APTD-1503

PLAINTIFF'S EXHIBIT

UC-2968

BACKGROUND INFORMATION ON THE DEVELOPMENT OF NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS: ASBESTOS

A20232

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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ACL Doc 17822 · Page 1 of 33 asbestosclaims.law/library/17822/1

GENERAL PROVISIONS

The primary purpose of the general provisions is to set forth the administrative requirements related to compliance with the standards. Changes from the proposed regulations were made to improve and clarify the general provisions. The general provisions are summarized and explained below, with changes from the proposed regulations noted.

202 Applicability of the Standards

The standards are applicable to new, modified, and existing sources. New or modified sources must comply with the standards upon beginning operation. Existing sources must comply within 90 days after final promulgation of the standards, unless granted a waiver of compliance.

Approval for Construction or Modification

204, Prior to commencement of construction of a new source or modification of an existing one, a source owner is required to obtain the approval of the Administrator. The application must include, among other information, emission estimates in sufficient detail to permit assessment of their validity. The Administrator is required to approve or deny such application within 60 days after submission of sufficient information to evaluate the application.

Notification of Startup

The proposed regulations did not include provisions specifically requiring new or modified sources to notify the Administrator of their startup date before beginning operation. Such a provision, requiring

A20233

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ACL Doc 17822 · Page 2 of 33 asbestosclaims.law/library/17822/2

that the Administrator be notified 30 to 60 days in advance of startup, has been added.

Waiver of Compliance

Under the provisions of Section 112(c)(1)(B)(ii) of the Act, the Administrator may grant existing sources waivers of compliance for up to two years after the effective date of a standard. The conditions for such a waiver are that such time is necessary to install controls, and that steps are taken during this period of the waiver to assure that the health of persons is protected from imminent endangerment.

The general provisions outline in detail procedures for application for waivers, and for approval or denial of such applications. There is no regulatory deadline for applications for a waiver of compliance. However, continued operation in violation of a standard beyond the 90th day after final promulgation is a violation of the Act unless a waiver has been obtained. For this reason, the owner or operator of an existing source should submit the request within 30 days after final promulgation of the standards.

The Administrator has no authority to waive compliance for any period exceeding two years from the effective date of the standard. However, the President may exempt any new, modified, or existing source from compliance with the standards for a period of up to two years, provided technology is not available to implement the standards and the operation of such source is required for reasons of national security. The President may grant exemptions for additional periods of two years or less.

UCC 016404

A20234

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ACL Doc 17822 · Page 3 of 33 asbestosclaims.law/library/17822/3

Source Reporting

The proposed regulations required existing sources to submit certain information to the Administrator within 30 days after the effective date of the standards. The promulgated regulations allow 90 days for submission of the information and a form was added to the regulations as Appendix A to help simplify the reporting. The form also includes the information a source must submit when applying for a waiver of compliance and a waiver of initial emission testing.

Requirements for Emission Testing

The proposed regulations required all sources of mercury and beryllium to test their emissions within three months of the effective date and at least once every three months thereafter. Comments received indicated that this provision imposed an unnecessary, and expensive burden on a large number of small sources.

The promulgated regulations require the sources covered by the standards to conduct an initial stack test within 90 days after final promulgation; however, the Administrator may waive the requirement under certain conditions. Periodic emission testing (of sources which have already been certified to be in compliance) is not required by the promulgated standards. The Administrator may require any source to test its emissions at any time under the authority of Section 114 of the Act. Compliance will be monitored by regular inspection of the sources unless such inspection indicates the need for a stack test.

A20235

UCC 016405

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ACL Doc 17822 · Page 4 of 33 asbestosclaims.law/library/17822/4

Upon request, the Administrator may waive the initial stack test requirement when a source has requested a waiver of compliance, or has submitted sufficient information to demonstrate that it is in compliance with the applicable standard. Some very small sources may be able to demonstrate that they could not reasonably emit enough of a pollutant to exceed the applicable standard, even if operating completely uncontrolled. Sources which are granted a waiver of emission testing during the period of a waiver of compliance will be required to demonstrate compliance by an initial stack test at the end of the waiver of compliance.

These changes in the emission testing requirements were made primarily in response to comments from small beryllium users. As revised, the requirements are applicable to beryllium and mercury sources.

Source Sampling and Analytical Methods

Three terms are associated with determining compliance by means of source testing: (1) reference method, (2) equivalent method, and (3) alternative method. Reference methods are the preferred methods of sampling and analyzing used to determine compliance. The reference methods for beryllium and mercury are included in appendix B to the regulations. An equivalent method is any method of sampling and analyzing which has been demonstrated to the Administrator's satisfaction to have a consistent and quantitatively known relationship to the reference method under specified conditions. An alternative method is any method of sampling and analyzing which does not meet all the criteria for equivalency but which can be used in specific cases to determine compliance. Alternative methods may be approved

A20233

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ACL Doc 17822 · Page 5 of 33 asbestosclaims.law/library/17822/5

by the Administrator for source testing; however, in cases where determinations of compliance using an alternative method are disputed, use of the reference method or its equivalent will be required by the Administrator.

