health Effects and Magnitude of Exposure To Asbestos

1. *Health effects.* The human health effects caused by exposure to asbestos are well-documented. This Unit reiterates the major health effects and the uncertainties that exist regarding this subject. More comprehensive analysis can be found in the *Airborne Asbestos Health Assessment Update* (Ref. 1), the *Report to the U.S. Consumer Product Safety Commission by the Chronic Hazard Advisory Panel on Asbestos* (Ref. 2), and *Asbestiform Fibers: Non-occupational Health Risks* (Ref. 3). Further responses to comments on this subject can be found in the Re...

The conclusions reached by EPA regarding the health effects of asbestos exposure represent a widely accepted consensus of opinions of health agencies, scientific organizations, and independent experts. The major health effects of asbestos are summarized below.

a. *Lung cancer.* Excess lung cancers have been documented among workers involved in asbestos mining and milling and in the manufacturing and use of a variety of asbestos products. The risk of lung cancer is related to the intensity and duration of exposure. The latency period for the disease is generally 20 years or more after exposure. This means that lung cancer usually does not manifest itself until 20 years after the exposure-initiating exposure. Most persons who develop lung cancer die within 2 years of diagnosis.

While both asbestos and cigarette smoking can separately increase risk of lung cancer, together they appear to interact synergistically to multiply lung cancer risk in humans. Commenters have suggested that smoking should be controlled to reduce the very high lung cancer risk due to combined asbestos exposure and smoking. However,

Mesothelioma is a rare cancer of the lining of the lung (pleural mesothelioma) or abdominal (peritoneal mesothelioma).

The latency period for the disease is generally between 25 and 30 years. In almost all instances, the disease is rapidly fatal, with

Most epidemiological studies have been conducted on occupational populations exposed to high airborne concentrations of asbestos for relatively long periods of time. However, short-term occupational exposures have been shown to cause serious health effects. For example, one group of asbestos factory workers with less than 2 months of occupational exposure had a two-fold increase in lung cancer risk (Ref. 4). Also, many documented cases of mesothelioma have been linked to extremely brief exposures to relatively high concentrations of asbestos (Ref. 1).

There is also direct evidence of adverse health effects from non-occupational asbestos exposure.

Mesotheliomas have also been documented in populations whose only identified exposure was living near asbestos mines or asbestos product factories, or shipyards with heavy asbestos use (Ref. 1).

epidemiological findings regarding the health effects of asbestos exposure. All commercial forms of asbestos have been shown to produce lung tumors and mesothelioma in laboratory animals with no substantial differences between the form of asbestos forms in carcinogenic potency.

b. *Gastrointestinal cancer.* A number of epidemiological studies have documented significant increases in the incidence of gastrointestinal cancer due to occupational exposure to asbestos. Gastrointestinal cancers consist largely of cancers of the esophagus, stomach, colon, and rectum. However, the magnitude of gastrointestinal cancer risk is lower than that of lung cancer or mesothelioma and no dose-response data are available.

A number of commenters argued that the evidence indicating a positive association between gastrointestinal cancer and asbestos exposure is weak and inconclusive. They indicated that unidentified facts may cause the excess gastrointestinal cancers. Commenters suggested that many of the excess cancers attributed to gastrointestinal sites may be due to misdiagnosis of peritoneal mesotheliomas. Other commenters contended that in the absence of any positive experimental

EPA recognizes that the evidence supporting an association between gastrointestinal cancer and asbestos exposure is not as strong as that which is available to support an association between asbestos exposure and lung cancer and mesothelioma. However, after weighing available information,

The evidence includes the following: (1) A statistically significant increase in gastrointestinal cancer was found in 10 of 23 epidemiological studies. (2) A consistent relationship exists between increased gastrointestinal cancer risk and increased lung cancer risk (approximately 10 to 30 percent of the lung cancer excess). (3) It is biologically plausible that asbestos could be associated with these tumor sites, because it is conceivable that the majority of fibers inhaled are cleared from the respiratory tract and subsequently swallowed, allowing the fibers to enter the gastrointestinal tract (Ref. 5). Additionally fibers may be swallowed directly. (4)

gastrointestinal cancers identified in the epidemiology studies described above are the result of misdiagnosis. Cancers of some gastrointestinal cancer sites (e.g., stomach and pancreas) could be the result of misdiagnosis of peritoneal mesotheliomas. However, this does not account for all of the excess cancers seen at sites such as the colon or rectum. OSHA, in its final rule lowering the asbestos PEL concluded that the studies conducted to date "constitute substantial evidence of an association between asbestos exposure and a risk of incurring gastrointestinal cancer." EPA agrees with this conclusion.

risk of cancers other than mesothelioma and lung and gastrointestinal cancers have been observed in populations occupationally exposed to asbestos. An excess of laryngeal cancer in asbestos workers has been reported in a number of studies (Ref. 2). Available data, however, indicate that there may be an interaction between smoking and asbestos exposure in the etiology of

...ian cancer has been found among ...ale workers in three studies (Refs. 9, ...0, and 11). Therefore, evidence suggest an association between asbestos exposure and cancers other than lung cancer, mesothelioma, and gastrointestinal cancer. However, because of study limitations, inconsistencies among studies, and the possibility of misdiagnosis of disease, the relationship between asbestos exposure and cancer at these extrathoracic sites is not clear. Bec...se of this uncertainty, EPA did not calculate the risk of cancers at othe... sites for purposes of the quantitati... risk assessment for this rule.

d. *Asbestosis.* Asbestosis is a disabling fibrotic lung disease that ...as been associated with high levels o... occupational exposure to asbestos... Clinical signs and symptoms asso...ated with asbestosis include shortness ... breath, pulmonary functional chan...es, basal rales, and small, mainly irre...lar, opacities on chest radiographs. Asbestosis can both appear and progress many years after the termination of exposure. All types ... asbestos have been associated wi... the development of asbestosis.

...demiological data indicate that ...e ...idence rate increases and the di...ease becomes more severe with increas... dust level and duration of exposu... This has also been confirmed in a... studies via inhalation exposure. I... ...ot clear whether an exposure thresho... exists for asbestosis. However, the... is no available evidence that disablin... asbestosis is caused by non-occupational asbestos exposure or ... relatively low levels of occupationa... exposure. Therefore, the risk of disabling asbestosis from low level... of exposure to asbestos was not calcu...ted for purposes of the quantitative risk assessment performed for this final ...le.

e. *Effect of fiber type.* A number o... commenters argued that chrysotile, ...e major commercial form of asbestos, ... far less carcinogenic than the amphi...ble asbestos types (e.g., amosite and crocidolite) and thus, different carcinogenic potency values for chrysotile and amphiboles should be used for quantitative risk assessmen...

For lung cancer, EPA finds the evidence supporting this argument t...be inconclusive and inconsistent. Some of the lowest unit risk factors observed ...or ...g cancer are among cohorts exp...ed predominantly chrysotile asbesto... (Refs. 12 and 13). However, some of ... risk of lung cancer. The cause of the observed variability in lung cancer unit risk for chrysotile in different studies is unknown, but some of the variabilities can be attributed to differences in the fiber characteristics associated with different processes, uncertainties due to small numbers in epidemiological studies, and incorrect estim...

For mesothelioma, EPA recognizes that peritoneal mesotheliomas have largely been associated with crocidolite exposure and that there is some epidemiological evidence suggesting that crocidolite is more potent than chrysotile in inducing pleural mesothelioma. Howeve...

...inconsistencies and uncertainty ... regarding this issue, ...

...that some evidence exists indicating that amphiboles may be more potent in inducing mesothelioma than chrysotile. However, the need for further study to resolve this issue, and the resulting delay in EPA's risk assessment for asbestos, cannot be justified given the volume of data showing the carcinogenic potency of all fiber types. Similar conclusions were reached previously by other scientific bodies and agencies (Refs. 2, 3, and 16).

According to these commenters, short fibers do not contribute to any significant risk to humans and therefo... EPA should base its cancer risk estimates on only fibers longer than 5 microns in length.

Injection or implantation studies in animals indicate that longer, finer fibe... of the same asbestos fiber type appear ...o have greater carcinogenic potential ...an shorter, thicker fibers (Refs. 1, 2, ... 3). Results of several recent in...alation studies also indicate that lo... fi...ers (>5 microns) are more c...cinogenic than short fibers (<5 ...crons) (Refs. 17 and 18). However, ...udies performed to date have not ...tablished fiber dimensional thresho...s ...r potency.

Although animal studies have ...ovided an indication of the qualitati...e ...lationship between fiber dimension ...d carcinogenic potency, they are no... ...ed for quantifying dose-response ...lationships for humans because EPA ...lieves that extrapolation of data fro... ...man exposures in the workplace to ...man exposure in non-occupational ...ttings is more appropriate. EPA based ...ost of its estimates of non-occupational exposure in terms of the ...tal mass of asbestos released to air. ...o estimate health risks from the non-occupational exposure, the mass ...easurements need to be converted t... ...e equivalent optical fiber ...ncentration (fibers longer than 5 ...icrons and greater than 0.25 μm in ...ameter) that are used as dose ...easurements in workplaces for whic... ...ose-response relationship has been ...veloped. Some data exist that relat... ...ptical fiber counts to the total mass ... ...sbestos. The range of conversion factors between optical fiber count m...ss concentration is large (5 to 150 μg/m³ f/ml) because these values vary with different environments and sampling techniques, and any average value derived from this range has a large uncertainty. Despite the uncertainties they are the best data available for s...h ...assessments and therefore EPA belie...s that for the purpose of extrapolating ... ...ow mass concentration from fiber ...ount, the approximate geometric me...n, ...0 μg/m³/f/ml is appropriate (Ref. 1). Additionally, uncertainty may be ...troduced in the assumption made ... ...his assessment that the fiber size ...istribution is the same in both ...ccupational and non-occupational a... ...nvironments. The assumption is ...nsidered prudent in view of the fa...

...pted by the National Academy of ...ences (Ref. 3) and the Chronic ...azard Advisory Panel (CHAP) on Asbestos (Ref. 2) in estimating human health risk associated with low-level non-occupational exposure to asbestos.

g. *Potency values.* Commenters stated ...cer risks vary from one industry ...ent to another and maintained that EPA should use different potency values for different industries in its quantitative cancer risk assessment for asbestos. Most of the commenters singled out two segments of the asbestos industry, manufacturers of chrysotile friction products and A/C products made from chrysotile, in which the lung cancer risks were considerably lower than those in chrysotile textile production.

EPA has concluded that the data supporting this suggestion are not convincing because of significant methodological or statistical uncertainties in these studies. Further, when the 95 percent confidence limits on the potency factors for lung cancer are considered along with the uncertainties associated with estimates of exposures, there is considerable overlap of the unit risk estimates across ...stry segments and fiber types (Ref. ...ccordingly, EPA believes that its ... of a geometric mean unit risk derived from 11 studies that cover all industrial processes (with the exception of mining and milling) and that provide a dose-response relationship is reasonable. This approach recognizes that lower cancer risks may exist in some industry segments because of uncertainties in the measurement of exposure or statistical variabilities, but the potency factor for asbestos is considered to be equivalent across industry segments. In fact, a follow-up study (Ref. 24) reported a lung cancer unit risk of 0.0076 for A/C production workers who were exposed predominantly to chrysotile. This value is closer to the best estimate for the fractional increase in lung cancer, K_L, for asbestos exposure, 0.010. This study provides further support for the use of a single potency factor for all asbestos exposure scenarios.

2. *Quantitative Risk Assessment.* Risk assessment usually requires extrapolation between different routes of exposure, from animals to humans, and from test groups to the population at large. Despite uncertainties, risk ...essment provides an estimate of the ...nitude of risk for making decisions ...out controlling exposure to a ... the risk posed by asbestos exposure is far more certain than that posed by exposure to other hazardous substances for which only animal data and/or fewer, less conclusive human data are available.

Data from a study of U.S. insulation workers allow models to be developed for the time and age dependence of lung cancer and mesothelioma risk (Ref. 4). Thirteen other epidemiological studies demonstrate a linear dose-response relationship between cumulative occupational asbestos exposure and lung cancer. Although much less data are available regarding a dose-response relationship for mesothelioma, existing data suggest a linear response with dose and duration of exposure. To obtain dose-response estimates for current occupational and non-occupational exposures to asbestos, it is necessary to extrapolate the effects observed in occupational settings with historically high exposure to anticipated effects at low levels of exposure. This is based on a no-threshold linear extrapolation. The assumption of no-threshold low dose linearity for asbestos carcinogenicity is reasonable and well-supported because (1) cumulative dose-response relationship have been shown in several epidemiological studies over a wide range of exposure; (2) threshold dose has not been demonstrated; and (3) the concept is consistent with accepted theories of carcinogenesis.

Both the lung cancer and mesothelioma models used for this final rule have been adopted by OSHA (Ref. 16). The National Academy of Sciences (Ref. 3) also adopted a similar no-threshold model to estimate lung cancer risk to non-occupational populations from exposure to asbestos. No-threshold linear models have widespread support (Refs. 2, 3, 16, 22, and 23). The derivation and validation of the models as well as the assumptions and uncertainties involved in the model, are discussed in detail in Refs. 1, 2, and 21.

$d_{(t-10)}$ = duration of exposure from onset until 10 years (minimum latency period) before present (years).

f = intensity of exposure to fiber equivalents longer than 5 microns (f/cc).

K_t = dose response constant = 0.010. (Refs. 1 and 21)

Because mesothelioma is a very rare form of cancer in the general population, an absolute risk model is used to estimate excess mesothelioma incidence due to asbestos exposure. According to this model, the added risk of

This model incorporates a delay of 10 years for the manifestation of disease (i.e., a minimum latency period of 10 years). Four epidemiological studies provided quantitative data suitable for calculation of potency factors for mesothelioma (K_M). EPA (Ref. 1) selected an average value for K_M of 1.0 10^{-8} as the best estimate for environmental exposures. Although it was not possible to determine directly the 95 percent confidence limits on K_M, a multiplicative factor of 5 was estimated for the average value of K_M, and a multiplicative factor of 20 was estimated for its application to any unstudied exposure circumstance.

The absolute risk model for mesothelioma can be expressed as:

$I_M(t, d, f) = K_M \cdot f[(t-10)^3 - (t-10-d)^3]$ for $t > 10 + d$

$= K_M \cdot f(t-10)^3$ for $10 + d > t > 10$

$= 0$ for $t < 10$

Lung cancer is best described by a relative risk model. According to this model, excess risk of lung cancer from asbestos exposure is proportional to the cumulative exposure (i.e., the duration of exposure times the intensity of exposure, in terms of fiber-year/cc) and the background risk in the absence of exposure. EPA used this model and data from 11 studies of workers exposed to asbestos in textile production, asbestos product manufacturing, and insulation application to calculate potency factors for lung cancer (K_L, the fractional increase in risk per fiber-year/cc of exposure) (Ref. 1). The geometric mean value of K_L for these studies, 0.010, was used as the best estimate for environmental asbestos exposure. The 95 percent confidence limits for this value are 0.0040 and 0.027 (multiplicative factor of 2.5) based on an analysis of variances in the 11 studies from which the K_L was calculated. The 95 percent confidence limits for K_L that might be applied in any unstudied exposure circumstances are estimated to be a multiplicative factor of approximately 10.

The relative risk model for lung cancer can be expressed as:

$I_L = I_E[1 + K_L \cdot f \cdot d_{(t-10)}]$

where:

I_L = age – specific lung cancer death rate with exposure to asbestos.

I_E = age – specific lung cancer death rate without exposure to asbestos.

t = time from onset of exposure until prese... (years).

carcinogenic potency expressed as the incidence of mesothelioma per unit of exposure in fiber-years ^{3}/cc.

f = intensity of exposure to fiber equivalents longer than 5 microns (f/cc).

t = time after exposure in years.

d = duration of exposure in years. (Refs. 1 and 21)

In extrapolating rates of excess asbestos-related deaths from gastrointestinal cancer, EPA adopted the approach used by OSHA (Ref. 16) in assuming that excess gastrointestinal cancers will be equal to 10 percent of those for lung cancer in each time period. However, this approach may actually understate the rate of gastrointestinal cancers. OSHA noted that this approach could result in an underestimate, and EPA's analysis indicates that the excess gastrointestinal cancer rate could be as high as 30 percent of the lung cancer rate (Ref. 1).

