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Dr. J. Stefan Dupre, Chairman
Royal Commission on Matters of
Health and Safety Arising from
the Use of Asbestos in Ontario
180 Dundas Street West
22nd Floor
Toronto, Ontario
Canada M5G 1Z8

Dear Chairman Dupre:

The Asbestos Information Association/North America has appreciated the opportunity to participate in the proceedings of the Royal Commission. In order to assist the Commissioners as they move toward the drafting of a final report, our counsel have prepared the enclosed summary of the evidence presented to the Commission on health, monitoring and regulatory issues.

The summary includes occasional references to asbestos literature not formally in the Commission's record as testimony or exhibits. Most of this literature is no doubt in your library; but, if there are any publications cited that are not readily available, we would be glad to supply them to the Commission.

I am enclosing copies of the summary for the active interested parties in Toronto and ask that you please deliver them.

Respectfully yours,

B.J. Pigg
Executive Director

Enclosures

cc w/ enc.: Dr. Mustard
Dr. Uffen
Mr. Laskin
Ms. Kahn
Mr. Casgrain
Mr. Lederer
Ms. Jolley
Mr. McCombie
Mr. Starkman

ROYAL COMMISSION ON MATTERS OF
HEALTH AND SAFETY ARISING FROM
THE USE OF ASBESTOS IN ONTARIO

SUMMARY OF THE PHASE II HEARINGS ON HEALTH, MONITORING AND REGULATORY ISSUES

EXECUTIVE SUMMARY

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ONTARIO ROYAL COMMISSION ON ASBESTOS

INTRODUCTION TO THE COMMENTS OF
AIA/NA ON HEALTH, MONITORING AND REGULATORY ISSUES

In the course of the proceedings before the Ontario Royal Commission on Asbestos, a substantial segment of the world's experts on the health effects and monitoring of asbestos have appeared. Although there were clearly differences among the witnesses, and although many issues were deemed still unresolved, consensus was reached in important areas that should serve as the basis for determination of a rational societal policy toward asbestos:

-- All human health effects of asbestos are dose-related, and present-day health effects are attributable to high, often uncontrolled, exposures of the past.

-- Asbestos exposures today are orders of magnitude lower than the historical exposures upon which knowledge of ill effects is based.

-- Although the potential health effects of the lower exposure levels found in the workplace today cannot be determined definitively, the best scientific evidence indicates the risks are minimal, if not insignificant.

-- Even conservative overestimates of the health effects of asbestos at low exposure levels based on linear, non-threshold assumptions about the dose-response relationship predict that properly controlled asbestos use today poses de minimis, or well within acceptable level, occupational risks.

-- Often expressed fears about asbestos risks to the general population have been widely exaggerated; no public health risk need exist from the continued proper use of modern encapsulated and locked-in asbestos products.

Based on these principles, a rational societal policy toward asbestos recognizes that the substance continues to serve an important role in many applications where it can be used with minimal or no risk. At the same time, the evidence demonstrates that all uses must be closely scrutinized to minimize unnecessary exposures.

In order to assist the Commission in understanding and synthesizing the substantial record that has been accumulated, we present this Summary. The Summary covers the following questions which are before the Commission:

(1) What is known about the biology of asbestos fibers: their respirability, their deposition and disposition in the body, and the effect on such fibers of the body's clearance and immune mechanisms?

(2) What is known about the pathogenicity of asbestos fibers and the mechanisms by which they cause human disease?

(3) Do asbestos fibers differ, given varying chemical compositions, sizes and dimensions, in their biologic and pathogenic significance?

(4) What diseases have been found to be associated with asbestos exposure and with what dose-response relationships?

(5) To what extent do other factors, particularly smoking, account for disease among asbestos-exposed persons?

(6) What conclusions can reasonably be reached in predicting the risks of asbestos exposure at the lower levels found in the workplace today, and in general population exposure?