The reference methods for beryllium and mercury have been used successfully in five tests (beryllium) and seven tests (mercury), respectively. Results from these tests have been reliable, precise, and apparently accurate. Neither method has been submitted to rigorous testing, although EPA has performed limited interlaboratory comparisons and found the methods to have relative standard deviations of 10% to 15%.

A number of comments were received which criticized the complexity of the sampling procedures in the beryllium and mercury reference methods (i.e. the requirements for isokinetic sampling, and the use of wet impingers). Simpler methods could have been adopted, but only with a drastic reduction in accuracy and precision. The characteristics of the gas effluents from the affected mercury and beryllium sources warrant the complex sampling procedures.

The reference method for beryllium is the only beryllium sampling procedure in use that uses both a dry filter and wet impingers. This is required because significant quantities of beryllium have been detected in the wet impingers. During EPA test runs, an average of 39.9% of the total collected beryllium passed through the dry filter and was collected in the wet impingers. From this, EPA has concluded that nonfilterable beryllium is being generated by many sources and

A20237

UCC 016407

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ACL Doc 17822 · Page 6 of 33 asbestosclaims.law/library/17822/6

the reference method is substantially more accurate than any other procedure in use.

Recognizing the complexity of the beryllium reference method, an alternative method for beryllium has been approved in the promulgated regulations. The approved alternative method can take many different configurations, each of which would probably yield somewhat different results. The method uses equipment and techniques that are widely accepted, albeit not necessarily as accurate or precise as those specified in the beryllium reference method. The beryllium emissions from a large number of sources covered by the standard are significantly below the 10 gram per day emission limit. Using the alternative method to determine the beryllium emissions from the sources whose emission rate is very low will give results sufficiently below the 10 gram per day emission limit that it will be clear that the sources are complying with the standard. Where the alternative method gives results which indicate that the beryllium emissions from a source are close to the 10 gram per day limit, the Administrator will require that the reference method be used to clearly determine if the source is complying with the standard.

Many comments on the proposed methods were addressed to the possible inaccuracy of mercury analysis below concentrations of 1 $\mu g/m^3$. However, the lowest concentration measured in a stack test to date is 3700 $\mu g/m^3$; the highest is 200,000 $\mu g/m^3$. While mercury analysis may be inaccurate at the relatively low levels encountered in ambient monitoring, its accuracy is adequate for stack testing to monitor

A20230

UCC 016408

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Standa... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 7 of 33 asbestosclaims.law/library/17822/7

compliance with the hazardous pollutant emission standards. The major threat to accuracy in the concentration ranges generally characteristic of effluent streams is the potential for laboratory contamination; the reference method has been written to emphasize the precautions which must be followed to avoid such contamination.

Mercury sampling trains were operated with three wet impingers and one dry filter either before or after the wet impingers. Separate analysis of the three wet impingers detected mercury in a ratio of 89/10/1, with a following dry filter capturing less than 0.1% of the total mercury collected. This suggests a collection efficiency of 99.9% for the mercury train.

The Administrator has not approved an alternative method for mercury because there is no known method available that is easier to use than the reference method and gives reliable results. The standard for chlor-alkali plants, which are the most difficult to test, allows a source to follow certain housekeeping and maintenance practices to avoid the source testing problems. This is explained in more detail later in this report.

A2023

UCC 016409

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ACL Doc 17822 · Page 8 of 33 asbestosclaims.law/library/17822/8

ASBESTOS

The following information augments that given in the preamble to the promulgated regulations.

Health Effects

The proven or suspected effects of asbestos minerals on human health include nonmalignant changes, such as pulmonary and pleural fibrosis, and several types of malignancy, notably of the lung, pleura, and peritoneum. Nearly all the positive evidence of an association between asbestos and human disease has come from studies of occupational groups. With few exceptions, these have consisted of workers engaged in the mining and milling of asbestos, the manufacture of asbestos-containing products (such as textiles and construction materials), and the application and removal of asbestos-containing insulating materials.[53]

Asbestosis, or asbetotic pneumoconiosis, was the first clearly demonstrated adverse effect of asbestos in man.[53] Many persons exposed to asbestos dust develop asbestosis if the dust concentration is high or the duration of exposure is long.[1-7] There is evidence that persons experiencing intense intermittent exposures also are at risk.[52]

A large number of studies have shown that there is an association between occupational exposure to asbestos and a higher-than-expected incidence of bronchogenic cancer.[8-30] Some studies[9] have demonstrated differences in the degree of risk among different occupationally

UCC 016410

A20249

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Standa... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 9 of 33 asbestosclaims.law/library/17822/9

exposed groups, probably related to dose, as well as to other factors.