There are inconsistencies in findings among different epidemiological studies with regard to excess mortality for cancers at sites other than the lung, mesothelial linings, and gastrointestinal tract (e.g., laryngeal, kidney, and ovary cancers). Also, there are uncertainties about the development of disabling [illegible]estosis at low exposure. Therefore, [illegible] has not made numerical estimates [illegible]he risks for these asbestos-related diseases for purposes of this analysis. Since estimates of these diseases are not included in the overall risk estimates, EPA believes that the total health risk posed by exposure to asbestos is underestimated.

A number of commenters contended that it is inappropriate to adhere to a linear, no-threshold dose-response model for estimating lung cancer and mesothelioma risk from asbestos exposure. They cited a number of epidemiological studies which they stated show that there is a threshold below which asbestos-related disease does not occur (Refs. 12, 13, 25, and 26). EPA has reviewed these studies and found that they are all insufficient to detect a threshold at low doses (Ref. 1).

Other commenters expressed concern about the low-dose linearity assumption because the shape of the dose-response curve at extremely low doses is subject to conjecture and that the use of no threshold linear model greatly overestimates true risk. Others believe that asbestos is a non-genetic carcinogen. As discussed above, EPA [illegible]s concluded that the low-dose [illegible]earity assumption is reasonable [illegible]ecause direct evidence for linearity of response is linear at very low doses is not known (Ref. 1). In the discussion of the choice of mathematical procedures in carcinogen risk assessment, the White House Office of Science and Technology Policy (OSTP) stated: "When data and information are limited, however, and when such uncertainty exists regarding the mechanism of carcinogenic action, models or procedures which incorporate low-dose linearity are preferred when compatible with the limited information" (Ref. 27). EPA generally concurs with this position as reflected in EPA's Guidelines for Carcinogen Risk Assessment (51 FR 33992). Thus, given the lack of complete understanding of the mechanisms by which asbestos induces cancer, and the goal of protecting human health, EPA believes that the choice of low-dose linearity is most prudent.

3. *Magnitude of human exposure.* Exposure to asbestos is discussed in more detail in the Asbestos Exposure Assessment (Ref. 29), the Asbestos Modeling Study (Ref. 30), and the Non-occupational Asbestos Exposure Report (Ref. 31). Further responses to comments on this subject can be found in the Response to Comments document.

Most of the population of the United States is exposed to some level of airborne asbestos from asbestos-containing products. Asbestos products have been in wide use in the U.S. for decades. Although U.S. asbestos consumption has declined in recent years, thousands of tons of asbestos are still used annually in the manufacture in the U.S. of the products that are subject to this rule (Ref. 21). Fibers can be released to the air and exposure can occur at all stages of the life cycle of asbestos products, including mining, processing, and the transport, installation, use, repair, removal, and disposal of asbestos-containing products.

Once released, asbestos fibers exhibit a number of characteristics that tend to increase human exposure to them. They are odorless and fibers of respirable size are largely invisible, presenting risk to persons who are not aware that they are being exposed. They are also extremely durable and possess aerodynamic properties that allow them to remain suspended in the air for a long time and to reenter the air readily after settling out. Asbestos, therefore, can persist for a very long time in the environment and can travel extended

EPA has quantified many of the life cycle exposures anticipated from the continued manufacture, importation, processing, and use of the asbestos products that are subject to this rule. EPA estimates that over 135,000 full-time equivalent (FTE) workers are exposed during the life cycles of these products to levels of asbestos carrying lifetime risks of between 7 in 10,000 and 7 in 1,000 (Ref. 29). At least 40 million consumers face a potential hazard as they install, use, repair, and dispose of these products (Ref. 31). In addition, the general population is exposed to asbestos that is released into the ambient air during all of these activities. Both consumers and members of the general population frequently incur individual lifetime risks of 1 in 1,000,000 or greater of developing cancer from these exposures (Ref. 31).

There are other exposures associated with the continued production of asbestos products that cannot be readily quantified, but which could pose a significant risk to large populations. As discussed in more detail below, many releases of asbestos from asbestos products take place intermittently and over long periods, making them difficult to measure. Because of the difficulty of obtaining accurate monitoring data for these releases, they have not been quantified for purposes of this rule's analyses, but qualitative evidence indicates that cumulatively, they are probably significant. Similarly, because it is difficult to quantify the tendency of asbestos to be resuspended in air, EPA has not quantified in its analyses the risk posed by asbestos that is repeatedly reentrained after settling out. However, some reentrainment certainly occurs, and asbestos may pose some threat years after its initial release from asbestos products. These exposures, although unquantified, have the potential to affect large numbers of people for long periods of time. Thus, in addition to the exposures quantified for this rule, they are a source of considerable concern.

a. *Occupational exposures.* Since EPA's proposed rule was issued, OSHA has promulgated new occupational exposure standards for asbestos, lowering the 8-hour Time Weighted Average (TWA) PEL from 2.0 to 0.2 f/cc (51 FR 22612). OSHA has also set an Excursion Limit (EL) of 1 f/cc as a half-hour TWA in a September 1988 amendment to the standards (53 FR 35610). The probable impact of the 0.2

...v PEL still pose significant risks, as ... exposure at the EL. OSHA notes that the new PEL and EL do not represent "safe" levels of asbestos exposure, but are the lowest levels that industry can feasibly achieve during current control technologies. EPA estimates that under the new PEL, approximately 135,000 FTE workers engaged in the manufacture, processing, installation, repair, and disposal of the products to be banned are exposed to levels of airborne asbestos between 0.02 f/cc and 0.2 f/cc (Ref. 29). Assuming that workers are exposed to these levels over a 45-year working lifetime, they incur individual risks of between 7 in 10,000 and 7 in 1,000 of developing cancer (51 FR 22644).

A number of commenters criticized the occupational exposure data base used to support the proposal as being outdated and incomplete. Much of that data came from the 1982 TSCA section 8(a) reporting rule (40 CFR 763.60). In response to these comments and because of the passage of time since the proposal, EPA has updated and expanded its analysis of occupational exposures, making use of available literature and data bases and ...ducting surveys of asbestos use and ...osure levels. Materials used by EPA ...n the updated analysis include OSHA and Mine Safety and Health Administration (MSHA) compliance inspection reports, National Institute for Occupational Safety and Health (NIOSH) studies, academic and industry studies, and public comments. In 1986 and 1987, EPA conducted the Asbestos Exposure Survey and gathered exposure and release information on the manufacture of most of the major asbestos product categories from primary and secondary manufacturers of asbestos products. EPA gathered data on populations engaged in manufacturing in the 1986–87 Asbestos Market Survey.

EPA was able to obtain extensive information on occupational exposures during primary and secondary manufacturing for many product categories. Air monitoring data for primary and secondary manufacturing were available for many products from the 1986–87 EPA Exposure Survey, OSHA inspections, and numerous studies. EPA has estimated that approximately 9,300 workers in the U.S. are exposed to asbestos during the primary and secondary manufacturing ...he products that are affected by this ... (Ref. 29). These exposures are listed two product groups for which exposures are likely to be highest during these life cycle stages. For the installation and removal of construction products (roofing felt and A/C pipe, sheet, and shingle), air monitoring data were available from several studies. Occupational populations (in terms of FTEs) were estimated on the basis of crew size, productivity, and total manufacture and import volumes of the products. Exposures associated with the replacement and repair of friction materials were estimated in a similar fashion. EPA estimates that 125,400 FTEs are exposed to asbestos during the installation, repair, and disposal of asbestos friction and construction products. More than 125,400 workers are actually exposed to asbestos during these processes (OSHA estimates that 550,320 persons are exposed), but many are exposed on a less than a full-time basis (Ref. 29). FTE exposures are listed in Table I of this Unit.

Very little monitoring data on occupational exposures during installation, repair, and disposal were available for the other asbestos products that are subject to this rule, and EPA's estimates therefore do not include exposures from the installation, repair, and disposal of these products. However, on the basis of the limited data that exist for these products and on the basis of data for similar products and processes, EPA believes that significant exposures during installation, repair, and disposal of these products do take place (Ref. 57). Therefore, EPA believes that its analysis underestimates exposures associated with these products. EPA conducted an analysis in order to gauge the possible impact of the absence of some occupational exposure data on calculations of the rule's benefits; the results of this analysis appear in Table II of this Unit and Table VIII of Unit V.D.

In general, when data relating to a certain type of exposure could not be obtained, EPA did not quantify that type of exposure, reflecting what EPA considers to be a reasonable approach to risk assessment. EPA finds the exposures quantified for this rule sufficient in themselves to support EPA's risk assessment conclusions for asbestos. However, EPA notes that if all exposures to asbestos from the products affected by this rule could have been quantified, the benefits calculated for

Much of EPA's occupational exposure data base for this rule represents exposure that took place before OSHA's lowered PEL of 0.2 f/cc became effective in 1986. To estimate exposures taking place after the lowering of the PEL, EPA first lowered to 0.2 f/cc all data points which reported exposures above 0.2 f/cc. EPA then averaged these points with those points that were reported as lower than 0.2 f/cc for each job category in each product category. For purposes of this analysis, EPA considered it appropriate to assume that previously high exposures will probably not be lowered significantly below the PEL. OSHA determined that 0.2 f/cc, which is 10 times lower than the previous PEL, was the lowest PEL that most of the asbestos industry could feasibly achieve using work practices and engineering controls. The asbestos industry challenged OSHA's standards, arguing that a PEL of 0.5 f/cc was the lowest feasible standard, and OSHA acknowledged that some industry sectors might not be able to control exposures to 0.2 f/cc without the use of respirators. Thus, while EPA believes that it is possible that some companies are below the 0.2 f/cc PEL by some margin, it is probable that others are not and that some of these actually exceed the PEL. EPA believes that adjusting previously high exposure points to 0.2 f/cc is a reasonable means of adjusting for facilities that may be above the PEL.

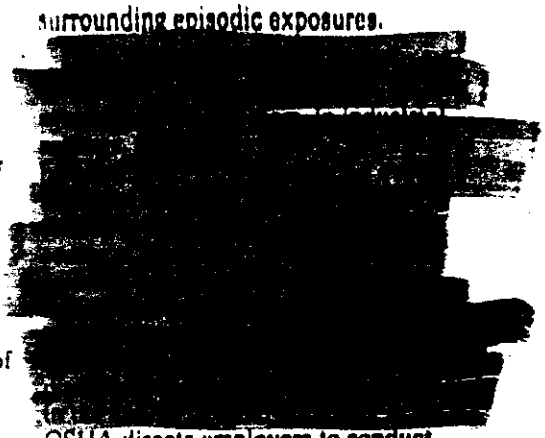
In estimating the benefits of its 0.2 f/cc PEL, OSHA used somewhat different assumptions than EPA has in this rule to estimate the impact of the PEL on workplace exposure levels. OSHA's analysis adjusted all exposures in its data base that were at or above 0.2 f/cc to 0.15 f/cc in cases where OSHA assumed that engineering controls were used. In cases where OSHA assumed that respirators were used, OSHA reduced the exposures by a factor equal to the effective protection factor of the respirator. OSHA assumed that exposures below 0.2 f/cc would be reduced by 20 percent due to engineering controls. OSHA's approach assumes not only general compliance with its fiber level standards, but also that, on average, those subject to the PEL will reduce their workplace exposures significantly below the standards to ensure compliance. OSHA did not factor non-compliance into its

...e other hand, EPA's assessment ...osts and benefits of this rule is ...ed by non-compliance with the ...HA PEL. EPA's approach assumes ...eral compliance with the PEL, but ...o accommodates the possibility that ...me level of non-compliance with the ...ndard exists. As is discussed further ...low, OSHA issued many citations for ... of the asbestos standards in ... first year after they went into effect. ...ing OSHA's fiber level adjustment ...ions in place of EPA's to ...imate the effects of this rule results in ... approximately 20 percent lower ...timate of cancer-cases-avoided for ...cupational settings. However, if a ...n-compliance rate of 2 percent (a ...tively low rate based on non-...mpliance rates in other Federal health ...d environmental regulatory settings) ... assumed in conjunction with the ...SHA fiber level adjustments, the ...sulting estimated benefits are virtually ...e same as those estimated using EPA's ...ssumption about fiber level average ...xposure (Ref. 21). Therefore, EPA ...elieves that its assumptions are ...ppropriate for purposes of calculating ...e benefits of this rule. In practice, ...ve some level of non-compliance with ... 's asbestos regulations, actual ...r cases that would have occurred ...s a result of that non-compliance will ...ow be prevented by this rule's product ...ans.

One commenter maintained that EPA should base its analyses solely on the data collected before OSHA promulgated its asbestos standard and should not adjust the data to reflect compliance with the standard. However, EPA considers it reasonable to assume that previously high exposure levels have been reduced to some lower level as a result of OSHA's action, and as discussed above, EPA has selected the PEL as a logical approximation of this level. Other commenters contended that EPA's approximation of occupational exposures taking place after the lowering of the PEL was too high, arguing that because exposure levels vary considerably from day to day, industry keeps average exposures significantly below the PEL to guarantee constant compliance. These commenters made similar arguments during OSHA's rulemaking setting the new PEL. However, in that instance, the commenters used the variability ...ment to support a claim that the PEL ... infeasible because average ...osures could not be kept low enough might be above the PEL some of the time, a finding of technological feasibility does not require that employers be able to comply with a standard constantly (51 FR 22653).

Moreover, data from recent OSHA inspections do not support the assertion that current exposures are significantly below the PEL. OSHA cited employers for nearly 1,000 violations of its asbestos standards in the first year after the standards went into effect, and the violation most frequently cited was the failure of employers to institute engineering controls to maintain employee exposure at or below the PEL (Ref. 32). Personal monitoring data from recent inspections showed that 91 out of 655 establishments inspected had concentrations of airborne asbestos above the PEL, and the average concentration level for all establishments inspected was 0.29 f/cc, 45 percent higher than the PEL (Ref. 33). While respirators were in use in many of the establishments with air concentrations higher than the PEL, 20 percent of these establishments were cited for violations of respiratory protection provisions or for violations of the PEL (Ref. 49).

On a related issue, some commenters stated that EPA had ignored the effect of using best available control technology (BACT) to reduce exposures, arguing that industry-wide exposure values are "not relevant to determination of the consequences of an effective PEL and consistent use of good work practice." As is discussed more fully in Unit V.E. and in the Response to Comments document, EPA has analyzed the likely effectiveness of mandating the use of BACT and has concluded that this regulatory option would not sufficiently reduce exposures to asbestos from the products affected by this rule. For calculating the cancer-cases-avoided through regulation, EPA considers existing rather than best-case exposures to be the appropriate baseline. The evidence discussed in the preceding paragraphs indicates that many workplaces do not utilize BACT and that the adjustments EPA has made to its exposure data account for the impact of the 0.2 f/cc PEL. Where BACT is utilized, EPA's analysis has taken it into account. For instance, in its analysis of exposures during brake repair, EPA estimated that 9.6 percent of brake repair shops used BACT, and EPA calculated an average of industry-wide exposures including the relatively low allowable short-term exposures to 1 f/cc over a half-hour period. OSHA took this action after noting that controlling episodic exposures to asbestos would lower the significant risk posed by asbestos in the workplace. However, while the EL will probably reduce workplace exposures, EPA does not believe that this reduction will be very great. EPA bases its judgment on a number of observations regarding the nature of and circumstances surrounding episodic exposures.



OSHA directs employers to conduct initial monitoring of employees' exposures where they "may reasonably be expected" to exceed the excursion limit. However, if peak exposures cannot reasonably be expected, they are unlikely to be either monitored for or protected against.

Second, the initial monitoring required to measure short-term, peak exposures where they are expected to occur is subject to error. To obtain accurate estimates of short-term exposures, monitoring must be conducted using the strictest sampling strategies and analytical techniques. If the proper protocol is not observed precisely, violations of the EL can go undetected (53 FR 35618 and 35619).

Third, where violations of the EL are detected and control measures are implemented, these control measures will frequently be ineffective. OSHA expects that for many of the employees exposed to predictable bursts of airborne asbestos, including workers in industry and in building maintenance and repair, respirator use will prove the only feasible means of controlling exposure (53 FR 35618 and 35624). Unfortunately, respiratory protection has not been found to be very reliable. OSHA ranked respirator use last in its recommended hierarchy of controls in its 1986 revision to the asbestos standards, observing:

by the employee, carefully maintained, and replaced when they have ceased to provide adequate protection. While theoretically it is possible for all of these conditions to be met, more often the case that they are not (53502).

