

Internal
Memorandum



Date July 7, 1978

Letter No. 392

Southfield, Michigan

To S. K. Rhee

From P. H. S. Tsang

Subject International Conference and Workshop on Health Hazards of Asbestos Exposure

Background and Summary

This international conference and workshop was held from June 23 to 27 in New York City and was sponsored by the New York Academy of Sciences. It consisted of three whole-day sessions for formal presentations and a one-day workshop. Participants came from various parts of the globe such as the U.K., Netherlands, France, Italy, Finland, South Africa, Germany, Sweden, Switzerland, Turkey, Canada and the U.S. etc.

A total of 33 formal papers on the harmful effects of asbestos exposure were presented by medical and physical scientists from all over the world. Numerous small discussion sessions on issues of "acceptable exposure standards," methodology of asbestos concentration measurement, the role of government agencies and manufacturers in regulatory actions, asbestos workers' protection and compensation, etc. also took place during the conference and workshop. Different viewpoints were well represented by the government agencies (both domestic and foreign), workers trade unions (both U.S. and international) and the asbestos manufacturers and users (e.g. Johns-Manville, Raybestos-Manhattan, Cape Industries of London, etc.).

It is clearly evident that asbestos exposure is harmful not only to the asbestos workers themselves but its effects also extend to their family members, and to the residents neighboring the asbestos plants or mines. At the present, "acceptable" exposure limit is not known, since there is evidence that even one-day exposure to asbestos in a concentration of ~300 fibers/cc can result in asbestos disease some 20-35 years later. Based on the available data, the government is likely to put 0.5 f/cc airborne asbestos limit into effect in the near future, and perhaps will push for a near zero limit achievable by the available technology. Medical and physical scientists were urged to establish (1) the dose-response relationship of asbestos exposure, (2) an internationally acceptable technique for fiber identification and quantification, (3) the relationship of aspect ratio of asbestos and non-asbestos fibers (e.g. glass fibers, iron fibers, steel wools, zeolite, etc.) to asbestos-related diseases. The asbestos industries were urged to take positive actions to protect workers and their family members by minimizing the asbestos exposure with reduction of airborne asbestos concentration and by providing proper training of safe handling of asbestos and asbestos products.

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Bendix is a leading manufacturer of both asbestos-based and non-asbestos friction materials in the world. It is imperative that (1) we are fully aware of the severity of asbestos effect, (2) we maintain and update our current practices for compliance with the governmental regulations on plant working environment safe handling of asbestos by workers and on the monitoring of workers' health, (3) we should accelerate our development efforts for non-asbestos friction materials and (4) we should also urge the suppliers of our substitute fibers to provide acceptable documents of the product safety with respect to asbestos. The last point should not be taken lightly since some zeolite fibers and some very small glass fibers of 0.1-0.4 μ in diameter and 20-50 μ in length have been reported to be potential carcinogens, although the Fiberglas for our non-asbestos friction materials are reportedly too large to be respirable and does not yet pose any threat.

The following are some highlights of the conference and workshop.

Session I: Asbestos Disease in Employed Groups: Miners, Millers, Insulators, Maintenance Workers in Chemical Industries

1. Asbestos definitely is a carcinogen; is responsible for alarmingly large number of lung cancer deaths in the U.S., Canada, U.K., France, Finland, Italy, Africa, and Holland.

Example: In one Quebec mine case, out of 11,000 asbestos infected workers between 1966-1975, 24% (1966) to 44% (1975) died of lung cancer.

In still another case, 253 out of 632 deaths of insulation workers (1943-1977) were caused by asbestos exposure.

2. All three major forms of asbestos in use, namely chrysotile, amosite and crocidolite are carcinogenic; crocidolite mostly used in insulation is, perhaps, the most damaging.

3. Asbestos can cause:

- Asbestosis
 - Pleural thickening/fibrosis
 - Peritoneal fibrosis
 - Mesothelioma (cancer in membrane/linings of esophagus, lung, stomach, etc.)
- } lung

4. Latency period for asbestos-caused disease is about 20-40 years.

5. Cigarette smoking definitely increases the cancer risk, and shortens greatly the latency period. Cigarette smokers exposed to asbestos generally have 2-8 times greater risk factor than non-smoking asbestos infected victims.

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6. Any exposure to asbestos is considered dangerous. Convincing evidence showed that exposure to asbestos at an estimated level of ~300 f/cc for only one day can result in asbestos disease some 20-35 years later. In another study, it was shown that 1 month exposure to asbestos in a level of 5-20 f/cc resulted in asbestos disease some 20 years later. It was estimated that a continuous exposure to 5-20 f/cc for 2 years or greater can result in a loss of life expectancy of 10-15 years.

7. In general, cancer and respiratory disease mortality is in direct proportion to the concentration and duration of asbestos exposure, as well as to the extent of cigarette smoking. The latency (or incubation) period is in inverse proportion of the above factors.

The "Dose-Response relationship" is not clear, however. A study to determine the threshold of accumulated "fiber-year" for potential cancer induction is underway.

8. On the methods of surveillance on asbestos workers

- Membrane filter collection/counting method is now internationally accepted; the actual size of filter, membrane pore dimension, sampling period, peak concentration determination, collection site, etc. still need universal standardization.
- Its results do not always correlate with the midget impinger method used prior to 1977, however. A factor of 2-5 was possible between the two methods.
- Personal monitoring methodology for individual worker is necessary, but not yet in practice.
- Counting technique needs to be modernized; perhaps transmission electron microscope should be used instead of light microscope.
- Dose-response relationship needs to be established.
- Methods to improve the life expectancy of asbestos workers need to be established — an immediate goal requiring the joint efforts of medicinal and physical scientists, asbestos manufacturers, asbestos-using industries, asbestos workers and the Government.