Asbestos also has been identified as an etiologic factor in mesothelial malignancies. In 1960, there was a report[47] of 33 cases of pleural mesothelioma in a part of South Africa important for crocidolite mining. For all but two of the patients, the authors discovered likely asbestos contacts two decades or more earlier. However, only 17 of these had had occupational exposure. The remainder had lived near mines or had had household contacts. A large number of studies providing additional information supporting a relationship between asbestos and malignant mesothelioma have been reported since 1960.[30-46,48] Included among them are reports of mesothelioma associated with non-occupational exposures in the neighborhood of asbestos sources.[38,42,47,48] An outstanding feature has been the long period, commonly over 30 years, between the first exposure to asbestos and the appearance of a tumor.[49,50] This disease may occur after a very limited exposure; furthermore, it may occur at exposure levels lower than those required for prevention of radiologically evident asbestosis.[51,52,69]

It has been suggested that the various types of asbestos differ in their relative pathogenicity, but neither laboratory nor epidemiological data are conclusive on this question.[53] All the commercially used forms of asbestos can produce asbestosis. In only relatively few studies has the incidence of malignancies been determined in groups with exposures to a single asbestos type.[53] Where there are data that suggest a lower risk, as in the chrysotile-producing areas of Canada[9,41] and Italy,[54] there are possible explanations for the difference other than

A20241

UCC 016411

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 10 of 33 asbestosclaims.law/library/17822/10

asbestos type. The high incidence of mesothelial tumors in the North Western Cape area of South Africa has led to the suggestion that crocidolite is unusually hazardous, but mesotheliomas have been rare in the Transvaal, where crocidolite is produced also.[55,56] Although one investigator[44] found many mesotheliomas in insulation workers whose exposures had been largely to chrysotile and amosite, others[56,57] have not found the incidence of mesothelioma high in areas where amosite or chrysotile were mined and milled. All epidemiologic studies that appear to indicate differences in pathogenicity among types of asbestos are flawed by their lack of quantitative data on cumulative exposures, fiber characteristics, and the presence of cofactors. The different types, therefore, cannot be graded as to relative risk with respect to either asbestosis or neoplasia.[53]

Direct and indirect evidence that persons other than those working directly with asbestos minerals are being exposed to asbestos is of several types. For example, asbestos fibers can be demonstrated in the lungs of persons not occupationally exposed. In a few geographic areas, pathologic changes regarded as representing a reaction to asbestos, e.g., pleural calcification, have been found in populations with no history of occupational exposure. Asbestos fibers have been shown to be present in ambient air.[53]

Evidence is strong that most human lungs harbor thousands or millions of fibers. Some of these are chrysotile asbestos,[52] and other types of asbestos minerals are probably there also. In most persons not occupationally exposed to asbestos, the numbers of fibers

A20242

UCC 016412

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand...
ACL Doc 17822 · Page 11 of 33
Published by AsbestosClaims.Law
asbestosclaims.law/library/17822/11

are relatively small, compared with the numbers found in the occupationally exposed.[52,58] Although there appears no doubt that asbestos fibers are present in many human lungs, there are sources of airborne fibers other than asbestos.[52,59,60] Some are probably derived from the burning of leaves and plant products, such as paper, wood, and coal.[53] Man-made (mostly vitreous) fibers have also been identified in the sediment isolated from human lungs.[53] Talc, often used generously as a dusting powder, may contain a significant amount of tremolite asbestos fibers,[53] as well as chrysotile and anthophyllite. Information is sparse concerning possible increase of fibers in lungs with increasing use of asbestos and concerning the existence of significant differences between urban and rural populations.[53] A comparison of lung tissues obtained in 1934 and 1967 revealed no significant increase in the proportion containing ferruginous bodies[58] (a term used to describe coated fibers found in lung tissues, without regard to whether the fibers are asbestos or other material). This suggested that, despite increasing use of asbestos in New York between 1934 and 1967, fibers of a type producing ferruginous bodies had not been increasing at a corresponding rate. However, there has also been a report of an increase over each decade in asbestos bodies in samples of lungs from persons who died in London in 1936, 1946, and 1956.[58] The significance of the presence of ferruginous bodies (and, in particular, of asbestos fibers and fibrils) in a large percentage of the lungs of adult urban dwellers is as yet unknown.[52] Annual world production of asbestos has risen from 50,000 tons at the turn of this century to 4,000,000 tons[62] at

A20243

UCC 016413

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ACL Doc 17822 · Page 12 of 33 asbestosclaims.law/library/17822/12

present.

Studies have implicated asbestos in the development of malignancies in persons not occupationally exposed; i.e., in development of diffuse mesothelioma, a tumor that is uncommon but has been the subject of special attention in recent years.[48,53] Many of the mesotheliomas reported in South Africa[47] were attributed to household and neighborhood exposures in a crocidolite-producing area. Although nonoccupational, these exposures have been described as substantial.[45] Among 76 patients with mesothelioma diagnosed in London Hospital from 1917 to 1964, 31 (40.8%) had occupational exposures to asbestos, 9 (11.8%) had a relative who worked with asbestos, 11 (14.5%) had neither of those backgrounds but had lived within a half-mile of an asbestos source, and 25 (32.9%) had no known contacts.[61] Of 42 persons with mesotheliomas reported in Pennsylvania, 10 had worked in asbestos plants, 8 lived or worked close to an asbestos industry, and 3 were members of families that included asbestos workers; in 11, no history of exposure could be obtained, and the remaining 10 had questionable random exposures.[38] While no quantitative conclusions can be drawn from these studies, which present serious methodologic problems to the epidemiologist, they suggest a risk in household contacts and in residence in the immediate neighborhood of an asbestos plant. There appear to be different levels of risk in different types of occupational exposures, and some of these may be reflected in corresponding household and neighborhood experiences.[53]