The drawbacks cited above are aggravated if those using the respirators are not accustomed to working with them or with asbestos. OSHA states in its amendment establishing the EL that it "is concerned about relying on respirator use to meet the EL in the maintenance and repair sector of the construction industry," where contact with asbestos is often only occasional (53 FR 35624). Finally, even if all the conditions mentioned above are met, respirators will do nothing to reduce the quantity of asbestos released into the immediate environment of respirator wearers. Thus, during the activity that generates the airborne asbestos, persons near the respirator wearer can be exposed to levels that are quite high even if they do not violate the EL; and after the activity, all persons in the area, including those who have removed their respirators, can be exposed to dust that remains airborne or that is reentrained after settling out.

Like respirators, other control measures may reduce some short-term exposures without having much impact on long-term exposures. Some control measures replace one opportunity for exposure with another. For instance, to reduce short-term exposures during brake repair, OSHA recommends that mechanics utilize either a solvent spray or a vacuum enclosure equipped with a High Efficiency Particulate and Aerosol (HEPA) filter. While both of these controls can be effective in reducing short-term exposures during the brake job, exposures can be high later if the asbestos-contaminated solvent is allowed to remain in the area to evaporate, or if care is not taken during the removal of the HEPA filter from the vacuum device (Ref. 29). Because establishments using HEPA enclosures are exempt [illegible] under the OSHA stud[illegible] exposures during fil[illegible] be detected. Agai[illegible] respirators, the effect[illegible] brake repair control measur[illegible] reducing overall exposures depends heavily on the knowledge and conscientiousness of the user. This is also true for shrouded tools, the control measure recommended by OSHA for reducing short-term exposures during [illegible] of A/C pipe (53 FR 35622).

Fourth, the implementation of additional control measures will be difficult, expensive, and time-consuming for much of the regulated community, discouraging compliance with the EL. For instance, although some brake repair establishments servicing large government fleets utilize HEPA vacuum enclosures, smaller establishments repairing brakes less frequently are less likely to invest in these relatively expensive devices. Moreover, while employees in government brake repair shops are usually paid by the hour, employees in private establishments are often paid by the job, which discourages the use of time-consuming work practices and engineering controls (Ref. 50). A similar situation exists in the maintenance and repair sector of the construction industry where, as noted earlier, many smaller building firms may find it difficult to institute adequate respirator programs. In these industry sectors and others, limitations on resources and time may discourage the diligent use of control measures that is required to achieve substantial reductions in occupational exposures to asbestos. The record of compliance with OSHA's 0.2 f/cc PEL supports this projection. The provisions most frequently violated in the year after OSHA's 1986 PEL went into effect included the requirements to conduct initial and daily monitoring, to institute engineering controls, and to institute a respirator program, all of which are as important to achieving the EL as the PEL. In fact, achievement of the EL requires stricter application of these requirements than does achievement of the PEL, making uniform compliance more difficult. Moreover, the structure of the brake repair and building maintenance and repair industries, in which numerous, small businesses are the norm, will also make enforcement of the EL difficult.

In summary, attempts to reduce short-term exposures are likely to have only a limited effect in eliminating the exposure risks posed by asbestos. Peak exposures are both unpredictable and difficult to detect. Efforts to control them must rely largely on respirators and work practice controls, control measures whose effectiveness is uneven, depending upon the conscientiousness of the user. Implementation of these control measures also requires resources that employers and employees may have difficulty investing, and the record of compliance with the 0.2 f/cc PEL indicates that in many cases, the investment will not be made. For these reasons, occupational exposures will probably not be greatly lowered as a result of the EL. Although the estimates given below may slightly overestimate occupational exposures in those cases where the impact of the EL is greatest, EPA believes that any overestimate is likely to be minor overall.

The following table summarizes EPA's estimates of occupational exposures to asbestos by [illegible] process. This [illegible] in this Unit[illegible] terms of millions [illegible] year (10^6 f/yr), an [illegible] accounts for vary[illegible] concentration levels [illegible] and duration of [illegible] workers, [illegible] population [illegible] workday. [illegible] conditions [illegible] industries [illegible] of [illegible] 0.025 f/cc. [illegible] fibers/[illegible] ($1.29 in 1,000 [illegible] FR 35610). In many cases, [illegible] in these [illegible] significant [illegible] not available, [illegible] that no [illegible] takes place. [illegible] fibers [illegible] relatively low pop[illegible] repair and disposal of A/C [illegible] sheet, and roofing felt are [illegible] FTE appro[illegible] benefits (dollar-[illegible] reality, per person fiber levels are lower and populations [illegible] noted, all exposure [illegible] presented [illegible] data [illegible] which a complete [illegible] available in the [illegible] Surveys. In calculating [illegible] avoided through [illegible] has assumed that [illegible] would [illegible] at the [illegible] protection [illegible]

TABLE I—OCCUPATIONAL EXPOSURES

Product	Primary manufact.		Secondary manufact.		[illegible]		[illegible]	
	Pop.	10^6 f/yr	Pop.	10^6 f/yr	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]mercial paper [illegible]								
[illegible]board [illegible]								

TABLE I—OCCUPATIONAL EXPOSURES—Continued

Product	Primary manufact		Secondary manufact		Install		Repair/disp	
	Pop	10⁻⁹ f/yr	Pop	10⁻⁹ f/yr	Pop.	10⁻⁹ f/yr	Pop.	10⁻⁹ f/yr
Millboard								
Pipeline wrap	[illegible]	145	440	[illegible]				
Beater-add gaskets [2]	[illegible]	134						
Roofing felt	[illegible]	[illegible]	1,296	[illegible]				
Flooring felt [1]					346	439	243	296
Corrugated paper								
[illegible]ty paper								
[illegible]r tile [1]	[illegible]	[illegible]	119	[illegible]				
[illegible]e								
A/C flat sheet	[illegible]				933	296		
A/C corrugated sheet	[illegible]	[illegible]			49	723	61	2,080
A/C shingles					7	723	9	2,080
Drum brake linings	[illegible]	473			325	130	225	244
Disc brake pads, LMV	1,565	385	2,710	125			86,398	376
Disc brake pads, HV	915	230	300	146			32,568	368
Brake blocks	15	395					117	380
Clutch facings [2]	293	377	19	127			3,935	368
Automatic transmission components	239	406	48	166			72	125
Friction materials	11	113						
Asbestos clothing [1]	191	368	28	195			43	120
Sheet gaskets [1]								
Roof coatings	187	208	885	276				
Non-roof coatings	582	273						
	553	220						

[1] No U.S. manufacture or import.
[2] Exposures listed include a relatively small number of exposures posed during the production of specialty industrial gaskets, which [illegible] banned by this rule.
[3] Repair and disposal figures include repair only.

EPA was not able to quantify all occupational exposures to asbestos. As noted earlier, there are few data on exposures during the installation, use, repair, removal, and disposal of a number of products, although exposure is believed to take place during these processes for many of these products. Moreover, existing exposure data do not reflect the elevated levels of airborne asbestos that can result from unpredictable episodic events, such as the accidental disturbance of asbestos material by a maintenance worker.

As a means of representing part of this recognized but unmeasured exposure, EPA estimated occupational exposures associated with the installation, repair, and disposal of certain products on the basis of the limited data that exist for these products and processes and on the basis of exposure data for similar products and processes. Populations (in terms of FTEs) were estimated [illegible] production volumes [illegible] hours typically [illegible] of concern. [illegible] presented in [illegible] used as indicators [illegible] assess the possible impact of the absence [illegible] occupational [illegible] data on calculation [illegible] benefits.

TABLE II—ANALOGOUS EXPOSURE ESTIMATES

Product	Installation		Repair/Disposal	
	Population	10⁻⁹ f/yr	Population	10⁻⁹ f/yr
Millboard				
Pipeline wrap	20	57	20	57
Beater-add gaskets [1]	2,725	57	2,725	57
Specialty paper	53,417	57	53,417	57
A/C pipe	350	57	350	57
Clutch facings [1]	(2)	[illegible]	1,456	[illegible]
Sheet gaskets [1]	[illegible]	[illegible]	475	[illegible]
Non-roof coatings	5,741	228	5,741	370
	1,780	398	[illegible]	[illegible]

[1] Exposures listed [illegible] relatively small number of exposures posed during the production of specialty industrial gaskets, which [illegible] banned by this rule.
[2] Exposures listed [illegible] occupational exposures [illegible] place in addition to those listed under Repair and Disposal in Table I.
[3] See table I.

In view of the information presented in this Unit, EPA concludes that despite OSHA's recent promulgation of new, stricter standards for exposure to asbestos in the workplace, occupational exposures and risks remain unacceptably high. As noted earlier, OSHA has observed that risks at the 0.2 f/cc PEL remain significant but that [illegible] from setting the PEL any lower. EPA's extensive data base on occupational exposures, including information collected after OSHA's 0.2 f/cc PEL became effective, indicates that individual risk remains higher than 1 in 1,000 for tens of thousands of people who work with asbestos products.

b. *Non-occupational exposures.* [illegible] of the U.S. population is exposed to asbestos that is released during the life cycle of asbestos products. Some of these people are consumers who are exposed to asbestos as they install, repair, remove, and dispose of asbestos products that they have purchased, such as roofing materials and automotive brakes. Others [illegible]

manufacture, installation, use, repair, and disposal of asbestos products. Risks from non-occupational exposure are not [illegible]ly incurred [illegible] populations [illegible]out occasionally can be [illegible] high. EPA estimates that approximately [illegible] million consumers and [illegible] million [illegible] exposed to ambient asbestos incur risks of 1 in 1,000,000 or more of developing cancer from their exposure. Approximately 223,000 of those exposed to ambient asbestos incur lifetime risks of 1 in 10,000 or greater of developing cancer (Ref. 30).

Historically, consumer exposures to asbestos have not received as much attention as occupational exposures to asbestos, but they are a source of significant concern. While consumer exposures are not likely to be as frequent for individual consumers as occupational exposures are for workers, they are likely to be more intense than occupational exposures because consumers generally lack the exposure-reducing equipment and expertise available to protect workers. For instance, consumers replacing their brakes are not likely to use either solvent spray or a HEPA enclosure, the two pieces of equipment recommended by OSHA for use in reducing exposures to asbestos during brake repair. [illegible]onsumers may in fact employ a shop or [illegible]usehold vacuum cleaner to remove [illegible]sbestos dust from brake assemblies, a technique that can lead to very high exposures because most vacuum cleaners fail to capture asbestos dust and simply force it back out into the air (Ref. 59).

Consumer exposures are also experienced by a much larger population than occupational exposures. According to two recent, independent consumer surveys, approximately 40 million consumers repair their own brakes once every 3 years, and other consumer surveys indicate that at least 840,000 consumers [illegible] every 4 years [illegible] not include [illegible] exposed to asbestos [illegible] installation, re[illegible] gaskets, A/C [illegible] other process[illegible] exposures are [illegible] Populations annually exposed to asbestos during brake and roof repair are presented along with equivalent information for exposures to ambient asbestos in Table IV of this Unit. Air concentration levels were estimated from occupational data. This may result [illegible] underestimates because, as noted [illegible]ove, consumers are unlikely to have [illegible]

practices and engineering controls used by workers.

The ability of asbestos to persist and to spread in the environment makes it a hazard to millions of people who may not have any direct occupational or consumer contact with asbestos products. Several tons of asbestos are released to the ambient air during mining and milling, during the manufacture of asbestos products, during brake use and repair, and during construction and demolition (Ref. 30). Additional asbestos is released from asbestos products during other parts of their life cycles. Once released, this asbestos accumulates and spreads in the environment. Air monitoring studies have demonstrated that urban areas, with their high concentrations of motor vehicles, construction, and demolition, generally have levels of ambient asbestos one or two orders of magnitude higher than rural areas. While rural background levels range between 0.01 and 0.1 $\mu g/m^3$, readings in large cities range from 1 $\mu g/m^3$ upward (Ref. [illegible]). Thus, asbestos released during the life cycle of asbestos products is capable of elevating ambient levels of asbestos to several times the background level.

The release estimates and atmospheric modeling that EPA used to estimate ambient exposures capture at least part of the contribution of asbestos-containing products produced and used in the [illegible] to ambient levels. For this rulemaking, EPA calculated ambient exposures attributable to releases from mining and milling, the manufacture of asbestos products, brake use and repair, and construction with asbestos products. Since the proposal, these calculations have been expanded and refined to include ambient exposures from brake repair, construction, and demolition.

To estimate ambient exposures attributable to milling and product [illegible]facturing, EPA first estimated air [illegible] per facility in milling and in [illegible]ach product category, using production [illegible]olumes and the efficiency of pollution [illegible]ontrol equipment for each product [illegible]ory. EPA then used atmospheric [illegible] modeling based on site-[illegible]ific meteorological data to estimate ambient concentrations and exposed populations. Because the number of plants involved in the manufacture of asbestos products is quite large, monitoring air concentrations around each plant is impractical. The atmospheric modeling used in EPA's asbestos exposure analyses has been tested on other pollutants and has [illegible]

concentrations within a factor of [illegible] (Ref. 47).

As explained in the Asbestos Exposure Assessment (Ref. 29), EPA[illegible] methodology to estimate asbestos a[illegible] releases from manufacturing and processing plants is presented in the March 5, 1987 draft EPA report entit[illegible]d National Emission Standards for Asbestos Background Information for Proposed Standards (Ref. 46). This document presents emission scenarios based on the only published study on the efficiency of baghouses in the asbestos industry. For each industry [illegible] emission scenarios were presented for baghouses operating [illegible] normal [illegible]failure mode: minimum, maximum, and "best estimate" [illegible] emissions. [illegible] gravimetr[illegible] the study. [illegible] failures. [illegible] various [illegible] range from [illegible] failure [illegible] efficiencies [illegible] product [illegible] concentr[illegible] (less than [illegible] asbestos product [illegible] inlet conc[illegible] with low [illegible] an efficiency [illegible] paper, [illegible] gaskets, and [illegible] in the preamble [illegible] occa[illegible] bagho[illegible]

released during milling and product manufacturing. Under the [illegible] sion scenario with [illegible] ure assumed, a number [illegible] would incur risks of at [illegible] developing cancer from [illegible] exposure (Ref. 30). Under [illegible] estimate" assumption of [illegible] efficiency with occasional baghouse failure assumed, many thousands of persons would incur risks of at least 1 in 10,000 of developing cancer from ambient exposure to asbestos from plant emissions.

Table III of this Unit, based on the maximum emissions scenario with no baghouse failure assumed, lists the exposure levels and populations associated with plant releases for each product category. For each category, exposure levels have been averaged over the entire population exposed. As detailed in Unit V.F and in the Asbestos Modeling Study, actual exposures are much higher for some people and lower for others, but the total populations and average exposures presented here provide a general gauge of exposure for each product category and were used to calculate the benefits (cancer cases avoided) of the rule.

Averaging has no effect on EPA's calculation of benefits because EPA [illegible] a linear dose-response model to [illegible]ect cancer cases avoided. A linear [illegible]se-response model assumes that an individual's risk of developing cancer increases at a constant rate with his or her exposure to asbestos. Thus, for populations of equal size, a given increment of exposure carries the same amount of risk regardless of any differences that may exist between the populations in the magnitude of the exposures that they experience in addition to it. For example, if half of a population is exposed to an asbestos concentration of 0.19 f/cc and half is [illegible] to an asbestos concentration of [illegible], the expected incidence of [illegible] for the entire population can be [illegible] by "moving," for the purposes [illegible] analysis, 0.01 f/cc of exposure from the 0.21 f/cc population to the 0.19 f/cc population, yielding an average exposure level of 0.2 f/cc for the entire population. For populations of the same size, the 0.01 f/cc carries the same risk whether it is associated with an additional exposure of 0.2 f/cc or of 0.19 f/cc. As long as the cumulative population exposure (the sum of the products of the various exposure levels and the populations exposed to each) remains constant, it can be distributed in any way among the population without affecting the calculation of expected cancer cases. The following Table III, based on the maximum emissions scenario with no baghouse failure assumed, lists the exposure levels and populations associated with plant releases for each product category.