Following our discussion of the exposure and health effects evidence, we suggest to the Commission a series of societal measures that appear appropriate to minimize asbestos risks in the future. These measures include:

-- Continuing efforts to employ all reasonable, technologically feasible methods to control asbestos fiber emissions in fixed-site mines and mills and primary and secondary manufacturing facilities and to monitor through use of the membrane filter method such emissions to ensure achievement of acceptably low exposures.

-- Employment of recommended work practices in non-fixed workplaces -- such as construction sites -- in order to eliminate excessive fiber emissions.

-- An educational labeling scheme for asbestos-containing products to ensure their proper handling.

-- Promotion of smoking cessation programs among asbestos-exposed workers.

-- Continuing surveillance and research to answer many of the more particular, but still unresolved, questions concerning asbestos.

Our proposal does not include the government-mandated phase-outs or bans of asbestos use that have been suggested in some quarters. Such regulatory steps cannot be justified given the extensive evidence supporting the feasibility of continued safe use. Appropriate measures are now being used, and further measures could be employed, to control asbestos fiber emissions. It should be the role of Government to ensure that such measures are employed whenever asbestos is used. However, given the minimal risks when such controls are used, the marketplace should be relied upon to decide whether the cost of such practices is justified by the necessity or desirability of asbestos use.

ONTARIO ROYAL COMMISSION ON ASBESTOS

SUMMARY OF THE PHASE II HEARINGS
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In an era of increasing public concern about carcinogens, asbestos has often been a centerpiece of public attention. Because the adverse health effects of asbestos generally develop only twenty or more years after initial exposure, the consequences of very high occupational exposures during World War II and before have become apparent only in recent years. The medical consequences of these very high occupational exposures must, however, be distinguished from the related, but distinct, issue of whether the much lower asbestos exposure levels prevalent today pose a significant risk to either workers or the general population. Consideration of this issue requires a detailed examination of the evidence on exposures to and health effects of asbestos.

Asbestos is a naturally occurring mineral found in many parts of the world. Through natural processes, it spreads to ambient air and waters with the result that human exposure is virtually unavoidable. Although very high occupational exposures to asbestos occurred in the past, improved controls in modern manufacturing processes and changes in the products in which asbestos is used have vastly reduced exposure today. Within the past decade, most mines and

manufacturing facilities have achieved continued substantial decreases in exposure levels. As a result, most asbestos workers experience exposures well below existing governmental standards. Almost all products now marketed employ asbestos embedded in a matrix that eliminates or substantially limits fiber release. As a result, little likelihood of harmful exposure exists for product users. General population exposures to asbestos, where they exist at all, are several orders of magnitude lower than today's workplace exposures.

Fiber Type

Since the associations between high asbestos exposures and asbestosis, lung cancer and mesothelioma were first discovered, medical research has concentrated on trying to establish what size and shape and which type asbestos fibers are most dangerous. Animal research has essentially established that fibers longer than eight microns and less than one micron in diameter are the most pathogenic. Distinctions among the major fiber types (chrysotile, amosite and crocidolite) are less clearly established. Apparently diverging medical data complicates determination of relative pathogenicity. Although animal and tissue culture experiments tend to demonstrate more disease-causing potential for chrysotile, the human evidence has usually shown greater disease, particularly mesothelioma, among persons exposed to crocidolite and amosite.

Asbestos Epidemiology

The many epidemiology studies of workers with high asbestos exposures in the past have confirmed associations with asbestosis, lung cancer and mesothelioma and have also strongly suggested that very little if any risk still exists at today's much lower exposures. These studies have also emphasized the extent to which smoking accounts for much of the past disease.

Asbestosis, a fibrotic lung condition that may lead to death in its advanced stages, has occurred almost exclusively among very heavily exposed workers. This chronic disease is closely related to sustained high exposures and at its advanced clinical stages is very unlikely to occur at today's exposure levels -- even among lifetime asbestos workers.

Threshold levels below which asbestosis symptoms have not been found have been established in the asbestos-cement worker studies of Dr. Weill. Even in other studies where no clear thresholds have emerged (the Canadian miners and Rochdale, England textile workers), very little asbestosis would be predicted based on extrapolations from the exposures of those cohorts to workers at today's exposure levels. Continuing surveillance of worker populations in Australia and the United States demonstrates the declining incidence of asbestosis in populations being exposed to lower and lower asbestos concentrations. The consensus opinion of

the experts who appeared before the Commission was that asbestosis is not a significant occupational health concern for the future.