In summary: Any of the commercially used asbestos minerals, when inhaled in sufficient numbers, as in uncontrolled occupational

A20244

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 13 of 33 asbestosclaims.law/library/17822/13

exposures, can cause disabling fibrosis of the lungs. An association between occupational exposures to asbestos and bronchogenic carcinoma has been established, but the dose-response relation and the role of cofactors other than smoking[46] have not been defined. Evidence of a causal association between some but not all exposures to asbestos fibers and diffuse malignant mesotheliomas of the pleura and peritoneum is substantial. Although the different types of asbestos differ in some of their biologic effects, no type can be regarded as free of hazard.[53]

The demonstration of ferruginous bodies, similar to those found in asbestos workers, in a large proportion of randomly selected lung specimens in many parts of the world is presumptive evidence that persons with no occupational contact may have inhaled and retained asbestos. Proof has come in some areas with positive identification of chrysotile asbestos fibers in the lungs.[52] Analyses of community air for asbestos have been too limited to define the sources, concentrations, and distribution of fibers in the environment. The fiber concentrations that have been demonstrated in ambient air are small, compared with those in industry, but data are inadequate for definitive comparisons.[53]

Industrial experience indicates that there is no likelihood of significant asbestosis in nonoccupational exposures.[53] However, any carcinogen (initiator) must be assumed, until otherwise proven, to have discrete, dose-dependent, irreversible and cumulative effects on cells that are transmissible to the cell progeny. Thus, initiation of

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A2024

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ACL Doc 17822 · Page 14 of 33 asbestosclaims.law/library/17822/14

malignancy following single small exposures to asbestos is possible, but of a low probability. With frequent or chronic exposure and a low dose rate, the probability of initiation of malignancy is increased. Yet, even under optimal conditions of cell proliferation (in the presence of promoters) these malignant transformations do not lead to instantaneous cancer, but remain latent, often for decades.[51]

The major potential for risk appears to lie in those with direct occupational contacts, indirect occupational contacts, household contacts, or residence in the immediate neighborhood of an asbestos source; and even there, the actual risk is poorly defined. The appearance of a gradient of effect in such groups, however, suggests that there are levels of inhaled asbestos without detectable risk,[53] so that even with respect to neoplasms, consideration must be given to the concept that an inverse relationship exists between dose rate and the latent period; as the dose rate becomes progressively lower, the latent period may approach or exceed the life span of exposed individuals.[51] It is not known what range of respirable airborne asbestos fibers will ultimately be found to have no measurable effects on health. At present, there is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity.[53]

It is probable that the effects of asbestos inhalation are cumulative; that is, low-level and/or intermittent exposure to asbestos over a long time may be equally as important in the etiology of asbestotic disease as high-level and/or continuous exposure over a shorter period. On the other hand, the available evidence does not

A20243

UCC 016416

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ACL Doc 17822 · Page 15 of 33 asbestosclaims.law/library/17822/15

indicate that levels of asbestos in most community air cause asbestotic disease. Taking both these considerations into account, and in light of the known serious effects of uncontrolled inhalation of asbestos minerals in occupational situations and the uncertainty as to the shape and character of the dose-response curve for man, the Administrator has made a judgment that, in order to provide an ample margin of safety to protect the public health from asbestos, it is necessary to control emissions from major man-made sources of asbestos emissions into the atmosphere, but that it is not necessary to prohibit all emissions. In making this judgment, the Administrator relied largely on the National Academy of Sciences' report on asbestos[53] which reached similar conclusions.

Development of the Standard

An important consideration in the development of the asbestos standard was the former lack of satisfactory methods of sampling, identifying, and measuring airborne asbestos, which could be used to establish dose-response relationships. Only within recent years have methods for determining concentrations of fibers for industrial hygiene purposes been standardized;[51,63,66,68] they use samples collected or membrane filters in which fibers are counted with phase contrast illumination. Electron microscopic methods give a much more complete indication of the total fiber content of the air; but when the need for fiber identification is included, they are tedious and relatively expensive for routine use.[51]

A20247

UCC 016417

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ACL Doc 17822 · Page 16 of 33 asbestosclaims.law/library/17822/16

The aforementioned phase contrast illumination method for quantifying occupational exposures to asbestos determines the number of fibers (longer than 5 microns) per unit volume of air sampled; no chemical analyses are performed to verify that the fibers are asbestos, and studies have shown that the method accounts for less than 5% of the total number of fibers present in a sample. Nor is there any evidence that only those fibers longer than 5 microns are significant in the production of adverse health effects in humans.

It is impossible to specify with reasonable accuracy an ambient concentration for asbestos which provides an ample margin of safety to protect the public health. The needed definition of a dose-response relationship is not available. Research and analysis in this area have been hampered severely by two factors: (1) The effects of inhaling asbestos do not usually become evident until long after the exposure, i.e., a 30-year latent period is not uncommon; consequently, exposure histories can only be roughly estimated; and (2) until recently, there were no reliable techniques for measuring ambient concentrations of asbestos; therefore, the concentrations to which the public might be exposed remained unknown. In addition, a satisfactory means of measuring asbestos emissions is still unavailable.