TABLE III—EXPOSURES TO AMBIENT ASBESTOS FROM PRIMARY AND SECONDARY MANUFACTURING

Product	Population exposed	[illegible] (10[illegible] f/yr)
Commercial paper	[illegible]	[illegible]
Rollboard	[illegible]	[illegible]
Millboard	5,747,875	0.0232
Pipeline wrap	4,847,337	0.0478
Beater-add gaskets	37,169,845	0.0373
High-grade electrical paper	254,772	0.406
Roofing felt	0	0
Flooring felt	0	0
Corrugated paper	0	0
V/A [illegible]	0	0
A/C pipe	3,313,602	0.167
A/C flat sheet	21,232,368	0.0218
A/C corrugated sheet	0	[illegible]
A/C shingle	[illegible],143	[illegible]

TABLE III—EXPOSURES TO AMBIENT ASBESTOS FROM PRIMARY AND SECONDARY MANUFACTURING—Continued

Product	Population exposed	Average [illegible] (10[illegible])
Drum brake linings (LMV)	34,542,107	0.0575
Disc brake pads (LMV)	[illegible]	[illegible]
Disc brake pads (HV)	[illegible]	[illegible]
Brake blocks	[illegible]	[illegible]
Clutch facings	[illegible]	[illegible]
Automatic [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] specialty industrial [illegible] this rule.

[illegible] counted.

TABLE IV—EXPOSURES TO AMBIENT ASBESTOS FROM [illegible] CONSTRUCTION AND BRAKE REPAIR AND [illegible]

Product	Population [illegible]	[illegible]
Roofing felt	[illegible]	[illegible]
A/C pipe	171,[illegible]	[illegible]
A/C flat sheet	171,[illegible]	[illegible]
A/C corrugated sheet	171,[illegible]	[illegible]
A/C shingles	[illegible]	[illegible]
Drum brake linings (LMV)	[illegible]	[illegible]
Disc brake pads (LMV)	[illegible]	[illegible]
Disc brake pads (HV)	[illegible]	[illegible]
Brake blocks	[illegible]	[illegible]
Roof coatings	218,[illegible]	[illegible]

mates of miles traveled by vehicle e (because emissions vary by vehicle /pe) in each city. Second, EPA performed atmospheric dispersion modeling of these emissions to estimate concentrations in each city. Third, EPA grouped the cities together by population, obtaining average concentrations for each group. To estimate the populations exposed to each of these average concentrations nationwide, EPA added up the populations living in the U.S. cities similar in size to the cities of each group. Because none of the original 24 cities had fewer than 25,000 inhabitants and because vehicular traffic is less concentrated in rural areas than in cities, populations living in areas with fewer than 25,000 inhabitants were assumed to have no exposure to asbestos released during brake use. Finally, EPA averaged the estimated concentrations over all population groups from areas with more than 25,000 inhabitants, weighting each concentration by the population exposed to it. Using this technique, EPA estimates that 100 million people (the 1980 U.S. population living in areas of more than 25,000 people) are exposed to 8.7×10^{-5} µg/m³ of asbestos resulting n the use of asbestos brakes (Ref.). The individual risk of developing cancer from a lifetime of exposure to this concentration of asbestos is estimated at approximately 1 in a million, a level which is significant given the very large population exposed. Because populations living in areas with fewer than 25,000 people (55.5 percent of the U.S. population) probably are exposed to at least some asbestos from brake use, this estimate should be considered a lower bound.

In addition to the exposures quantified above, EPA believes that other significant ambient exposures occur that cannot be easily quantified. One type of unquantified exposure results from releases of asbestos that are difficult to measure, such as the gradual weathering and disintegration of construction products used outdoors. A number of studies indicate that these releases are probably significant. Indirect evidence of weathering comes from several studies of corrosion in A/C pipe: soft, acid water has been found to dissolve A/C pipe in some instances (Ref. 64). Because rain water is likely to be both soft and acid, it is likely to be very corrosive to A/C materials.

Direct evidence of weathering upports this projection. A study of elements and areas that were protected, and inspection of the worn areas with a scanning electron microscope revealed a network of asbestos fibers on the shingle surface. In addition, concentrations of asbestos as high as 343 million fibers per liter (mfl.) were found in runoff collected from roofs covered in A/C single. Ten mfl. is considered abnormally high (Ref. 51). Another study detected asbestos releases from construction materials after a shingle storm; several air samples taken after a heavy rain at a school with A/C walkways and roof panels showed significantly elevated asbestos concentrations (Ref. 1). Thus, in areas where there is widespread use of A/C sheet and A/C shingle, weathering is probably an important source of ambient asbestos.

Another type of unquantified exposure results from the tendencies of asbestos to persist in the environment and to reenter the air after settling out. Both the durability and aerodynamic properties of asbestos are well documented. The extraordinary ability of asbestos to survive for long periods under a variety of different conditions is often cited as an important reason for its incorporation into a number of products, including paper products used as insulation, friction materials, asbestos cement products, packings, and gaskets. Reentrainment is supported by studies finding high airborne asbestos concentrations not only near waste piles but upwind as well as downwind of point sources (Ref. 48), a finding most likely to result from the resuspension of asbestos deposited earlier by winds blowing in the opposite direction. This evidence indicates that over time, asbestos builds up to some degree in surface waters and soils and that some of this build-up is continuously reentrained in the air. This process of build-up and reentrainment is referred to as environmental loading. Because the likelihood of reentrainment in the environment depends upon a number of factors that are difficult to measure, including the fraction of asbestos that is washed away by rainfall or buried under later soil deposits, reentrainment has not been included in EPA's atmospheric modeling. Thus, EPA has not quantified exposures attributable to environmental loading. Nonetheless, EPA is very concerned about the possible impact of this process on exposures to ambient asbestos. Given its durability, asbestos may persist in the environment for a long

populations both create and come into contact with asbestos releases. In fact the elevated concentrations of asbestos found by numerous studies in urban areas probably result at least in part from environmental loading. The potential longevity of the risk posed by environmental loading was a major factor in EPA's decision to eliminate that risk at its source by banning most asbestos products.

Some commenters argued that exposures to asbestos released into the ambient air by the manufacture, importation, processing, and use of asbestos-containing products are insignificant because the risks associated with such exposures are very small. However, individual risks from asbestos in the ambient air can be quite high for persons living near asbestos product plants, construction sites, or other sources of release. As noted earlier, under the maximum emission scenario with no baghouse failure assumed, a number of people would incur risks of at least 1 in 1,000 of developing cancer by living in such areas. Under the "best estimate" emissions scenario, many thousands of persons would still incur a risk of at least 1 in 10,000 from ambient exposure to asbestos from plant emissions. Moreover, while most people exposed to ambient asbestos from asbestos-containing products incur individual risks smaller than 1 in 1,000, the number of people exposed is extremely large, making the total risk a concern.

c. *Exposure from imported and exported asbestos products.* EPA has determined that significant exposure is likely from imported asbestos products. Although some exposure to U.S. populations is avoided when asbestos products are manufactured abroad and imported rather than manufactured in the U.S. (foreign exposures and resulting cancer cases are not included in the estimates for this rule), significant exposures still occur after import of the products into this country. U.S. exposures occur during transport, installation, use, maintenance, removal, and disposal of the product. As noted above, large numbers of people are exposed to asbestos during these activities and the level of exposure is often quite high.

Significant exposures also occur during the U.S. portion of the life cycle of asbestos-containing products manufactured in this country for export. These exposures occur during the

. are also exposed to asbestos as a ult of these activities. Therefore, as is discussed in Unit III.B of this preamble, EPA finds under section 12(a)(2) of TSCA that the manufacture or processing for export of asbestos-containing products that are subject to the rule will present an unreasonable risk of injury to human health. Therefore, the manufacture and processing of asbestos-containing products for export is not exempted from this rule under section 12(a)(1), and is subject to the rule's bans.

d. *Exposure conclusions.* In conclusion, EPA finds the intensity, scope, and potential longevity of human exposure to asbestos released during the life cycles of the products subject to this rule cause for serious concern. In spite of efforts to control exposure, asbestos is released and inhaled at all stages of the life cycles of asbestos products; extensive exposures have been quantified for workers, consumers, and the general population. EPA estimates that thousands of asbestos workers and members of the general population incur individual risks near 1 in 1,000 from sure to asbestos released from the ucts subject to this rule and that ions of people incur risks near 1 in ,000,000 from such exposure. These risks are very large. Moreover, evidence indicates that significant exposures take place that cannot be quantified. EPA is especially concerned about exposures from environmental loading, which may occur long after the initial release of asbestos from a product.

D. Environmental Effects

The unreasonable risk finding for this rule is based on the risks to human health posed by exposure to asbestos. These risks are the most readily quantifiable consequences of the commercial use of asbestos and are sufficient to support the actions taken in this rule. However, EPA is concerned about the potential environmental effects of ambient loading due to continued manufacture, importation, processing, and use of commercial asbestos products. Exposure to asbestos fibers has been clearly shown in both human and animal studies to cause severe health effects. Effects on wildlife have not been quantified for purposes of this rule. However, because asbestos s are extremely durable and sportable, EPA believes that

C. Asbestos Substitutes

This Unit discusses the relative availability of substitutes for asbestos in asbestos-containing products and the potential health hazards posed by such substitutes. EPA has found that suitable substitutes currently exist for most uses of asbestos. EPA believes that the benefits to society of asbestos-containing products are relatively small because of the current availability of many substitutes and the expected development of others after promulgation of this final rule.

1. *Availability of substitutes.* This subject is described in more detail in Volume III, Appendix F of the Regulatory Impact Analysis (RIA). Further responses to comments on these subjects can be found in the Response to Comments document. The availability of substitutes for the various product groupings subject to this rule are discussed in Unit V.F. of this preamble.

The following Table V lists currently-available major substitutes for asbestos-containing products that are banned by this rule and the market shares for each product category projected for the substitutes in the absence of asbestos. This breakdown does not take into account the development of new substitutes or new applications of existing substitutes since the preparation of the RIA. It also does not account for the likely development of new substitutes before the effective date of this rule's bans. EPA is aware that it may not have identified all substitutes for asbestos-containing products and that the costs of the rule may be overstated as a result.

TABLE V. —PROJECTED MARKET SHARES OF CURRENT SUBSTITUTES

Product and substitute	Approximate Substitute Market Share (percent)
Pipeline wrap:	
Mineral felt	48
Safelt (R)	32
Duraglass (R)	20
Beater-add gaskets:	
Cellulose	25
Aramid	30
Fibrous glass	20
Polytetrafluoroethylene	10
Graphite	10
Ceramic fibers	5
Sheet gaskets:	
Para-aramid	30
Fibrous glass	25
Graphite	15
Cellulose	15

TABLE V. —PROJECTED MARKET SHARES OF CURRENT SUBSTITUTES—Continued

Product and substitute	Approximate Substitute Market Share (percent)
A/C pipe:	
Polyvinylchloride (PVC)	9
Ductile iron	
A/C flat sheet:	
Calcium silicate	
Non-calcium silicate	
Laboratory sheet	
A/C corrugated sheet:	
Fiberglass reinforced plastic	44
Aluminum	32
Steel	11
Polyvinylchloride	
A/C shingles:	
Wood	
Vinyl	
Asphalt	
Aluminum	
Tile	2
Drum brake linings:	
Non-asbestos organics	
Semi-metallic	
Disc brake pads (LMV and HMV):	
Semi-metallic	10
Brake blocks:	
Non-asbestos organics	
Semi-metallic	1
Clutch facings:	
European woven	
U.S. woven	
Molded aramid	
Molded fiberglass	
Automatic transmission components:	
Cellulose	10
Other friction materials:	
Fiberglass & para-aramid	10
Millboard:	
Standard board	
Premium board	
Specialty paper:	
Earth and cellulose	
Loose cellulose	
Roof coatings:	
Cellulose	7
Polyethylene	3
Other	5
Non-roof coatings:	
Synthetic fibers	
Clay and mineral	

Substitutes for asbestos products are steadily being developed and accepted in the marketplace. It should be noted that a number of products that are subject to this rule's bans are no longer manufactured or imported in the U.S. In these cases, viable substitutes have apparently forced asbestos-containing products from the U.S. market. An increasing rate of availability and acceptance of substitutes is evidenced by a more rapid decrease in asbestos use in most product categories than was predicted in the RIA for the proposal. Public comments have identified new

development of substitutes, thereby decreasing availability and decreasing costs.

2. *Health risk review of fibrous asbestos substitutes.* This Unit addresses the potential health risks caused by exposure to various fibers projected to replace asbestos in products banned by this rule. This subject is discussed in more detail in (1) "Review of Recent Epidemiological Investigations on Populations Exposed to Selected Non-asbestos Fibers" (Ref. 35); (2) "Durable Fiber Exposure Assessment" (Ref. 36); (3) "Durable Fiber Industry Profile and Market Outlook" (Ref. 37); and (4) "Health Hazard Assessment of Non-asbestos Fibers" (Ref. 38). Further responses to comments on this subject can be found in the Response to Comments document.

Based on available information and a public health policy regarding asbestos, EPA has more concern about the continued use and exposure to asbestos than it has for the future replacement of asbestos in the products subject to this rule with other fibrous substances. Available information about the fibrous substitutes under review for this rulemaking supports the conclusion that the fibrous substitutes appear to pose a lower human health hazard than asbestos (Ref. 38). However, due to limited data, EPA cannot quantify the risk that may be posed by fibrous asbestos substitutes. EPA believes it is prudent public health policy to regulate asbestos rather than to delay regulation until all risks of substitute products are definitively determined. This conclusion is based on a consideration of (1) Available data on the health hazards and exposures posed by asbestos and its substitutes; (2) the factors that enhance or mitigate fiber pathogenicity; (3) an understanding of the deficiencies of the data available on health hazards and exposures of substitutes; and (4) EPA's public health policy of reducing known, serious health risks.

a. *Background.* EPA, for the proposed rule, performed a review of the available hazard and exposure information on eight fibrous substances that could substitute for asbestos in "Asbestos Substitutes and Related Materials" (Ref. 39). In response to public comments received on the proposal, EPA conducted an extensive review of available information and updated its hazard and exposure assessment of fibrous asbestos substitutes (see Refs. 6, 37, and 38).

Specifically, this analysis included six man-made or synthetic fibers (aramid, carbon/graphite, ceramic, glass, polyethylene, and polypropylene) and two naturally occurring fibers (attapulgite and wollastonite). These eight fibers were individually selected for review because (1) They are commercially important; (2) they are potentially the major fibrous substitutes for asbestos; (3) they represent fiber types with broadly different physical and chemical characteristics; and (4) hazard and exposure data are available. EPA chose to place its emphasis on the review of fibrous substitutes because their morphological similarity to asbestos suggested that they may induce cancer. Other non-fibrous substitutes, specifically, wood and other cellulose products, cement, and bricks, appear to pose little or no health hazard and, for this reason, their potential health effects have not been analyzed in detail for purposes of this rule.

b. *Health effects of fibrous substitutes.* EPA conducted a comprehensive review of the experimental and epidemiological hazard data for the eight fibrous substitutes (Refs. 35 and 38). Available epidemiological and toxicological data indicate that inhalation exposure to some fibrous substitutes may be associated with malignant and non-malignant diseases in humans. However, the evidence of carcinogenicity and fibrogenicity of these substitutes is more limited than for asbestos. Based on available data, EPA has concluded that, under similar experimental conditions, the fibrous substitutes are generally less biologically active and pathogenic than asbestos (Ref. 38). Unlike the fibrous substitutes, asbestos is a well-recognized, potent human carcinogen, which also causes non-malignant pulmonary effects. At this time, EPA cannot make a definitive assessment of the biological activity and pathogenicity of fibrous substitutes in comparison with asbestos because available data on the health effects of the substitutes are incomplete. EPA has not derived a carcinogenic potency for any of the fibrous asbestos substitutes suspected to pose a carcinogenic concern, because either available epidemiological data and/or animal inhalation data are inadequate to establish a quantitative exposure-response relationship or tumor response has only been observed in animals via non-physiological routes of administration, such as intraperitoneal injection (Ref. 38).

One commenter contended that a potency value could be determined for fibrous glass and mineral wool based on

potency value cannot be derived for fibrous glass because the epidemiological evidence for carcinogenicity of these substances is inadequate. The data cited by commenters do not show consistent elevation of lung cancer risks in exposed workers or provide sufficient information to demonstrate a dose-response relationship (Ref. 35). Further, it is not appropriate to compute potency values from the available experimental data because the inhalation studies in animals did not produce tumorigenic responses (Ref. 38). Similarly, carcinogenic potency cannot be determined for mineral wool because dose-response information is not available from existing epidemiological studies (Ref. 35) and no tumorigenic responses were found in available inhalation studies (Ref. 38).