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9. On the acceptable standard for industrial use of asbestos:

- From the medical standpoint, there is really no acceptable standard known; the ultimate is to ban the mining and use of asbestos for possible reduction of asbestos concentration to zero in our environment.
- From the practical and economic standpoint, the asbestos exposure should be held to the minimum, perhaps 0.1 f/cc, or to a level achievable by the state-of-the-art. The 0.5 f/cc limit will most likely be put into effect in the very near future.
- The industries should take on the responsibilities of (1) assuring the best environment achievable by the best available technology, (2) providing workers with proper training for safe handling asbestos products, and (3) warranting the safety for the exposure and usage of their asbestos products (e.g. brake linings and building insulations in use or in replacement operation).

Session II: The Vexing Shipyard Problems; Environmental Asbestos Disease.

10. Shipyard workers over the world, (U.S., Great Britain, Italy, France, Netherlands) dated as far back as World War II were studied and the harmful effect of asbestos (most amosite and crocidolite) was also convincingly confirmed. The workers include asbestos insulators, electricians, carpenters, painters, tool makers, maintenance crews, etc.
11. In a nation-wide Turkish study, it was found that zeolite fibers ($< 5\mu$ in length, $\sim 0.1 - 1\mu$ in diameter), chabazite and erionite may account for Turkey's recent mesothelioma epidemic.
- 12. In a study, pleural disease was found evident among the family members of workers exposed to asbestos (15-35% of the sample population suffered from asbestos disease versus $< 3\%$ from the control group without any exposure).
13. In a French study on Paris air, it was found that the air within some buildings, especially those fitted with asbestos insulations and asbestos sprayed panels was heavily contaminated with asbestos fibers. Majority of the buildings met the French standard of $< 50 \text{ ng/m}^3$ (with $< 7 \text{ ng/m}^3$), but in some buildings air reached a peak height of $1000-3000 \text{ ng/m}^3$, especially those sprayed with asbestos and also near asbestos plants. This finding also justifies the U.S. concerns for some old buildings, especially schools with asbestos insulations.

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14. The air in the neighborhood of an asbestos plant or a mine was found to be somewhat contaminated by dusts or asbestos fibers, although no hard evidence is yet available for higher cancer rate among those residents (probably due to the long latency period — only time will tell).
- 15. There are probably 1.5-2 million mechanics in the U.S. exposed to asbestos emissions from brake relining. No evidence of higher cancer rate caused by asbestos has been found among them to date.

Session III: Protection and Care of Workers; Surveillance of High Risk Groups; Future Problems.

16. The mining and manufacturing industries are urged to work closely with their employees and with the Government agencies to minimize the hazard and risk of their workers (see highlight #9) and consumers of their products.
17. The medical and physical scientists are urged to establish
 - (1) the dose-response relationship of asbestos exposure and in-body accumulation, (2) to establish a universally acceptable technique for fiber identification and quantification,
 - (3) to study the effect of other types of fibers on human health and (4) to provide means for extending the life-expectancy of the injured asbestos workers.
18. Ideally, there should be a zero f/cc airborne asbestos concentration standard. However, this may not yet be technically feasible and definitely will be economically disastrous throughout the world should asbestos be banned. Thus, a near-zero standard achievable by the best available technology might be the best compromise.

Work Shop

19. The present definition of "asbestos" is not technically conclusive nor exclusive and needs official revision.
20. The present standard "asbestos fibers (with an aspect ratio >3:1) with a length >5 μ should be kept less than 2 f/cc" is not technically correct nor medically safe. The "5 μ -criterion" was adopted on the basis of the limitation of the light microscope. Under a transmission electron microscope, the air sample which met the current 2 f/cc standard was found to have high concentration of fibers (as high as 5-20 f/cc) with smaller diameters and shorter lengths. Furthermore, the fibers present in the tissue of patients died of asbestos disease were found to have a mean diameter of 0.095-0.58 μ and a mean length of 0.5-6 μ (up to 40 μ in length). In addition to asbestos, other inorganic fibers and particles such as talc,
 - zeolite, rutile, iron oxide, mullite, SiO₂, etc. were also found. Thus, a new counting technique, and a new standard for

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20. Continued -

fiber aspect ratios, length and number are needed. The effect of inorganic fibers or particles other than asbestos should also be investigated.

21. In a screening study with hamsters by pleural injection a non-silanized fiber glass with a diameter of 0.1-0.4 μ and a length of 10-50 μ were found to be carcinogenic. (Fortunately, the Fiberglas we use in the Bendix friction materials development program are much too large to be respirable; no concrete proof of their biological inertness has been reported, however).

Recommendation

1. Review our current plant conditions at ACSG, HVSG, Jurid and DBA; assess the impact of 0.5 f/cc requirement which may become effective in the near future.
2. Launch a program to educate our personnel about the DANGER of asbestos and to train them for safely handling asbestos. Minimize the potential danger of infecting asbestos worker's family via careless family contact.
3. Increase the medical check-up frequency of those with over 10 years exposure to asbestos. The current medical monitoring program possibly needs re-evaluation for its effectiveness in identifying asbestos disease at an early stage.
4. Bendix non-asbestos friction materials development efforts need to be accelerated.
5. Urge suppliers of our alternative fibers to conduct valid study and provide acceptable documentation to warrant their product safety with respect to asbestos.
6. Bendix attorneys responsible for product liability should be fully aware of the danger of asbestos, and be prepared for possible law-suits against Bendix by consumers of asbestos-based friction materials, and, probably unlikely, by our own workers who may develop asbestos disease in the future.

A handwritten signature in dark ink, appearing to read "P. H. S. Tsang".
P. H. S. Tsang

PHST/vp