W. E. Davis & Associates were contracted to study the sources of asbestos emissions. Their emissions inventory was based on information obtained from production and reprocessing companies, 1968 production and use statistics from the Bureau of Mines and emission factors developed by Davis personnel. Although these emission factors

A20242

UCC 016418

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ACL Doc 17822 · Page 17 of 33 asbestosclaims.law/library/17822/17

are not based on quantitative data (i.e. emission tests), they are considered adequate for the purpose of identifying major sources. The estimated emissions of asbestos from sources studied by Davis Associates are as follows.[70]

ASBESTOS EMISSIONS

1968

SOURCE CATEGORY	SOURCE GROUP	SHORT TONS
MINING AND OTHER BASIC PROCESSING	Mining and Milling	5,610
REPROCESSING		
	Friction Materials	312
	Asbestos Cement Products	205
	Textiles	18
	Paper	15
	Floor Tile	100
	Miscellaneous	28
CONSUMPTIVE USES		
	Construction	61
	Brake Linings	190
	Steel Fireproofing	15
	Insulating Cement	25
INCINERATION OR OTHER DISPOSAL		NA
NA-Data not available.	TOTAL	6,579

Considering this and other information, the major sources identified were: asbestos mine-mill complexes; asbestos users, both manufacture of asbestos-containing products and fabrication operations using asbestos products; demolition; and spray application of asbestos products to buildings and equipment. Although demolition was not identified as a major source in the Davis report which was published in 1970, it was so identified in the National Academy of Sciences' report[53] which was

A20249

UCC 016419

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ACL Doc 17822 · Page 18 of 33 asbestosclaims.law/library/17822/18

published in 1971.

The preamble to the promulgated regulations describes the sources covered by the promulgated standard, the changes made to the standard between proposal and promulgation, and the factors the Administrator considered in making his final judgments.

The proposed standard for asbestos was not given in terms of numerical values. Instead, the standard was expressed in terms of required control practices that would have limited asbestos emissions to an acceptable level. In part, control of atmospheric emissions would have been achieved by:

1. Utilizing industrial fabric filters to clean forced exhaust gases from asbestos mining, milling, and manufacturing industries and from fabricating operations that involve materials containing asbestos.

2. Eliminating visible emissions of particulate matter from ore dumps, open storage areas, external conveyors, and tailing dumps associated with asbestos mining and milling facilities as well as from manufacturing and fabricating operations carried out with asbestos-containing materials in areas directly open to the atmosphere.

3. Prohibiting certain applications of asbestos fireproofing and insulation by spraying processes.

Also, indirect atmospheric emissions of particulate matter would have been controlled at manufacturing and fabricating sites where visible emissions normally result from operations using asbestos materials. The maximum allowable emissions would have been equivalent to those attained by either ventilating an entire work space through a fabric filter or by hooding emission sources and subsequently passing the required dust-control air through a fabric filter.

A20252

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 19 of 33 asbestosclaims.law/library/17822/19

The promulgated standard is not given in terms of numerical values. The provisions of the promulgated standard are limitations on visible emissions, or, as an option in some cases, the use of designated equipment, requirements that certain procedures be followed, and prohibitions on the use of certain materials or of certain operations. These provisions are included because of the impossibility at this time of prescribing and enforcing allowable numerical concentrations or mass emission limitations known to provide an ample margin of safety. The alternative of no control of the sources subject to this standard was rejected because of the significant health hazard of unregulated emissions of asbestos into the atmosphere from the designated major sources.

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Evaluation of Comments

Many representatives of industry, State and local governments, the academic community, and environmental groups expressed their views on the proposed standard for asbestos. All of the comments received during the comment period were evaluated, and the proposed standard was revised to reflect this evaluation. More comments were received on the proposed asbestos standard than either the proposed beryllium or mercury standards. A discussion of the evaluation of the comments and the resulting action by EPA follows:

1. Comments received questioned the listing of asbestos as a hazardous pollutant. While admitting the hazardous nature of occupational exposures to asbestos, they suggested that ambient concentrations of asbestos are not hazardous. The Administrator's reasons for considering asbestos a hazardous air pollutant are given in the section of this report which discusses the health effects of asbestos.

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A20251

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 20 of 33 asbestosclaims.law/library/17822/20

2. Some of the comments received after proposal of the standard suggested that the wearing of brake linings is a major source of asbestos emissions. As the Davis report indicates, wear from asbestos brake linings does generate a substantial amount of asbestos emissions, primarily in urban areas. This was not considered a major source of asbestos emissions because there is evidence[71,72,73] which shows that only a very small proportion of the asbestos worn from brake linings is released as free fiber; the remainder is converted into some other nonfibrous mineral, i.e., the material is no longer asbestos, as a result of the extreme temperatures generated on the lining surface.

3. Comments received indicated that the asbestos standard should be a numerical emission standard. Some of the difficulties of this approach are outlined in the section of this report on development of the standard.

It has been determined not to be practicable, at this time, to establish allowable numerical concentrations or mass emission limits for asbestos. Satisfactory means of measuring ambient asbestos concentrations have only recently been developed, and satisfactory means of measuring asbestos emissions are still unavailable. Even if satisfactory means of measuring asbestos emissions did exist, the previous unavailability of a satisfactory means of measuring ambient levels of asbestos makes it impossible to estimate even roughly the quantitative relationship between asbestos-caused illness and the doses which caused those illnesses. This is a major problem, since some asbestos caused illnesses have a 30-year latency period.