The commenter also stated that a unit cancer risk could be developed for aramid fibers using results from an animal inhalation bioassay for ultrafine para-aramid. The commenter made use of the linearized multi-stage procedure to calculate risk. In calculating the unit cancer risk value, the commenter only considered a subset of the bioassay data (Ref. 56). Consequently, EPA does not believe that the analysis presented by the commenter adequately reflects the results of the bioassay (Ref. 56). EPA is continuing to gather additional information to evaluate potential cancer risk of respirable aramid fibrils. Additionally, EPA is assessing the appropriate model to use to extrapolate cancer risk for aramid fibrils.

Unprocessed commercial-grade para-aramid, a type of aramid fiber, is manufactured in sizes that are too large to be respirable (Ref. 36). In addition, not all types of aramid fibers are expected to produce fibrils (e.g., continuous para-aramid) (Ref. 36). The para-aramid used in the cited animal study was a highly respirable material made specifically for the study (Ref. 38). Although the commercial-grade of para-aramid is believed to have the potential to generate respirable fibers as the small fibrils peel off from the non-respirable core matrix, exposure data are too limited to determine if fibril formation poses a significant concern. Limited monitoring data (combined area samples and personal samples) indicate that exposures to para-aramid fibrils range from not detectable to a maximum of 7.5 f/cc (Refs. 36, 54, and 55). According to a commenter, during

on materials, the maximum likely 8-hr TWA was less than 0.1 f/cc. Due to the way that the monitoring data were presented, it is difficult to determine if these data are representative of occupational exposure (Refs. 52 and 53). In addition to the limited monitoring data, exposures were only monitored at a few industrial operations which are suspected of producing respirable fibers (Ref. 52). Additionally, it is not known if these operations are representative of the industry (Ref. 53). Based on available information, EPA believes that neither commercial-grade aramid products nor fibrils formed from such products may pose major occupational, consumer, and ambient exposures. Generally, it appears that aramid fibrils tend to curl and clump together, thus reducing their tendency to become or remain airborne. Fibril formation appears to be a by-product of aramid manufacture and processing. Fibrils are not expected to become an integral component of aramid products. In contrast, asbestos becomes airborne easily and can remain airborne for long periods of time.

c. *Respirability.* A basic property which allows a fiber's potential toxicity to be expressed is its respirability, i.e., its ability to penetrate into the lower respiratory tract. Respirable fibers are generally defined as fibers with actual diameters of less than about 3.5 microns or an aerodynamic diameter of less than about 10 microns. Once in the lower respiratory tract, other factors such as fiber length and diameter, surface, and chemical properties are thought to influence biological activity (Ref. 38).

According to available information, a large percentage of the production volume of these fibrous substitutes consists of non-respirable fibers (Ref. 36). Because non-respirable fibers are unlikely to enter and penetrate the lung, such fibers pose minimal risk of inhalation toxicity. However, some portion of the production volume for many of these substitutes contains fibers of respirable size. Such fibers are of concern to EPA. However, available information indicates that fibers in the respirable size range are generally manufactured for specialty uses, such as high-temperature insulation materials, filtration media, ear defenders, spacecraft, and aircraft insulation (Ref. 36). Specialty uses may be of concern in terms of risk to individuals but do not have as great a potential for broad population exposures.

future trends of the eight fibrous substitutes (Ref. 37). EPA also developed an exposure profile of durable fibers (Ref. 36). To this end, EPA conducted a search of the literature and surveyed industry sources. This analysis focused primarily on activities and applications most likely to generate airborne fibers of respirable size. Exposure data for fibrous substitutes, although very limited, were available for all fibers except polyolefins. Most exposure data available in the literature are for fiber manufacture. Exposures during man-made and synthetic fiber production are typically less than 1.0 f/cc because processes are highly automated and often enclosed, meaning that operators are rarely in contact with the fiber (Ref. 36). Many of the packaging operations are also automated and ventilated, and the exhaust is sent to dust collection equipment (Ref. 36). Often the fiber size composition of a sample of airborne material is not noted. When fiber size distinctions have been made, respirable fibers can constitute 50 percent or more of airborne fibers. However, as noted above, airborne fibers typically measured less than 1.0 f/cc. Much of the airborne occupational exposure data available to EPA is outdated. Since many of these data were developed, the industry has become increasingly automated (Ref. 36). Therefore, current exposure levels may be lower.

Production of naturally-occurring substitute fibers presents a different exposure scenario than man-made fibers since the former are mined and milled. Mining and milling have traditionally been "dusty" operations where the use of engineering controls or personal protective equipment are difficult to integrate into the routine operations of the industry. Mining operations are labor intensive and exposures are likely; however, most mining is performed in open pits which allows for some ventilation. Milling operations use mechanical grinding and screening machines and exposure occurs to workers who run these machines. Both dust and fiber concentrations have been shown to significantly exceed OSHA's nuisance dust standards (Ref. 36). During wollastonite milling, a limited study found fiber concentrations ranging from 30 to 80 fibers/cc (Ref. 36).

While worker exposure to attapulgite and wollastonite may be high during certain mining and milling activities, available information indicates low

attapulgite (Ref. 37). Based on EPA's analysis (See Unit V.C.1 of this preamble), neither attapulgite or wollastonite are expected to be important asbestos substitutes.

Some commenters cited exposure data for various fibrous products and concluded that the exposures sometimes exceeded the asbestos PEL. These commenters were concerned that exposures may pose a significant risk. In general, production and use of respirable-size man-made fibers and mining and milling of the naturally-occurring mineral fibers, may potentially result in some exposures that exceed exposures from asbestos (Ref. 36). While the data on certain fibrous substitutes indicate that occupational exposure may range from not detectable to levels that exceed the asbestos PEL, levels in excess of the asbestos PEL alone will not lead to significant risks unless the substitutes present a health hazard of magnitude approaching that of asbestos. As explained above, available information on the hazards of the fibrous substitutes indicate that they are less biologically active and pathogenic than asbestos.

Given the scarcity of exposure data, the numerous types of processes or activities involved, and the variable characteristics of the many fibrous materials, EPA has concluded that reliable projections cannot be made about exposures to fibrous asbestos substitutes. This is contrasted with asbestos manufacturing, processing, and use practices, about which much is known and such conclusions or reasonable projections about exposure can be made.

e. *Risk of fibrous substitutes.* Some commenters stated that EPA should perform risk analyses of the same depth for the non-asbestos substitutes as EPA performed for asbestos. Commenters also stated that EPA's substitute analysis should consider the entire life cycle of the substitute, including the risks associated with non-asbestos raw materials, by-products, contaminants, and energy production. Additionally, some commenters stated that EPA should consider other health and environmental effects in addition to cancer associated with the substitute including silicosis and death due to trauma.

For reasons described previously, EPA believes that the available data base on the hazards and exposure to

alysis additional risks that may result om: (1) Exposure to raw materials, byproducts, or contaminants associated with production and use of asbestos-containing products; (2) accidents; or (3) energy production and consumption required to produce asbestos products.

antified, to the extent possible, y risks of cancer associated with exposure to asbestos fibers. EPA adopted a similar life cycle approach in its review of substitutes and only evaluated the potential that the fiber itself may cause cancer or non-malignant lung effects. In summary, the review approach adopted for substitutes is comparable to the approach used for asbestos and is only limited by the availability of data.

Some commenters stated that EPA could not conclude, based on available data, that substitutes pose lower risk than asbestos. EPA agrees that the data base is insufficient to quantify the risk of substitutes; however, in spite of the deficiencies of the data base, information is available to indicate that: (1) Some non-fibrous asbestos substitutes pose little or no health risk concern; (2) the inherent biological tivity or pathogenicity of the stitute fibers appears to be less than bestos; (3) a large percentage of the total production volume of fibrous substitutes is non-respirable, and thus does not pose a risk concern; and (4) the diameter size of man-made and synthetic fibers may be controlled, thus enhancing efforts to reduce the presence of contaminants or unnecessary respirable fibers in substitute products.

f. *Policy approach to asbestos and asbestos substitutes.* Regulatory decisions about asbestos which poses well-recognized, serious risks should not be delayed until the risk of all replacement materials are fully quantified. EPA believes that this is a prudent policy since: (1) Asbestos is a human carcingen and poses a serious risk to health; (2) substitute fibers appears to pose less hazard; (3) years are likely to pass before experimental toxicological data are available to quantify or adequately evaluate the possible health effects of substitutes; (4) a decade or more may pass before epidemiological data of the quality that exists for asbestos may be available to confirm any hazards of substitutes identified in experimental data; (5) olving fiber technology and the vances within the chemical industry

easier to control than the risks resulting from asbestos use because fiber diameter size can be technologically controlled.

EPA will control to evaluate hazards and exposures posed by fibrous materials and will determine appropriate regulatory action to mitigate any unreasonable risks that may be identified. EPA may consider regulation of fiber diameter and length of substitute fibers if it is determined that such risk reduction action is needed. EPA recommends, that, whenever feasible, manufacturers, processors and users avoid the production and use of respirable fibers. EPA also strongly encourages manufacturers and processors of fibers to institute quality control practices that minimize if not eliminate the inadvertent production of respirable fibers.

D. Economic Effects of the Rule

EPA has prepared a *Regulatory Impact Analysis of Controls on Asbestos and Asbestos Products* (Ref. 21) which analyzes the potential economic impact of the rule. EPA's assessment of the "reasonably ascertainable economic consequences of the rule," pursuant to section 6(c)(1)(D), is summarized below. The methodologies used by EPA to estimate the costs and benefits of this rule comport with widely-accepted cost-benefit techniques. The methodologies used and the data on which costs and benefit estimates are based have been updated to reflect public comments. Further responses to comments on this subject can be found in the Response to Comments document.

1. *Estimated costs.* Estimated costs were derived using the Asbestos Regulatory Cost Model (ARCM), which is described in the RIA and which primarily used information collected during telephone surveys conducted by an EPA contractor during 1986 and 1987. EPA also used some data obtained under the TSCA section 8(a) asbestos rule to estimate costs. Some information was adjusted to reflect more current data obtained through public comments and from other sources. The sources of information are noted in the record for this rule.

The costs represent the net present value of costs incurred due to changes in asbestos production volume between the years 1987 and 2000, using a social rate of discount of 3 percent. The 13-year time period serves as a reasonable

reasonable rate set by consensus by EPA economists. This figure falls with n the range of social discount rates suggested by the economics literature

In estimating the costs of this rule, allowance is made by the economic model to estimate declines in the pric of substitutes. In practice, the cost of product, in real terms, declines over t production as experience is gained in the manufacturing process. In addition experience under other regulations ha shown that the number of substitutes will increase as a result of product regulation. Some of the new substitute will be of lower cost than some of the existing substitutes or they will not capture market share from the existin substitutes. Both of these effects will lower the prices of substitutes. Neithe of these effects can be fully quantifie However, as the cost of substitutes decreases, the overall cost of this rule will also decrease.

The economic model does not take into account the cost reduction benef of using substitutes which currently have lower costs than the asbestos-containing products. In other words, t analysis assumes that the price of substitutes, after being adjusted for product life and performance, is alwa greater than or equal to the price of th comparable asbestos-containing product. This was done to account for differences in the characteristics of asbestos and non-asbestos substitute products that cannot be captured in cost differences. For example, because asbestos-containing products have be n traditionally used in these markets, a bias may exist toward the use of asbestos products rather than similarly-priced substitutes. However, this assumption overstates the costs imposed by the rule whenever the substitute actually costs less than the asbestos-containing product and there is no significant difference in product performance characteristics.

EPA attempted to gauge the possib effects of expected declines in the pr e of substitutes on the overall cost of t rule. The analysis of costs of the acti ns taken in this rule assumes that the prices of substitutes for asbestos products will decrease by 1 percent annually over the life of the 13-year period analyzed in the ARCM. Howe r, the analysis also assumes that the c of individual substitute products will always remain greater than or equal the price of the comparable asbestos

imate" in light of the effects of the growing markets for such products, increasing competition and production know-how in these markets, and the likely development of new, more cost-effective substitutes that have not been quantified for the ARCM.

Costs estimated in the RIA include costs to consumers and costs to producers. Consumer losses due to the rule result from increases in costs incurred for asbestos products or substitutes for asbestos products or from inferior performance of substitutes, to the extent that these latter costs could be quantified. It is estimated that consumers will incur $375.4 million in losses as a result of the actions taken in this rule, for the period of the analysis, spread across the retire consumer population.

Producer losses due to this rule would accrue when producers are forced to forego the portion of the return on their capital stock used to produce asbestos products. This occurs when the capital stock used in the production and processing of asbestos-containing ducts either cannot be used or not be used as efficiently in the production of substitute products. It is estimated that the rule will result in $83.49 million in total producer costs.

The rule will also result in some transition costs to workers who are displaced by product bans. These losses are incurred in the form of lost wages and job search costs. EPA believes that these transition costs will be relatively low compared to consumer and producer costs because of: (1) The amount of time allowed for companies to plan before the effective dates of most bans and (2) the already occurring transition to non-asbestos substitutes by many former producers of asbestos products.

The total costs of the rule were estimated first with costs discounted at 3 percent and benefits not discounted (hereafter 3 percent/0 percent) and then with both costs and benefits discounted at 3 percent (hereafter 3 percent/3 percent). The results of both analyses will be cited throughout the text of this preamble. Both analyses support the actions taken in this rule. The total estimated cost of the rule is $458.89 million. This cost will be spread over 13 years and a large population. Therefore,

TABLE VI—COST OF THE RULE BY PRODUCT CATEGORY ASSUMING A 1 PERCENT ANNUAL DECLINE IN THE PRICE OF SUBSTITUTES

Product	Total cost (in $ million, discounted at 3 percent)
Asbestos/cement (A/C) sheet	2.66
A/C shingles	23.57
A/C pipe	128.03
Products not currently in U.S. production (asbestos protective clothing and vinyl/asbestos floor tile)	0
Paper products (commercial paper, roilboard, millboard, corrugated paper, and specialty paper)	3.73
Felt products (flooring and roofing felt and pipeline wrap)	8.38
Gaskets [1]	207.72
Disc and drum brake pads for original equipment market (OEM) and brake blocks	12.97
Disc and brake pads for aftermarket (AM)	12.73
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	15.20
Coatings (roof coatings and non-roof coatings)	46.29

[1] Does not include specialty industrial gaskets.

EPA also analyzed the costs of the rule without the assumption about the declining price of substitutes that is described in the preceding paragraphs. Under this scenario, the total cost of the rule would rise from $458.89 million to $806.51 million. Estimated total costs of individual product bans under this scenario are set forth in the following Table VII:

TABLE VII—COST OF THE RULE BY PRODUCT CATEGORY WITHOUT THE ASSUMPTION OF A 1 PERCENT ANNUAL DECLINE IN THE PRICE OF SUBSTITUTES

Product	Total cost (in $ million, discounted at 3 percent)
Asbestos/cement (A/C) sheet	3.35
A/C shingles	34.18
A/C pipe	227.33
Products not currently in U.S. production (asbestos protective clothing and vinyl/asbestos floor tile)	0
Paper products (commercial paper, roilboard, millboard, corrugated paper, and specialty paper)	4.86
Felt products (flooring and roof-	

TABLE VII—COST OF THE RULE BY PRODUCT CATEGORY WITHOUT THE ASSUMPTION OF A 1 PERCENT ANNUAL DECLINE IN THE PRICE OF SUBSTITUTES—Continued

Product	Total cost (in million, discounted at percent)
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	27.92
Coatings (roof coatings and non-roof coatings)	180.56

[1] Does not include specialty industrial gaskets.

The costs in both of these analyses are likely overstated for a number of reasons. The methodology used in this analysis for dealing with a lack of information tends by design towards overestimating costs and underestimating benefits. This "cautious" approach is taken to ensure that the analysis provides a strong basis for the regulatory decision made in this rule.

A commenter stated that EPA, in the analyses used to support the proposed rule, underestimated the costs of banning the manufacture, importation, and processing of asbestos-containing products. The commenter argued that EPA overestimated the rate of development of asbestos substitutes, underestimated future asbestos consumption rates, and erred in a number of other ways, discussed in more detail in the Response to Comments document, in estimating the costs associated with the various options described in the proposed rule.