Although greatly increased lung cancer rates have been found among some asbestos workers, the amount of disease is closely related to worker smoking habits, as well as the high doses experienced in the past. Although definitive evidence has not yet been developed of a dose below which no increased risk exists, absence of increased mortality due to respiratory malignancy in several large cohorts for the persons with lower -- although still much higher than modern -- exposures provides strong support for concluding that no substantial hazard exists for modern asbestos workers. The medical evidence strongly suggests that any remaining risk is very small, and, for non-smokers, close to non-existent.

Several large cohorts of asbestos workers have failed to exhibit increased lung cancer risks. The subcohort of the Canadian miners with exposures below approximately 20 fibers/cc for twenty years, the Louisiana asbestos-cement workers with exposures below 100 mppcf-years, and the asbestos friction material production workers studied by Newhouse and Berry have not exhibited increased lung cancer risks -- despite their greater than current worker exposures. Although other studied cohorts have exhibited some lung cancer risks at such exposure levels, these three well-documented studies -- each of which specifically focused attention on dose-response

relationships -- suggest strongly that the much lower exposure levels found in industry today are so low that any remaining risks are too small to be detected.

Central to any assessment of the increased lung cancer risk of asbestos is the predominant role of smoking in determining risk. Although there is some evidence that lung cancer risks are increased for non-smokers, almost all lung cancer has occurred among smokers. At today's asbestos exposure levels, reduction of lung cancer incidence is far more dependent on termination of smoking than on elimination or reduction of asbestos exposure.

Mesothelioma is a rare tumor of the pleural and peritoneal tissues. Although often associated with asbestos exposures, mesothelioma also occurs in the absence of asbestos exposure. Like asbestosis and lung cancer, mesothelioma has been shown to be related to dose and to have occurred primarily among heavily exposed persons. Its future occurrence among persons exposed at today's occupational levels is likely to be quite rare.

Unwarranted fears of mesothelioma risks to the general population have been generated by scattered references to individual cases allegedly caused by casual exposures. In fact, all the existing evidence suggests that, on the one hand, those cases discovered among worker families were probably due to quite substantial exposures caused by contact with workclothes and prolonged household reentrainment

of fibers, and, on the other hand, cases where asbestos exposures were in fact casual are most likely attributable to the natural background rate for this disease. At today's exposure levels, the mesothelioma risk predicted, even if based on conservative extrapolation models, would be quite low.

Although some studies have reported associations between asbestos exposure and other forms of cancer, the overall evidence is equivocal. The scientific evidence demonstrates that such cancers normally occur only after very high exposures and account for a minimal amount of asbestos-related disease.

Risk Extrapolation

Because asbestos related diseases typically take more than 20 years to become manifest, no groups of workers exist who have been studied for long enough to provide documented evidence of the risk, if any, at current low exposure levels. However, using risk extrapolation methods, it is possible to set upper limits on the magnitude of such risks.

All human activities, including employment, involve risk. Man accepts risks every day, often without recognizing their magnitude. Many studies have quantified commonly accepted risks in order to place in context the risks posed by use of substances such as asbestos. Once risks are placed in such a context, rational societal decisions can be

made about the efficacy of risk reduction measures. In order to make such assessments, it is necessary to project the asbestos dose-response relationship to the low exposure levels prevalent in current asbestos use.

Dose-response relationships for asbestos-related diseases have been found to be linear at those high doses for which empirical data exist. It has thus often been suggested that a linear relationship will continue to lower doses. Such linear extrapolations, though, have not been empirically demonstrated and most likely overstate risks at low exposure levels. Their use thus sets an upper limit on potential risk.