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A20252

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 21 of 33 asbestosclaims.law/library/17822/21

EPA considered the possibility of banning production, processing, and use of asbestos or banning all emissions of asbestos to the atmosphere but rejected these approaches for the following reasons: (1) The available evidence relating to the health hazards of asbestos does not suggest that such prohibitions are necessary to protect public health; rather the evidence now available suggests that there are levels of asbestos exposure that will not be associated with any detectable risk, although these levels are not known.[53] (2) The difficulty of measuring "zero" emissions of any pollutant, together with the presence of asbestos in many commonly used materials, make such prohibitions impracticable. Either approach would result in the prohibition of many activities which are extremely important. Such prohibitions would mean, for example, that demolition of any building containing asbestos fireproofing or insulating materials would have to be prohibited as would the use of materials containing even trace amounts of asbestos which could escape into the atmosphere.

4. Many comments questioned the need for regulating mine-mill complex emissions other than those from process gas streams. Evaluation of these comments led to revisions in the standard.

As applied to mines, the proposed standard would have limited the emissions from drilling operations and prohibited visible emissions of particulate matter from mine roads surfaced with asbestos tailings. The Bureau of Mines has prescribed health and safety regulations (30 CFR 55.5) for the purpose of protecting life, the promotion of health and safety, and the prevention of accidents in open pit metal

A20253

UCC 016423

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ACL Doc 17822 · Page 22 of 33 asbestosclaims.law/library/17822/22

and nonmetallic mines. As related to asbestos mines, these regulations prohibit persons working in a mine from being exposed to asbestos concentrations which exceed the threshold limit value adopted by the American Conference of Governmental Industrial Hygienists.[64] The regulations specify that respiratory shall not be used to prevent persons from being exposed to asbestos where environmental measures are available. For drilling operations, the regulations require that the holes be collared and drilled wet. The regulations recommend that haulage roads, rock transfer points, crushers and other points where dust (asbestos) is produced sufficient to cause a health or safety hazard be wetted down as often as necessary unless the dust is controlled adequately by other means. In the judgment of the Administrator, implementation of these regulations will prevent asbestos mines from being a major source which must be covered by the promulgated standard. Furthermore, the public is sufficiently removed from the mine work environment that their exposure should be significantly less than that of the workers in the work environment. Accordingly, the promulgated standard does not apply to drilling operations or roadways at mine locations.

For asbestos mills, the proposed standard would have applied to ore dumps, open storage areas for asbestos materials, tailings dumps, ore dryers, air for processing ore, air for exhausting particulate material from work areas, and any milling operation which continuously generates in-plant visible emissions. The promulgated standard prohibits visible emissions from any part of the mill, but it does not apply to

A20254

UCC 016424

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 23 of 33 asbestosclaims.law/library/17822/23

dumps of asbestos tailings or open storage of asbestos ores. The Bureau of Mines' regulations previously referenced and regulations issued by the Occupational Safety and Health Administration (20 CFR 1910.93a) protect workers from the hazards of air contaminants in the work environment. The Occupational Safety and Health Administration regulations were promulgated on June 7, 1972. The regulations are intended to protect the health of employees from asbestos exposure by means of engineering controls (i.e. isolation, enclosures, and dust collection) rather than by personal protective equipment. It is the judgment of the Administrator that measures taken to comply with the Bureau of Mines and Occupational Safety and Health Administration regulations to protect the health of persons who work in proximity to dumps and open storage areas will prevent the dumps and storage areas from being major sources of asbestos emissions.

5. Other comments were directed at the proposed provisions for manufacturing and fabricating uses of asbestos. The proposed standard would have applied to buildings, structures or facilities within which any fabricating or manufacturing operation is carried on which involves the use of asbestos materials. Comments received on the proposed standard indicated that the requirements for fabricating and manufacturing operations were confusing. Much of the confusion was created by the use of terms such as "any," "continuously," and "forced gas streams." The promulgated standard is more definitive as to applicability of the provisions. The promulgated standard prohibits visible emissions from the nine manufacturing operations

A20253

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 24 of 33 asbestosclaims.law/library/17822/24

which, in the judgment of the Administrator, are major sources of asbestos. The promulgated standard does not cover fabrication operations. Of all fabrication operations, only those operations at new construction sites are considered to be major sources of asbestos emissions. The Occupational Safety and Health Administration regulations specify that all hand- or power-operated tools (i.e. saws, scorers, abrasive wheels, and drills) which produce asbestos dust be provided with dust collection systems. In the judgment of the Administrator, implementation of these regulations will prevent fabrication operations from being a major source which must be covered by the promulgated standard.

The nine manufacturing sources which are covered by the promulgated standard are listed below:

Manufacture of Asbestos Textiles

Manufacture of Asbestos Cement Products

Manufacture of Asbestos Fireproofing and Insulation

Manufacture of Asbestos Friction Products

Manufacture of Asbestos Paper

Manufacture of Asbestos Floor Tile

Manufacture of Paints, Coatings, Caulks, Adhesives, and Sealants

Manufacture of Plastics and Rubber Materials

Manufacture of Chlorine

6. Some comments suggested that a complete ban on open spraying of asbestos-containing materials unnecessarily restricted a wide variety of products, some of which contain trace amounts of asbestos.