For the final rule, EPA has updated the data base used to support its analysis of the costs and benefits of the rule and has modified its analytical approach in response to comments. In addition, the decline in the rate of consumption of asbestos in the U.S. has been more rapid in recent years than was predicted in EPA's models. Total annual consumption of asbestos in the U.S. dropped from a 1984 total of 240,000 metric tons to less than 85,000 metric tons in 1987. This change suggests that the use of asbestos substitutes has increased markedly since the proposed rule was published.

EPA has adopted several conservative

been adopted for those market sectors which substitution for asbestos was relatively uncomplicated. It also assumes a constant rate of asbestos consumption unless EPA is aware of specific instances in which substitution has been made. In addition, the analysis assumes that the price of a substitute for an asbestos product will not fall below the price of the asbestos product for which it is being substituted. Therefore, the analysis adopts a number of assumptions that likely overestimate the costs of the actions taken in this rule rather than underestimate them.

2. *Estimated benefits.* The costs described above will be offset to some extent by a number of avoided costs. While EPA did not attempt to place a value on the loss of life itself, or on associated costs such as "pain and suffering," "loss due to leisure time," or other similar factors, EPA has estimated that the actions taken in this rule will result in the avoidance of at least 202 quantifiable cases of lung and gastrointestinal cancer and mesothelioma when benefits are not discounted and at least 148 cancer cases when benefits are discounted at 3 percent from the time of exposure. These estimates assume the occupational exposure levels based on other analogous exposure scenarios, discussed in Unit V.A.3 of this preamble. These estimates do not, for reasons discussed in Unit V.A of this preamble, include the number of asbestosis cases and cases of other diseases avoided. In addition, EPA did not estimate losses due to lost work days or medical care costs. Thus the benefits of the rule (costs avoided by this rule) represent prudent estimates that likely understate actual benefits. The cancer-cases-avoided by individual product category are set forth in the following Table VIII:

TABLE VIII—CANCER-CASES-AVOIDED BY PRODUCT CATEGORY ASSUMING ANALOGOUS EXPOSURE FOR SELECTED PRODUCT CATEGORIES

Product	Discount rate	
	3 percent	0 percent
Asbestos/cement (A/C) sheet	0.96	1.19
A/C shingles	0.23	0.32
A/C pipe	3.17	4.39
Products not currently in U.S. production (asbestos protective clothing and vinyl/asbestos floor tile)	0	0
Paper products (commercial paper, rollboard, millboard, corrugated paper, and specialty paper)	0.43	0.60
Felt products (flooring and roofing felt and pipeline wrap)	2.62	3.25
Gaskets [1]	6.68	8.81
Disc and drum brake pads for original equipment market (OEM) and brake blocks	14.55	19.08
Disc and brake pads for aftermarket (AM)	88.37	122.11
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	1.45	1.91
Coatings (roof coatings and non-roof coatings)	2.41	3.33

[1] Does not include specialty industrial gaskets.

Analogous exposures could not be assumed for a number of exposures. Therefore, benefits are understated to the extent that these exposures are not included. For example, some exposures result when asbestos fibers are released to air due to weathering of A/C products and other products used in exterior uses.

Also, the analysis did not quantify the increased risk due to high concentration, episodic exposures to asbestos for many products. Further, additions to ambient loading caused by the activities affected by this rule and the resultant risk reduction from this rule's actions could not be adequately quantified. The effect these factors would have on the calculation of benefits is difficult to determine because of technological difficulties in quantifying the extent of these releases and the resultant exposures. However, the effect could be significant because releases via these routes are frequent and, on aggregate, broad-ranging.

EPA also analyzed the benefits that accrue due to the actions taken in this rule if the analogous exposure analysis described in Unit V.A.3 of this preamble are not assumed. In this analysis, in all instances where exposure is believed to exist, but specific exposure data are not available, EPA assumed no exposure. The figures in the following chart, therefore, understate the actual number of cancer-cases-avoided due to this rule to the extent that available monitoring data used in the exposure analysis

TABLE VIII—CANCER-CASES-AVOIDED BY PRODUCT CATEGORY ASSUMING ANALOGOUS EXPOSURE FOR SELECTED PRODUCT CATEGORIES—Continued

Product	Discount rate	
	3 percent	0 percent
Felt products (flooring and roofing felt and pipeline wrap)	3.53	4.38
Gaskets [1]	32.24	42.54
Disc and drum brake pads for original equipment market (OEM) and brake blocks	14.55	19.08
Disc and brake pads for aftermarket (AM)	88.37	122.11
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	1.45	1.91
Coatings (roof coatings and non-roof coatings)	2.41	3.33

[1] Does not include specialty industrial gaskets.

to 104 cases if benefits are not discounted and from 148 cases to 120 cases if benefits are discounted at 3 percent. The cancer-cases-avoided by individual product category using this analysis are set forth in the following Table IX:

TABLE IX—CANCER-CASES-AVOIDED BY PRODUCT CATEGORY WITHOUT ANALOGOUS EXPOSURE ASSUMPTIONS

Product	Discount Rate	
	3 percent	[illegible] percent
Asbestos/cement (A/C) sheet	0.96	1.19
A/C shingles	0.23	0.32
A/C pipe	2.25	3.11
Products not currently in U.S. production (asbestos protective clothing and vinyl/asbestos floor tile)	0	0
Paper products (commercial paper, rollboard, millboard, corrugated paper, and specialty paper)	0.43	0.60
Felt products (flooring and roofing felt and pipeline wrap)	2.62	3.25
Gaskets [1]	6.68	8.81
Disc and drum brake pads for original equipment market (OEM) and brake blocks	14.55	19.08
Disc and brake pads for aftermarket (AM)	88.37	122.11
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	1.45	1.91
Coatings (roof coatings and non-roof coatings)	1.29	1.79

[1] Does not include specialty industrial gaskets.

As stated earlier, EPA decided for this rulemaking to estimate potential risk from plant emissions using an assumption of baghouse efficiency of 99.95 percent for some product categories and 99.67 percent for other product categories (the maximum emission scenario with no baghouse failure assumed). However, EPA also estimated the number of cancer-cases avoided using the assumptions of 99.98 to 99.988 percent efficiency (the best estimate scenario with occasional baghouse failure assumed). These estimates, assuming the occupational exposure levels based on other analogous exposure scenarios discussed above, are 183 cases if benefits are not discounted and 134 cases if benefits are discounted at 3 percent. The cancer-

TABLE X—CANCER-CASES-AVOIDED BY PRODUCT CATEGORY ASSUMING ANALOGOUS EXPOSURES AND ALTERNATIVE EMISSIONS CONTROL RATES

Product	Discount Rate	
	3 percent	0 percent
Asbestos/cement (A/C) sheet	0.48	0.59
Shingles	0.22	0.31
A/C pipe	2.10	2.90
Products not currently in U.S. production (asbestos protective clothing and vinyl/asbestos floor tile)	0	0
Paper products (commercial paper, rollboard, millboard, corrugated paper, and specialty paper)	0.18	0.25
Felt products (flooring and roofing felt and pipeline wrap)	2.20	2.72
Gaskets[1]	28.83	35.41
Disc and drum brake pads for original equipment market (OEM) and brake blocks	12.72	17.27
Disc and brake pads for aftermarket (AM)	85.08	117.09
Other asbestos friction products (automatic transmission components, clutch facings, and commercial and industrial friction products)	1.29	1.70
Coatings (roof coatings and non-roof coatings)	2.03	2.80

[1] Does not include specialty industrial gaskets.

The different assumptions about baghouse efficiency do not have a significant effect on the estimates of cancer-cases-avoided. Under both the best estimate scenario with occasional baghouse failure assumed and the maximum emission scenario with no baghouse failure assumed, EPA believes that the manufacture, importation, processing, and distribution in commerce of these products presents an unreasonable risk of injury to human health.

The rule will result in a number of other significant benefits. However, many of these benefits are either in the future and are relatively small in current terms after discounting or are difficult to quantify. For example, costs avoided include the societal cost of the resources necessary to treat asbestos-related illnesses and the productivity lost as a result of asbestos disease that will be avoided due to actions taken under this rule. EPA has not estimated these costs generally result in death after relatively short periods of treatment or hospitalization. In addition, this total would be further lowered when discounted due to the fact that most asbestos-related diseases appear only after a long latency period.

Continued manufacture, importation, processing, and use of the asbestos-containing products banned by this rule would result in environmental loading of asbestos. The effect of environmental loading is discussed in more detail in Unit V.A.3 of this preamble. The actions taken under this rule will reduce the incremental increase in ambient concentrations of asbestos and thus reduce the risk of asbestos exposure faced by the general population. EPA has not attempted to quantify these benefits, due to the difficulty and probable imprecision of such an analysis. However, EPA believes that the long-term benefits derived from this incremental decrease in ambient concentrations of asbestos will result in substantial benefits because of the large populations that are affected. EPA has also concluded that these benefits can be attained through the source reduction actions taken in this rule, rather than by use of other options considered.

Further, due to the rule's bans, the substantial future costs associated with removal and disposal of asbestos-containing products that would have otherwise been produced and used will be avoided. These included higher removal, demolition, and disposal costs for asbestos products than those for non-asbestos products, as well as higher health risk expenses for asbestos products. Future removal, demolition, and disposal of asbestos construction products will likely be higher because special precautions will probably be necessary to meet OSHA, Clean Air Act (CAA), or other requirements. These costs can be substantial, but they have not been estimated for purposes of this rulemaking because estimates of the timing and frequency of building removal or renovation would be speculative.

Also, the continued use of asbestos will likely exacerbate the heavy burden on courts and workman's compensation boards that have, in recent years, been inundated with claims related to harm caused by asbestos exposure. This rule, by reducing the occurrence of asbestos-related diseases, will eventually reduce the costs related to claims arising out of illnesses and deaths caused by asbestos exposure.

believes that this rule will further stimulate technological innovation in the development of substitutes for asbestos and that this strong trend toward use and acceptance of substitutes will continue.

Different health benefits were estimated in support of the proposal than those development for the final rule. The number of cancer-cases-avoided estimated for the proposal (approximately 1,000 cases and more, depending on the regulatory options) is higher than the estimate for the final rule (202 and 148 cases if analogous exposures are assumed) for a number of reasons: (1) Several product categories are not included in this final rule estimates because they are no longer manufactured or imported in the U.S. (e.g., vinyl-asbestos floor tile). This change accounts for approximately 475 of the cancer-cases-avoided quantified in the proposal rule. (2) The production and exposure data supporting the rulemaking were updated for the final rule. U.S. asbestos consumption has decreased and substitute use had increased since the publication of the proposed rule. Therefore, the proposal's estimates of cancer-cases-avoided were higher than those for the final rule because consumption rates and resulting exposure totals were higher at the time of the proposal. (3) Updated exposure assessments were used in the health benefits model. The updated data were lower for some products than those used for the proposal, meaning that the proposal's estimates of cancer-cases-avoided were higher than those for the final rule. (4) The time frame used for estimating health benefits for the proposal was 15 years; for the final rule, the period is 13 years. Therefore, the final rule analysis covered 2 fewer years of exposure, resulting in fewer estimated health benefits. (5) Some modifications were made to the health effects model used for the final rule (e.g., minor modifications, including quantification of gastrointestinal cancer risk, and the use of a lower dose response constant for mesothelioma (using an average of the dose response constants from a number of studies, rather than the constant from one large study)) that resulted in an estimate of benefits that was approximately 20 percent lower for the final rule than for the proposal.

Several commenters stated that EPA underestimated the benefits associated with the product bans described in the proposed rule. These commenters asserted that the analysis of benefits

mesothelioma or exposures to families of asbestos workers, and failed to quantify factors like avoided pain and suffering and increased worker productivity. EPA agrees that the benefits of the rule may be understated, possibly to a significant extent, in the supporting analysis due to technological or other limitations. These factors, however, have been considered qualitatively in EPA's analysis.

One commenter argued that EPA significantly overestimated the benefits of the rule by overstating asbestos potency and exposure levels. The lung cancer and mesothelioma potency values used by EPA in its analysis of benefits are well-supported and are consistent with those used by OSHA in reducing its PEL to 0.2 f/cc. The potency values for lung cancer represent the mean of the results of 11 human epidemiological studies on the effects of asbestos exposure. The potency values for mesothelioma represent the mean of the results of 4 human epidemiological studies on the effects of asbestos exposure. In addition, the exposure estimates used in this analysis understate actual exposure for a number of reasons, as explained in Unit V.A.3 of this preamble. Therefore, EPA may have actually understated, not overstated, the benefits of this rule.

Some commenters argued that EPA, in the proposal, improperly failed to discount benefits to be derived from the rule, and in support documents for a final rule, only discounted benefits until the time of the exposure that results in the cancer rather than until the occurrence of the disease. Other commenters argued that EPA should not discount benefits, stating that discounting the benefit of saving human life is inappropriate methodology for this rulemaking.

This final rule provides estimated benefits both with and without discounting. Arguments can be made that estimating benefits without discounting is preferable in cases like this one where the primary benefits derived is the avoidance of human cancer cases. However, arguments also can be articulated supporting the discounting of benefits. EPA believes that if benefits in the form of cancer-cases-avoided are to be discounted, they are properly discounted to the time when risk is reduced or avoided. Since the benefit of a regulation to control a hazardous substance occurs at the time of the reduced exposure, EPA has included that the appropriate period over which to discount is until the time review of applicable literature and an examination of the inherent biases and features of other approaches.

3. *Small businesses.* EPA has, pursuant to section 6(c)(1)(D) of TSCA, also analyzed the economic impact of this rule on small businesses. The rule will not have a significant effect on small businesses because there are few such businesses affected by the rule and individual company producer losses are not expected to be substantial since capital equipment for the production of asbestos-containing products has little remaining useful life, is inexpensive, or can generally be converted at low cost to manufacture of alternative products. A small fraction of the manufacturers, importers, and processors subject to this rule are small producers and some could be adversely affected by the rule. In addition, a number of small governments may be affected by the ban of some asbestos products, for example A/C pipe. However, the economic impact of this rule is generally spread widely throughout the economy and any concentrated effect will not be focused on specific market sectors or on small businesses.

4. *Evaluation of the rule's economic impact.* The overall costs of this rule are significant. However, the overall benefits of the rule are also significant, although many of the benefits cannot be easily quantified.

The analysis performed to ascertain the economic consequences of the rule likely overstates the costs of the actions. However, the analysis points out several important factors: (1) The societal benefit, or "essentiality," of asbestos has decreased, and continues to do so, as asbestos consumption declines and substitutes for the mineral are developed for many applications; (2) most of the costs associated with the rule are short-term and spread over a relatively large population; (3) the continued development of price- and performance-comparable substitutes for asbestos indicates that the rule will not lead to either dramatic increases in consumer prices or decreases in the availability of products affected by this rule; and (4) the producer and consumer costs imposed by this rule are offset by the rule's benefits (e.g., cancer-cases-avoided, medical costs, and lost productivity avoided), although many of these benefits are either difficult to quantify or to express in monetary terms.

EPA, therefore, finds that, under the standards of section 6 of TSCA, the costs of the rule to be reasonable [illegible] illnesses that would occur if the actions in this rule were not taken.

E. Other Options Considered

Section 6 of TSCA requires EPA to select the least burdensome means to reduce an unreasonable risk. This Unit describes EPA's evaluation of options that would reduce or eliminate the unreasonable risk to human health posed by exposure to asbestos. Further responses to comments on this subject can be found in the Response to Comments document.

The options considered include the one selected for the final rule, a staged-ban of the manufacturing, importation, processing, and distribution in commerce of a number of categories of asbestos products. EPA selected a staged-ban for this final rule rather than one of the other regulatory options discussed in the proposal or identified in comments because these other options would either fail to adequately reduce the unreasonable risk posed by asbestos exposure or impose an excessive burden. Conversely, the final rule's staged-ban approach prohibits, at different times, the manufacture, importation, processing, or distribution in commerce for uses of asbestos that pose an unreasonable risk. Timing of these bans is based largely on the availability of suitable available or anticipated non-asbestos substitutes for the banned products. Therefore, the staged-ban approach takes into account the potential economic effects of the various bans, while still eliminating the sources of the risk. Other options were discussed in the proposed rule or identified in comments, but were not selected for the reasons described below.

Under two proposed rule alternatives, some product categories would be banned soon after the effective date of the rule and the remaining product categories would be "phased down." This would be accomplished by instituting a permit system which would create limits on the U.S. mining of asbestos and the importation of asbestos and asbestos-containing products. These limits would be based on previous volumes of the affected activity and would be managed by a system of issuing permits allowing gradually declining levels of the indicated activities. The permits would be transferrable. This system would, over time, restrict the total amount of asbestos available for use in the U.S.