Central to predicting future risks are determinations of past exposures among the studied cohorts. Concerted efforts to construct individual exposure profiles have been made for asbestos worker cohorts by Drs. McDonald, Weill, Enterline, Newhouse and Berry, Finkelstein, and Dement. It is from their studies that the primary data for extrapolating risks must be sought. Although most of these cohorts' exposures were initially measured in particles, not fibers, adequate work has been done on conversion to provide meaningful guidance for current regulatory purposes.

Also central to predicting current risks is an understanding of current exposure levels. Under the two fibers/cc standard that prevails in most Western nations, average exposure levels well below that standard exist for most

workers. Indeed, other than for the relatively small number of workers in mining and milling and primary and secondary manufacturing, most occupational exposures to asbestos are intermittent, and, when recommended work practices are employed, de minimis. For such workers, average exposures are thus many times lower than the two fiber standard. Among the entire worker population in Canada or the United States, therefore, only a few thousand workers are likely to have lifetime exposures of more than 10 fiber-years; most workers will have lifetime exposures below 1 fiber-year.

Applying extrapolation to the best available data indicates that the current risk to asbestos workers is within the range of risks faced every day by most workers. Once the significant part of that risk due to cigarette smoking is taken into account, the risk is well below most other occupational risks.

The disease risk predicted from the asbestos epidemiologic studies varies to some extent from study to study. Some of the variance can be explained by methodological differences among the studies, but some of the variation may also be due to true differences in disease potential in various asbestos operations. At one end of the spectrum, the risks predicted from the chrysotile mining experience is so low at current exposure levels as to leave little question about conclusions that mining and milling operations are acceptably safe. Some of the primary manufacturing

studies predict similarly very low risks, but a few studies predict higher risks. Although all such differences cannot be clearly reconciled with the present state of knowledge, even the higher risks predicted by these latter studies fall within the range of normally accepted occupational risks. If that proportion of the risk attributable to lung cancer caused by smoking is clearly delineated, the predicted asbestos risk is toward the low end of accepted occupational risks even when determined based on the studies predicting higher risks.

Environmental Risks

Despite the fears generated by the media, the opinion of most scientists, as well as expert governmental-scientific bodies, has been that no significant risk due to asbestos exists for the general public. Risk extrapolation methods can also be used to establish upper limits on the asbestos risks that theoretically would exist for the general population. Those risks are well below a number of commonplace risks faced daily by the general public.

The absence of evidence of a general population risk applies to both airborne and waterborne asbestos. Although serious medical consequences have been associated with heavy exposures through asbestos inhalation, no such body of evidence exists for ingestion. Animal studies of asbestos ingestion, including on-going state-of-the-art bioassays,

have failed to demonstrate any carcinogenic or other health risks. Similarly, the human epidemiologic evidence predominantly fails to find any association between ingestion and cancer.

Monitoring

In addition to the medical evidence, considerable testimony was presented to the Commission on the monitoring of asbestos. This testimony provides further important guidelines for governmental policies on asbestos control.

The membrane filter method is a practical and effective technique for conducting the large volume of routine occupational monitoring required in the asbestos industry. It has been adopted throughout North America and Europe, is the basis for current occupational standards, and can be related to the available epidemiological evidence. The advantages of membrane filter monitoring include its relatively low cost and simplicity, the ready availability of necessary equipment and skilled operators, and the significant progress made in the last decade toward methodology standardization.

The membrane filter method also has several important limitations. The basic method does not distinguish among asbestos fiber types or between asbestos fibers and other fibers; and it provides only an index of fiber concentrations, because it does not count very short or very thin

fibers. However, such discriminations often are unnecessary, and, where needed, can be made by supplementing membrane filter measurements in mixed fiber environments with occasional electron microscope characterization of dust cloud constituents. There is therefore no reasonable basis for change in the currently-employed monitoring system.

Potential alternatives to the membrane filter technique are infeasible for routine monitoring. Electron microscopy may be useful to characterize fiber proportions in mixed fiber environments, but no standardized method for either scanning or transmission electron fiber counts has been developed. Further, electron microscopy measurements cannot be related to membrane filter results or to the existing health evidence; capital costs are very high; insufficient qualified laboratories and technicians exist to meet existing monitoring needs; and, except for scanning electron microscopy at low magnification (offering little advantage over membrane filter measurement), operating costs per sample are very high.