A2025

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 25 of 33 asbestosclaims.law/library/17822/25

Evaluation of the comments led to revisions of the standard.

The proposed standard would have prohibited the spraying of any material containing asbestos on any portion of a building or structure, prohibited the spraying of any material containing asbestos in an area directly open to the atmosphere, and limited emissions from all other spraying of any material containing asbestos to the amount which would be emitted if specified air-cleaning equipment were used. The proposed standard would have: (1) prohibited the use of materials containing only the trace amounts of asbestos which occur in numerous natural substances, (2) prohibited the use of materials to which very small quantities of asbestos are added in order to enhance their effectiveness, and (3) prohibited the use of materials in which the asbestos is strongly bound and which would not generate particulate asbestos emissions. The promulgated standard applies to those uses of spray-on asbestos materials which could generate major emissions of particulate asbestos material. For those spray-on materials used to insulate or fireproof buildings, structures, pipes and conduits, the standard limits the asbestos content to no more than one percent. Materials currently used contain from 10 to 80 percent asbestos. The intent of the one percent limit is to ban the use of materials which contain significant quantities of asbestos, but to allow the use of materials which would (1) contain trace amounts of asbestos which occur in numerous natural substances, and (2) include very small quantities of asbestos (less than one percent) added to enhance the material's effectiveness. Although a standardized reference method

A20257

UCC 016427

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 26 of 33 asbestosclaims.law/library/17822/26

has not been developed to quantitatively determine the content of asbestos in a material, there are acceptable methods available, based on electron microscopy, which independent laboratories have developed. Determining the asbestos content of a material with these methods costs approximately $300, and the results are accurate within plus or minus fifty percent; these limits on accuracy were taken into account in establishing the one-percent limitation.

7. One comment questioned the practicability and enforceability of a no visible emissions provision for demolition; such a provision would, in effect, prohibit repair or demolition in many instances. Evaluation of the comment confirmed its validity, and the standard was revised.

The promulgated standard specifies certain work practices which must be followed when demolishing certain buildings or structures. The standard covers institutional, industrial, and commercial buildings or structures, including apartment houses having more than four dwelling units, which contain friable asbestos material. This coverage is based on the National Academy of Sciences' report[53] which states "In general, single-family residential structures contain only small amounts of asbestos insulation. Demolition of industrial and commercial buildings that have been fireproofed with asbestos-containing materials will prove to be an emission source in the future, requiring control measures." Apartment houses with four dwelling units or less are considered to be equivalent to single-family residential structures. The standard requires that the Administrator be notified at least 20

A20252

UCC 016428

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 27 of 33 asbestosclaims.law/library/17822/27

days prior to the commencement of demolition.

8. Other comments indicated that disposal of asbestos wastes should be covered by the standard. These comments were evaluated and rejected.

Consideration was given to including provisions in the standard requiring proper disposal of the asbestos material generated during demolition and collected in control devices used to comply with the requirements of this standard. It was decided that this was not necessary because the Occupational Safety and Health Administration regulations [29 CFR 1910.93a (h)] include housekeeping and waste disposal requirements. These regulations require that any asbestos waste, consigned for disposal, be collected and disposed of in sealed impermeable bags or other closed, impermeable containers.

Environmental Impact

The asbestos standard will substantially reduce asbestos emissions. A five-year projection of estimated control costs and emission reductions was prepared for EPA in 1972.[74] The estimated emissions for 1970 and projected reductions for 1977 are as follows:

Source Category	Number of Plants (1970)	Emissions (tons/year) 1970 Current Control	1977 Current Control	1977 Meeting Standard
Milling Products	9	3,860	5,440	218
Asbestos Cement	48	206	290	58
Floor Tile	18	101	142	28
Friction Material	30	314	441	88
Asbestos Paper	29	15	21	2
Asbestos Textiles	34	20	28	15

A20259

UCC 016429

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 28 of 33 asbestosclaims.law/library/17822/28

The number of affected sources and the amount of emission reduction for demolition, spray application, and other manufacturing sources has not been estimated.

Two potentially adverse environmental effects of the asbestos standard have been identified as:

1. The asbestos materials which will be collected in control devices and generated during demolition will have to be disposed of or recycled.

2. Materials, such as mineral wool, fiberglass, and ceramic wool, will be substituted for asbestos presently contained in spray-applied fireproofing and insulating materials.