In the analysis performed for this rulemaking, EPA concluded that a permit system approach would not be the least burdensome means of reducing the unreasonable risk posed by asbestos for all the products analyzed under the rule. Most commenters who rendered an opinion on the issue opposed the permit system options. Commenters stated that the implementation of these options could create significant administrative problems for EPA and industry, particularly in the area of imported asbestos products. EPA found that implementing the proposal's permit system options for all of the product categories in the rule would result in high administrative costs. EPA also believes that a permit system involving all of the products affected by this rule would be difficult to enforce.

EPA concluded that some uses of asbestos and some product-life cycle stages pose a substantially greater risk than others and that the permit systems described in the proposed rule would not necessarily control the highest risk exposures (e.g., persons that produced or used products with high levels of asbestos exposure could purchase permits). Therefore, EPA concluded that the proposed rule's permit system would not adequately control asbestos exposure for the rule's product categories.

Despite EPA's conclusion based on currently available information that a permit system approach is not viable for regulating all of the products analyzed under this rule, EPA recognizes that there are a number of inherent conceptual advantages to employing an economic incentive approach in regulating the risks posed by chemicals. Therefore, as a follow-up to EPA's review of the applicability of a permit system as a regulatory option in this rule, EPA will perform several extensive analyses of the advantages and disadvantages of using various economic incentive approaches, including marketable permit system alternatives, as possible mechanisms for reducing human health and environmental risks from chemicals. These studies will review in greater detail the viability of employing such approaches under regulatory authorities such as section 6 of TSCA.

One study will focus on economic incentive programs that could be applied under TSCA and other authorities, rather than, for example, concentrating on air-emission issues, as

chemical products would be appropriate candidates for the use of economic incentive approaches under TSCA and other authorities. Factors considered in identifying these criteria will include determining the characteristics of a chemical's market, such as its production and use, that would make the chemical a viable candidate for a permit system rather than a deposit system. The study will also examine these criteria in the context of specific candidate chemical substances.

Another study will analyze administrative problems associated with economic incentive approaches with the aim of devising methods that provide equitable and efficient regulation of these chemical substances. For example, the study will examine issues related to imports which complicate implementation and enforcement of economic incentive approaches. The study will also examine mechanisms to overcome complications caused by these factors and evaluate the type and level of assistance to EPA from other agencies (e.g., U.S. Customs Service) that would be necessary to implement and enforce an economic incentives approach.

Based on the analyses performed during this and other rulemakings, there is a continuum in the risks and benefits associated with product categories. Some product categories on the continuum have some characteristics (e.g., a large number of specialized uses or a lagging rate of substitute development) that may make the products amenable to regulation through use of a economic incentive approach based on the criteria developed in the studies described in the preceding paragraphs. Upon completion of these studies, EPA will review this rule and other rules, based on the identified criteria and on then-available information about products and markets. For example, with respect to this rule, this review could determine whether (1) any product categories not included within the rule's bans should be phased out by use of an economic incentives approach, (2) any products banned in Stage 3 for which a significant number of exemptions are likely might be more efficiently phased out via an economic incentives approach, and (3) substitute development could be more efficiently compelled by an economic incentive approach for any products that are the subject of an active exemption. EPA's review will determine whether economic incentive approach. If, after review of this or any other rule, EPA determines that an economic incentive regulatory approach is warranted for some of the categories, EPA may in the future initiate rulemaking under sections 6 and 8 of TSCA to amend such rules to implement an economic incentive approach.

Even within the stage-ban approach, EPA has considered a number of possible options for the number of stages, the number of years between the stages, and the scheduling of product bans at various stages. The final rule follows the 3-stage ban approach of the proposed rule. EPA has modified the timing of the ban from soon after promulgation and 5 and 10 years after the effective date of the final rule, as discussed in the proposed rule, to 1, 4 and 7 years, respectively, after the effective date of the final rule. This was done because of the passage of time since the proposed rule was published and because EPA's analysis of available data and comments indicates that marked advances have been made in the development of and conversion to suitable substitutes for asbestos in most product areas. The timing for the stages in the final rule are reasonable in terms of the current or anticipated availability of suitable substitutes, based on EPA's analyses. EPA rejected the option in the proposal of a limited 2-stage ban with a TSCA section 8(a) reporting requirement because that option would not sufficiently reduce the unreasonable risk posed by asbestos exposure. In addition, the final rule does not include a ban on the mining and import of bulk asbestos because not all asbestos-containing products are included within the bans on manufacture, importation, processing, and distribution in commerce. However, the risks posed by these activities are expected to decline as the demand for asbestos decreases due to the actions taken in this rule.

Also, in scheduling products for the staged-ban, EPA has analyzed the relative risks posed by the different asbestos-containing products and the probable availability of non-asbestos substitutes. In the rule, the various asbestos products are scheduled to be banned at times when it is likely that suitable non-asbestos substitutes will be available. For example, bans on asbestos-containing brakes pads and drum brake linings are divided into Stage 2 ban on the original equipment market and a Stage 3 ban on the

Summary of Individual Product Categories

This Unit describes EPA's unreasonable risk finding for each individual category of asbestos-containing products identified for this rule. It summarizes for each individual product category available information regarding exposure, individual risk levels, the development of substitutes, the results of EPA's analysis of the costs and benefits of a ban, and other qualitative factors that were considered in EPA's unreasonable risk analysis for each category. These discussions reflect public comments received on these subjects. Further responses to comments on these subjects can be found in the Response to Comments document.

In the product category discussions below, information regarding costs, benefits, and product substitutes is derived primarily from the RIA (Ref. 21), which is discussed in Unit V.D of this preamble. Information regarding exposure levels is derived from EPA's Asbestos Exposure Assessment (Ref. 29), Asbestos Modeling Study (Ref. 30), and Non-occupational Asbestos Exposure Report (Ref. 31), which are discussed in Unit V.A.3 of this preamble.

Based on available information, EPA finds that the manufacture, importation, processing, and distribution in commerce of asbestos for use in each of the following product categories, except those discussed in Unit V.F.1 of this preamble, presents an unreasonable risk of injury to human health. The discussions of EPA's findings, below, summarize: (1) The estimated benefits of the actions taken in this rule for each product category, (2) quantifiable asbestos exposure and lifetime risk levels for the product, (3) the projected availability of product substitutes, (4) a description of qualitative factors that were considered in reaching EPA's unreasonable risk conclusion for the product, (5) the estimated costs of the actions taken, and (6) an explanation of any changes in EPA's approach to regulating the product since the proposal.

The individual risk levels quantified for the product categories that are subject to this rule are very high. An individual lifetime risk level of 10^{-3} or greater has been quantified for many persons who are exposed during the primary and secondary manufacture of most of these products. Some other phases of these products' life cycles also result in very high levels of individual risk. An individual lifetime risk level of cancer during their lifetime as a result of the exposures. EPA considers the risk levels quantified for this rule for asbestos exposures to pose a substantial concern. EPA also believes that the risk levels quantified for this rule represent an underestimate of the actual risk posed by asbestos exposure from these products. A number of exposures to asbestos and the resultant risks, for example, the risks posed by incremental increases in environmental loading caused by the continued manufacture and importation of the asbestos products banned by this rule, are believed to be significant, but could not be quantified for purposes of this rule, often because of limits in exposure monitoring technology. Despite this "cautious" approach to estimating risk, the exposure and risk that can be quantified are sufficient to make an unreasonable risk finding for purposes of this rule.

The costs and benefits cited below include assumptions regarding anticipated declines in substitute prices (discussed in Unit V.D of this preamble) and exposures estimated by analogy for recognized, but unquantifiable, exposures (discussed in Unit V.A.3 of this preamble). EPA believes that this approach presents a prudent, representative analysis of the costs and benefits of the actions taken in this rule with some reasonable adjustments made for unquantifiable exposures or market changes. However, even if these assumptions are not used, EPA has concluded that the continued manufacture, importation, and processing of the asbestos-containing products that are identified in the rule poses an unreasonable risk of injury to human health.

a. *Felt products.* This grouping consists of the flooring felt, roofing felt, and pipeline wrap product categories. All of these categories will be banned in Stage 1. The benefits (in terms of cancer-cases-avoided) of the actions taken in this rule on these product categories are set forth in the following Table XI:

TABLE XI—CANCER-CASES-AVOIDED FOR ASBESTOS FELT PRODUCTS

Product	Discount rate	
	3 percent	0 percent
Flooring felt	0 [1]	0 [1]
Roofing felt	1.21	1.51
Pipeline wrap	2.31	2.86

[1] No current U.S. manufacture or import.

product installation, repair, removal, and disposal. Quantifiable lifetime risks for these products from occupational exposure ranges from an average of 7×10^{-4} for secondary manufacture of flooring and roofing felt to an average of 2.5×10^{-3} for the primary manufacture of roofing felt. EPA estimates that as many as 1,652 workers may be exposed to asbestos during the installation and removal of roofing felt, incurring individual risks comparable to those for manufacturing. These exposure estimates do not take into account high peak exposure to which homeowners or others may be unknowingly subjected during removal or repair of these products. EPA determined that the accurately quantifying these exposures and the resultant risks would be difficult and that sufficient other exposure and risk information is available regarding these products to make a finding of unreasonable risk.

Effective substitutes currently exist for all three of these product categories. These products are largely no longer produced in the U.S., and flooring felt is no longer imported in this country. In the proposal, flooring and roofing felt would have been subject to the Stage 1 ban and pipeline wrap would have been banned at Stage 3 or covered by the permit system. However, EPA received comments indicating that the product categories are not easily distinguishable from one another and that suitable substitutes are currently available for pipeline wrap. EPA therefore concluded that a Stage 1 is appropriate for all three product categories.

The total cost of the actions taken on these product categories are set forth in the following Table XII:

TABLE XII—COST OF THE RULE FOR ASBESTOS FELT PRODUCTS

Product	Total cost in $ million, discounted at 3 percent
Flooring felt	[1] 0
Roofing felt	7.31
Pipeline wrap	1.07

[1] No U.S. manufacture or import.

EPA has concluded that a Stage 1 ban is appropriate for these product categories for the following reasons: (1) Relatively high quantifiable exposure and individual risk levels exist for these products; (2) these products pose a high potential for ambient release during a number of life cycle stages, for example,

potentially subject to uncontrolled ~~posures during removal and repair k: (4) the cost of taking these actions easonable because suitable ɔstitutes exist for all of these products; and (5) while the quantified benefits of banning these products are relatively small, compared to other product categories banned by this rule, these products are likely both to lead to a number of serious exposures that could not be readily quantified for this rule and to contribute significantly to environmental loading.

b. *A/C sheet.* This grouping consists of the flat and corrugated A/C sheet product categories. These categories will be banned in Stage 1. These products were proposed for a Stage 1 ban. The benefits (in terms of cancer-cases-avoided) of the actions taken in this rule on these product categories are set forth in the following Table XIII:

TABLE XIII—CANCER-CASES-AVOIDED FOR A/C SHEET

Product	Discount rate	
	3 percent	0 percent
A/C flat sheet	0.85	1.05
A/C corrugated sheet	0.12	0.14

rimary routes of exposure to ɔestos from these products occur during manufacture, installation, and repair. Approximately 53 workers are exposed to asbestos during primary manufacture of A/C flat sheet. EPA estimates that as many as 735 workers may be exposed to asbestos during the installation, repair, and disposal of A/C flat sheet, and that as many as 109 workers may be exposed during installation and repair of A/C corrugated sheet. Quantifiable risk posed for these products from occupational exposure is estimated to range from an average of 6.2×10^{-3} for the primary manufacture of A/C flat sheet to 6.7×10^{-3} for repair and disposal of flat and A/C corrugated sheet. Quantifiable risk from non-occupational, lifetime exposures to asbestos released during the manufacture of A/C sheet is estimated at 1×10^{-6} for approximately 4,500 people and at greater than 1×10^{-6} for over 200,000 people.

EPA believes that the exposures quantified for these product categories are understated. Ambient release of asbestos occurs due to weathering of these products during outdoor uses. ~~tting, drilling, and sanding take place ɩing secondary processing. [illegible] others may be unknowingly exposed to significant levels of asbestos when they sand these products in preparation for repainting or removing them. Worker exposure estimates for this rule assume compliance with OSHA restrictions, but EPA believes, based on some public comments, that there may be some cutting of A/C products with power saws in violation of OSHA restrictions. Asbestos releases to the ambient air due to weathering of these materials during outdoor uses were not calculated and high peak exposures occurring during cutting or scraping of these products were not quantified for purposes of the rule. EPA determined that accurately quantifying these exposures and the resultant risks would be difficult and that sufficient other exposure and risk information is available regarding these products to make a finding of unreasonable risk.

Effective substitutes exist for all uses of these products. The total costs of the actions taken in this rule for these product categories are set forth in the following Table XIV:

TABLE XIV—COST OF THE RULE FOR A/C SHEET

Product	Total cost in $ million, discounted at 3 percent
A/C flat sheet	2.37
A/C corrugated sheet	0.29

EPA has concluded that a Stage 1 ban is appropriate for these product categories for the following reasons: (1) Relatively high quantifiable exposure and individual risk levels exist for these products; (2) these products pose a high potential for ambient release during a number of life cycle stages; (3) homeowners and workers are potentially subject to uncontrolled, high peak exposures during installation, repair, and removal; (4) the cost of taking these actions is reasonable because suitable substitutes exist for all of these products; and (5) while the quantified benefits of banning these products are relatively small, compared to other product categories banned by this rule, these products are likely to lead to a number of serious exposures that could not be readily quantified for this rule and to contribute significantly to environmental loading.

c. *A/C shingles.* This product category covers roof shingles and siding composed of a mixture of cement and [illegible] (in terms of cancer-cases-avoided) of the actions taken in this rule on this product category is as follows: 0.32 cases if benefits are not discounted and 0.23 cases if benefits are discounted at 3 percent.

Currently, A/C shingles are rarely used in new building construction and are used primarily for replacement, maintenance, and historical restoration. Primary routes of exposure to asbestos from products in this category occur during manufacture, installation, repair, removal, and disposal. Quantifiable risk posed by these products from occupational exposure is estimated to range from a lower bound of $3.7 \times 10^{-[illegible]}$ for installation to an average of [illegible] 6.1×10^{-3} for primary manufacturing. Quantifiable risk from non-occupational, lifetime exposure to asbestos emissions released during manufacturing is estimated at 2.1×10^{-6} for approximately 1,500 people and at greater than 1.0×10^{-6} for approximately 8,600 people. EPA believes that a number of factors contributed to exposure being underestimated for this category. Ambient releases result from weathering of these products and high peak exposures potentially occur during cutting, sanding, scraping, and hammering of these products. EPA is concerned about unknowing, inadvertent high peak exposures for homeowners or others during replacement or repair of existing shingles and siding. Such exposures can result from sanding, chipping, cutting, or other activities that result in substantial fiber release. Asbestos releases to the ambient air due to weathering of these materials during outdoors uses were not calculated and high peak exposures occurring during replacement or repair of these products were not quantified for purposes of the rule. EPA determined that accurately quantifying these exposures and the resultant risks would be difficult and that sufficient other exposure and risk information is available regarding these products to make a finding of unreasonable risk.

The traditional appeal of A/C products is their durability and their ability to be fabricated. A number of non-asbestos products are available that are effective substitutes from the perspective of performance. Suitable substitutes, including wood, aluminum, and vinyl sidings and asphalt, cedar wood, and tile shingles, exist for many applications of the products in this category. However, suitable substitutes

product for Stage 3 rather than Stage 1, ...tginally proposed, to allow for the ...lopment of cost-effective ...stitutes while still addressing risks in a timely manner.

The total cost of the actions taken in this rule for this product category is $23.57 million. EPA believes that this cost estimate may be overstated. This is because the cost analysis for this product category assumed that wood ...stitutes would capture 32 percent of ...C shingle market if the asbestos ...cts were banned. This assumption was made largely because wood is more physically attractive than other substitutes, although it is much more expensive and does not perform significantly better.