In establishing workplace standards based on membrane filter monitoring, the substantial measurement variability, as well as day-to-day variations in workplace concentrations, must be considered. Given these sources of variability, and the generally recognized 0.1 fiber/cc detection limit for the membrane filter method, the lower bound for possible asbestos standards is in the range of 0.5 to 1 fiber/cc.

With any lower standard, employers and enforcement officials would be unable to determine compliance status with reasonable confidence. Standards in the range of one to two fibers/cc can be implemented using membrane filter monitoring, if employers allow for variability, by maintaining average workplace concentrations well below mandatory standards.

Membrane filter monitoring can be used, along with occupational exposure standards consistent with the method's accuracy, to achieve highly protective workplace conditions. Because employers must measure well below the occupational standard to obtain reasonable assurance of compliance, average workplace concentrations will be maintained well below mandatory standards.

Outside the workplace -- in ambient air and water, or in buildings -- the membrane filter method is inadequate to provide meaningful monitoring results. The extremely low asbestos concentrations found in such settings fall well below the membrane filter detection limit. In addition, membrane filter fiber counts outside the workplace would be meaningless, because the membrane filter method does not distinguish between asbestos fibers and the many other fibrous materials found in the general environment.

Although electron microscope techniques meet some of the technological requirements for environmental monitoring, there is no standardized electron microscopy method and no

basis for relating electron microscopy results to the health evidence on asbestos. There is therefore no basis for establishing environmental standards or for comparing results from different laboratories quantitatively.

Nevertheless, electron microscopy monitoring results of air and water -- which are qualitatively useful when compared with similar background measurements -- demonstrate no cause for concern. Both in England and Ontario, investigators have recently determined that fiber concentrations in buildings with asbestos insulation do not exceed background levels found in outdoor measurements -- except where insulation has recently been removed. The present evidence thus shows little need for environmental asbestos control standards.

Policy Implications

The comprehensive medical evidence on asbestos that allows estimation of the extent of risk, if any, posed by current asbestos mining, manufacturing, installation and use, makes it possible to design an appropriate societal policy for the substance. Such a policy recognizes both the value of asbestos as a versatile mineral and the necessity for educational and control measures to minimize human exposures. A variety of government initiatives would be useful to guarantee reasonable control of fiber emissions.

First, in the mining and milling of asbestos, continuation of the extensive control measures that have been adopted in recent years is necessary. The well-documented mining epidemiology evidence demonstrates that such levels provide an acceptably safe workplace.

Second, continuation of the control measures that have succeeded in recent years in vastly reducing exposure levels in the manufacture of asbestos-containing products (including, inter alia, the most significant uses -- asbestos-cement products, friction materials, and flooring) is necessary to maintain a safe workplace. Although variations exist among the risk estimates derived from manufacturing cohorts, the much-reduced exposure levels common today do not pose significant risk of disease.

Third, new inducements or requirements to increase use of recommended work practices in the installation and removal of asbestos-containing products are desirable. Although workers in industries where exposure to asbestos is infrequent and intermittent are unlikely to have cumulative asbestos exposures in the ranges experienced by workers exposed on a daily basis, it is nonetheless advisable to control unnecessary exposures. Most such non-fixed site exposures can be dramatically reduced through proper work practices. Similar cost-effective work practices can and should be employed in fixed site garage work with asbestos friction products.

Fourth, educational labeling of raw asbestos fiber and many asbestos-containing products to describe and encourage the use of safe work practices will greatly reduce the potential for inadvertent and unnecessary fiber emissions.

Fifth, smoking cessation programs can greatly diminish the risk of disease, especially lung cancer, among asbestos workers. Indeed, with asbestos levels much reduced in the workplace today, considerably more will be accomplished by such anti-smoking programs than by further reductions or elimination of asbestos exposure.

Finally, continued medical and technological research is warranted to fill existing gaps in knowledge of the health effects of asbestos and to improve further the capability of minimizing fiber release while still making beneficial use of this versatile mineral.