Dry asbestos-containing particulate matter captured by fabric filters is expected to account for the major portion of the increase in asbestos-containing wastes; the increased usage of wet collectors which would generate larger quantities of asbestos-containing sludge is anticipated to be minimal. A preliminary evaluation indicates that in some manufacturing operations a major portion of the asbestos materials collected by fabric filters are either recycled to the process or can be marketed for other uses. For example, one asbestos textile mill recycles large quantities of longer-fiber asbestos for process use and sells more than 90 percent of the remaining collected materials to a brake lining manufacturer. Consequently, a significant portion of the increased quantities of "waste" asbestos-containing materials which will result from the implementation of the standard will not require disposal. Proper solid and liquid waste management practices

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UCC 016430

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 29 of 33 asbestosclaims.law/library/17822/29

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are available which can ensure the environmentally acceptable ultimate disposal of asbestos wastes. Occupational Safety and Health Administration regulations [29 CFR 1910.93a(h)] require that manufacturing wastes which contain dry, unbound asbestos be disposed of in sealed, impermeable bags or other closed, impermeable containers to control potential airborne asbestos emissions. The possible contamination of ground water supplies with asbestos from the landfill disposal of asbestos sludges and dry wastes has not been identified as a potential problem; the asbestos materials will be disposed of in impermeable containers and even if they were not, there is no evidence which indicates that such materials would be carried to surface or underground water supplies.

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The substitution of mineral wool, ceramic wool, and fiberglass for asbestos is not known to be a problem. There is no evidence that these materials cause health effects in the concentrations found in occupational or ambient environments.

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Economic Impact

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Although the standard was not based on economic considerations, EPA is aware of the impact[74] and considers it to be reasonable. Costs among the various sources covered by the standard are variable. Although the standard may adversely effect some individual plants or companies which are marginal operations, it appears that such effects will be minimal and the impact to the asbestos industries as a whole will not be large.

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Approximately 15 percent of the asbestos consumed in the United States is obtained from domestic production and 85 percent

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UCC 016431

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 30 of 33 asbestosclaims.law/library/17822/30

from imports. Canada, with Quebec having the world's largest deposit, provides about 90 percent of the asbestos imports and the Republic of South Africa most of the rest. U. S. production has tripled since 1956, representing a growth rate of about 7 percent per year. Domestic consumption is growing at 3 percent per year.

The basic processing of domestic asbestos ores is carried out by nine companies owning nine mine-mill operations with production capacities ranging from 200 to 65,000 tons per year.

Although mining is not covered under the standard, the associated milling operations are subject to controls. Milling facilities are located at or within 60 miles of the mine site with the exception that the small-volume North Carolina output is transferred to a mill in Baltimore, Maryland. The estimated total investment cost of $400,000 required of the nine existing mills for compliance with the standard yields an annualized cost range of $0.50 to approximately $6.00 per ton, with the average being approximately $1.00 per ton and the maximum figure applying to facilities accounting for less than 5 percent of domestic production. These costs represent a range of less than 1 to 7 percent of the average selling price per short ton of domestic asbestos in 1969 of $86.22, F.O.B. mine. Investment outlays range from $3,000 for a partially controlled mill of 200 ton/year capacity to $225,000 for a partially controlled mill of 65,000 ton/year capacity.

Because asbestos prices are determined in the world market and U. S. production supplies only a small fraction of the U. S. consumption, it is expected that domestic plants will in general not be able to pass on their higher costs in the form of price increases. However, no plants are

A20262

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand...
ACL Doc 17822 · Page 31 of 33
Published by AsbestosClaims.Law
asbestosclaims.law/library/17822/31

expected to shut down due solely to the cost burdens imposed by the standard.

For the major categories of industries that manufacture products containing asbestos, i.e., producers of asbestos-cement products, asbestos-containing floor tile, asbestos-reinforced friction materials, asbestos paper, and asbestos textiles, a total additional investment of about $5,000,000 is estimated to be required to bring existing, partially controlled sources into compliance with the standard. An annualized cost of 0.4 percent of the output product value will be required. In terms of alterations in product price, there would result an average increase of 0.4 percent; the most significant increase would be 5.2 percent for asbestos textile products.

For the categories of manufacturers that process small quantities of commercial asbestos, e.g., producers of paints and coatings, a total additional investment of approximately $1,500,000 will be required to bring existing sources into compliance with the standard. This represents an annualized cost of less than 1 percent of product value.

The use of asbestos in spray-applied fireproofing and insulation represents less than 0.5 percent of the annual domestic consumption of asbestos. No major impact on the price of asbestos or upon producers of asbestos would result from the limitations on asbestos content of spray-applied asbestos fireproofing and insulation. Further, increased costs for substitute materials, available or scheduled for introduction in the near future, range from zero to a maximum of 15 percent. The use of these materials, some of which are asbestos-free, does not require new equipment or extensive retraining of personnel.

A20263

UCC 016433

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand... Published by AsbestosClaims.Law
ACL Doc 17822 · Page 32 of 33 asbestosclaims.law/library/17822/32

It is estimated that the wetting and removal of asbestos fireproofing and pipe insulating materials prior to the demolition of buildings or structures will increase demolition costs by less than 8 percent. Based on a rough estimate that 4,000 apartment buildings and 22,000 commercial or industrial buildings are demolished annually at a total cost of approximately $550 million, compliance with the standard would cost about $45 million. Further, since demolition costs represent a minor portion (probably less than 10 percent) of the overall costs of rehabilitation and construction projects, the increase in demolition costs as a result of the promulgated asbestos standard is insignificant.

A20264

UCC 016434

Union Carbide trial exhibit UC-2968: EPA Background Information on the Development of National Emission Stand...
ACL Doc 17822 · Page 33 of 33
Published by AsbestosClaims.Law
asbestosclaims.law/library/17822/33