EPA has concluded that a Stage 3 ban is appropriate for this product category for the following reasons: (1) Relatively high quantifiable exposure and individual risk levels exist for these products; (2) these products pose a high potential for ambient release during a number of life cycle stages; (3) homeowners and workers are potentially subject to uncontrolled exposures; (4) suitable substitutes exist for many of these products and are likely to exist for others by the time of ...n ban; (5) the cost of taking these ...ions is reasonable, especially in light the assumption made regarding the portion of the market substituted for by wood shingles in the estimate of the costs, the time provided for substitute development, and the level of ambient exposure posed by products in this category; and (6) while the quantified benefits of banning these products are relatively small, compared to other product categories banned by this rule, these products are likely to lead to a number of serious exposures that could not be readily quantified for this rule and to contribute significantly to environmental loading.

d. *Other product categories that are currently out of production.* This grouping consists of the vinyl/asbestos floor tile and asbestos clothing categories. These categories will be banned in Stage 1. These products were proposed for a Stage 1 ban.

These products are no longer produced in the U.S. and are currently imported in, at most, only small quantities. In instances in which these products are still imported, EPA is concerned about the potential for uncontrolled consumer exposure, for ...xample, the sanding, cutting, and removal of vinyl/asbestos floor tile. The fact that these produ...ts are no longer in commerce in the U.S. ...dicates that ... Therefore, the cost of banning these products is minimal.

EPA has concluded that a State 1 ban is appropriate for this product category for the following reasons: (1) Relatively high quantifiable individual risk levels would exist for these products were significant U.S. manufacture or importation to begin again; (2) these products pose a high potential for ambient release during a number of life cycle states; (3) homeowners and workers would be potentially subject to uncontrolled exposures were significant U.S. manufacture or importation to begin again; (4) the cost of banning these products is negligible because there is no current significant manufacture or import of these products and because suitable substitutes exist for them; and (5) these products are included within the ban to ensure that their U.S. manufacture, importation, processing, or import does not resume.

e. *Vehicular brakes.* This grouping includes drum brake linings, disc brake pads and brake blocks used in new and existing motor vehicles. The manufacture or import of 1994 or later model year motor vehicles containing asbestos drum brake linings or asbestos disc pads (hereafter referred to as the original equipment market, or OEM) will be banned in Stage 2. Asbestos brake friction material manufactured, imported, or processed as replacement drum brake linings or disc brake pads for light- and medium-weight (LMV) motor vehicles with brake systems designed to use non-asbestos friction material will also be banned in Stage 2. The manufacture, import, or processing of asbestos brake blocks for heavy-weight (HV) motor vehicles will be banned in Stage 3. In addition, all friction material containing asbestos manufactured, imported, or processed as replacement parts for vehicles designed to use asbestos friction material (hereafter referred to as the aftermarket, or AM) will be banned in Stage 3.

The benefits (in terms of cancer-cases-avoided) of the actions taken in this rule on these product categories are set forth in the following Table XV:

TABLE XV—CANCER-CASES-AVOIDED FOR ASBESTOS VEHICULAR BRAKES

Product	Discount Rate	
	3 percent	0 percent
Drum brake linings (OEM)	6.33	8.38
Drum brake linings (AM)	76.79	106.26
Disc brake pads, LMV (OEM)	0.75	0.99
Disc brake pads, LMV (AM)	11.58	15.85

TABLE XV—CANCER-CASES-AVOIDED FO... ASBESTOS VEHICULAR BRAKES—Co... tinued

Product	Discount Rate	
	3 percent	0 perc...
Brake blocks (OEM & AM)	7.31	10 ...

In the proposal, EPA discussed two approaches for regulating asbestos vehicular friction material, either banning all such material in Stage 2 or via the operation of a permit system. EPA stated that it would consider a class exemption for replacement parts under the proposal's staged-ban option.

Asbestos brake friction products are some of the most widely-used asbestos products and are a source of broadly ranging exposures to asbestos. EPA has quantified exposures to asbestos from the manufacture, installation, use, and repair of brake friction products. During the life cycle of these products, both occupational and non-occupational exposures to asbestos post a lifetime risk of cancer mortality. The populati...n at risk from these products is larger t...n that at risk from any other asbestos product category for which exposure has been quantified for this rule.

Occupational exposure to asbestos from the primary and secondary manufacture of friction products is h...h and affects many people. The 8-hour TWA exposure level quantified for t...e primary manufacture of all friction products is 0.145 f/cc (Ref. 29). The lifetime risk from this exposure is estimated to be 5.0×10^{-3}, with 2,77... workers exposed. The exposure leve... from secondary manufacture is considerably less than from primary manufacture, because secondary manufacture of friction products doe... not involve cutting, grinding, and fitt...ng of brake material. However, the TW... exposure level for secondary manufacture is still high, ranging upward from 0.446 f/cc (Ref. 29). Th... lifetime risk from secondary manufacture ranges from an averag... of 1.6×10^{-3} for drum brake linings to ...n average of 1.9×10^{-3} for disc brak... pads, with 3,033 workers exposed. Quantifiable risk from non-occupat...nal, lifetime exposure to asbestos relea...d during the manufacturing of drum brakes alone is estimated at $1.0 \times ...^{-4}$ for 92,008 people and greater than ... $\times 10^{-6}$ for 2 million people.

Occupational expoure from the installation and repair of asbestos ...rake pads/linings/blocks may result in

and drum brake systems is estimated to ...nge 0.05 f/cc (Ref. 29). The lifetime ... from this exposure is 1.68×10^{-3}. ...re are an estimated 329,000 brake repair facilities where an FTE population of 1,391,000 mechanics may be exposed to asbestos during installation and repair of asbestos brake friction products. Exposure and, thus, risk have not been quantified for the disposal of asbestos brake friction material.

EPA estimated that approximately 13 million do-it-yourself brake installation and repair jobs are done annually by consumers (Ref. 31). Exposure from consumer brake repair varies depending upon the technique used to repair the brakes, whether the repair is done in a garage or outdoors, and other factors. Release of asbestos fibers into the ambient environment resulting from the braking action of asbestos vehicular brakes contributes to the signficant risk of cancer mortality for members of the general population. EPA has quantified the non-occupational exposures from the use of three friction materials: drum brake linings, disc brake pads (LMV), and brake blocks. EPA estimates that the lifetime risk is one in one million for 101 million Americans, on average.

...PA received a large number of ...ments concerning exposure ...sociated with the use of asbestos-containing brakes. Several commenters stated that there is very little risk of exposure to asbestos fibers released from brakes, because the asbestos is transformed to forsterite by the high heat generated from the use of brakes. EPA recognizes that only a small percentage of the asbestos in brakes is eventually emitted into the air. The remainder is either trapped in the brake assembly or is transformed into minerals such as forsterite by the heat of abrasion before release. However, asbestos is definitely released from brakes during brake use. The three studies of brake emissions, which EPA relied upon in developing its exposure estimates, all used electron microscopy to obtain positive mineralogical identification of the emissions' components. The studies found that between 0.017 and 0.216 percent of the material released was asbestos. Although these percentages are quite small, the total amount of asbestos released from brake use (approximately 7 tons per year) is large because the total volume of brake emissions is large.

There are devices which can control release of asbestos during the ...ormal replacement of brakes. These devices, the enclosed cylinder/HEPA vacuum system and the compressed air/ solvent spray system, are recommended, but not required, by OSHA as means for reducing exposures below OSHA's PEL and action level (Ref. 16). The OSHA standard prohibits the use of air hoses during brake repair. Under ideal conditions these controls may significantly reduce exposure. However, controls must be used consistently to be effective and additional exposures can be created during the disposal of asbestos-contaminated solvent or during replacement of HEPA vacuum filters. If the devices are used properly and exposures are reduced to the PEL or lower, EPA believes that the residual exposure can still result in an unreasonable risk. The efficacy of controlled use as an approach to risk reduction is discussed in more detail in Units V.A. 3 and V.E. of this preamble.

Several commenters stated that EPA should not ban asbestos friction products, arguing that engineering controls can provide sufficient protection from the risks of asbestos exposure. EPA believes that while these controls, if used consistently, can reduce exposure to the OSHA PEL, EPA's analysis indicates that exposure at levels even below OSHA's 0.1 f/cc action level still pose significant risk. In computing workplace exposures, EPA assumed compliance with the OSHA standard when actual monitoring data was either unavailable or above the OSHA PEL. For example, the EPA exposure data for brake repair facilities estimate asbestos exposure at 0.05 f/cc (Ref. 29). Even at this level, which is one half the OSHA action level of 0.1 f/cc, EPA, using the risk table in the 1986 OSHA rule, calculates a lifetime risk of 1.8×10^{-3}. Given the substantial lifetime risk and EPA's concern regarding the consistent and proper use of these controls by mechanics (Ref. 50), EPA does not believe that use of controls during brake repair will sufficiently reduce risk.

Additionally, a controlled use approach as an alternative to a ban of asbestos in friction material would not reduce general population exposures to asbestos originating from brake use. In addition, these controls would not typically be available to the estimated 13 million consumers who annually perform do-it-yourself brake jobs (Ref. 31).

EPA has assessed the current availability of non-asbestos friction material for disc and drum brake system in various vehicle weight classes. This assessment can be found in Volume III of the Regulatory Impact Analysis (Ref. 21). To summarize briefly, use of non-asbestos friction material in recently-manufactured vehicles is increasing rapidly. There is nearly complete substitution for asbestos in disc pads used in recently-manufactured motor vehicles. Almost 100 percent of disc pads for newly manufactured heavy-weight vehicles are asbestos-free. For light- and medium-weight vehicles, 85 percent of the disc pads used in new vehicles are asbestos-free. Several producers estimate that by 1990, 90 to 100 percent of the disc pads for new vehicles will be asbestos-free.

Evidence also indicates that significant progress is being made in the development of substitutes for drum brake linings used in recently-manufactured motor vehicles. As noted by some commenters, substitution for asbestos in drum brake linings and brake blocks in new model vehicles appears to be more difficult than for disc brakes in new model vehicles. However, according to some commenters, much research is ongoing and some substitutes are currently available for drum brakes in newly-manufactured vehicles. Several commenters stated that asbestos substitutes are more readily available than EPA has estimated and that full conversion to asbestos-free brakes in newly-manufactured vehicles would be feasible in the near future. Some commenters pointed to the rapid conversion to asbestos-free brake friction material in the European market as proof of the technical feasibility of banning similar products in the U.S. For example, Sweden, the Federal Republic of Germany, Switzerland, Austria, Denmark, and Norway have either banned or are phasing out the use of asbestos friction material.

Primary substitutes include semi-metallic materials for disc brakes and non-asbestos organic materials (including fiberglass, para-aramid, mineral fibers; steel wool and fibers, and resins) for drums. Opinions from commenters vary greatly concerning ...e availability of effective and economic...l substitutes for brake friction products. While some commenters stated that there are substitutes currently availa...le for most, if not all, brake friction products, other commenters felt that substitutes would be available within 5 to 10 years of the time of the proposa... for most, if not all, brake friction products. Several commenters were more pessimistic about the future availability of substitutes. Other commenters indicated that adequate asbestos-free brake blocks may be difficult to develop for new model

weight of the vehicle puts greater demands on the braking system.

Many opinions were offered in comments and elsewhere about the progress being made toward the use of asbestos-free brake friction material. EPA did not receive analytical or quantitative data from commenters documenting technical difficulties encountered regarding substitution for asbestos in brake friction material. EPA acknowledges the inherent research and development variability associated with technological innovation. As a result, EPA decided to delay the ban on asbestos disc brake pads and drum brake linings in new light- and medium-weight vehicles and in replacement disc pads and drum brake linings for light- and medium-weight vehicles with brake systems designed to use non-asbestos until Stage 2. Manufacture, import, and marketing of brake blocks for use in either new heavy-weight vehicles or as replacements will not be banned until Stage 3. These dates are within the range of time frames suggested by comments and the American Society of Mechanical Engineers (ASME) expert panel's recommendations for new vehicles (Ref. 40). Specifically, ASME stated that "* * * at the present rate of technical progress, most new passenger vehicles will be equipped with totally new non-asbestos frictional systems by 1991, and most light trucks and heavy trucks with S-cam brakes, by 1992. However, a few low-volume new vehicle applications may not have acceptable non-asbestos friction materials at that time. Heavy truck wedge brake blocks, medium drum brake linings and many off-road vehicle brake linings may not be developed by 1992." Comments submitted to EPA in 1986 in response to its proposal described various lead-time frames that would be necessary to permit the transition to non-asbestos OEM friction materials. These schedules varied between 2 and 10 years. The most common time frame pointed to was 4 to 6 years for most friction products, with special considerations given to brake blocks and disc pads for heavy vehicles. Several commenters requested time frames in excess of 10 years be considered for these heavy vehicles. Keeping in mind that these comments were made in 1986, EPA believes that it is reasonable to assume that OEM brake friction material for light- and medium-weight vehicles and heavy-weight vehicles can be asbestos-free by the dates prescribed in the rule.

Commenters generally agreed that it is easier to develop replacement asbestos-free friction materials for use in vehicles that are intentionally designed to use such materials than it is to develop asbestos-free friction materials for use as aftermarket replacement products in vehicles currently in use that have brake systems designed to use asbestos. A number of commenters addressed the current availability and efficacy of asbestos free aftermarket replacements for vehicles designed to use asbestos friction materials. Some of these commenters maintained that substitutes are currently available for all friction material aftermarket applications. Some of the major producers of brake friction products, including aftermarket friction materials, no longer produce asbestos brake friction material. One commenter stated that asbestos replacements for heavy-weight vehicles are no longer available from reliable U.S. producers. On the other hand, some commenters stated that it would be infeasible, primarily for economic reasons, to develop effective asbestos-free substitutes for the aftermarket, while others indicated, in 1986 comments, that it would take 10 years to develop adequate aftermarket substitutes. These comments about the technical infeasibility of replacing asbestos friction material with asbestos-free friction material were not based on performance data, but rather theoretical discussions and anecdotal information. Due to the lack of analytical information, EPA cannot estimate quantitatively the rate at which asbestos-free substitution is occurring for the aftermarket products. EPA has delayed until Stage 3 the ban on aftermarket friction materials manufactured, imported, or marketed for use in brake systems designed to use asbestos. EPA believes this delay will permit time to address technological difficulties in developing aftermarket substitutes for vehicles designed to use asbestos. By the effective date of the Stage 3 ban, many of the vehicles on the road will be asbestos-free because of the Stage 2 ban and the prior manufacture of asbestos-free vehicles. EPA believes that it is important to force technology to develop asbestos-free replacements as rapidly as possible particularly in light of the fact that many commenters have pointed to the current availability of asbestos-free replacement linings/blocks and have noted rapid progress in the development of alternatives to asbestos friction materials. EPA plans to monitor the progress of substitute availability for aftermarket products, thus encouraging substitute producers and aftermarket manufacturers to report progress or technological difficulties that may necessitate modification of certain provisions of the ban.

Comments described technological replacement difficulties or economic disincentives associated with developing asbestos-free friction material replacement parts for older and antique cars or for specialty cars such as race cars. EPA will consider a class exemption for such vehicles if one is requested.

Some commenters stated that a ban on asbestos use in the aftermarket for brake systems designed for asbestos friction products will compromise the performance of braking systems designed for asbestos brakes. Some commenters went so far as to predict that there may be more deaths in vehicle accidents due to poor performance caused by premature substitution than from the health risk posed by continued use of asbestos in friction products. Several commenters stated that EPA has ignored the impact of an asbestos friction product ban on highway safety and that risks associated with substitution should have been considered as part of the rule's analysis of costs and benefits. One commenter urged EPA to confer with the National Highway Traffic Safety Administration (NHTSA) regarding possible motor vehicles safety considerations associated with use of non-asbestos friction materials in vehicular brake systems. EPA and NHTSA have met and discussed potential effects on vehicle safety if asbestos friction materials were banned (Refs. 61, 62, and 63). NHTSA has no objection to the staged ban and technical review approach adopted for this rule (Ref. 28).

Evaluation of the safety concern regarding asbestos substitution voiced by these commenters is complicated by the fact that there are no federal safety standards governing the performance of aftermarket brake friction products. While the NHTSA promulgated safety performance standards in 1968 for brakes in new vehicles, no similar standards exist for replacement parts. NHTSA received two petitions requesting that NHTSA promulgate safety standards for the aftermarket. These petitions noted the present use of inferior grade asbestos and non-asbestos friction materials and the inadvertent mismatching of aftermarket friction material to individual brake systems; the petitioners argued that there is a compelling need to establish performance standards for the aftermarket. NHTSA granted a petition requesting that NHTSA propose a standard requiring that all heavy truck brake linings be rated and marked in