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I have today after much thought and reading prepared this paper which presents some of the facts about the asbestos industry and its relationship to effects on the environment. A few weeks ago, I visited a university in the midwest and in the laboratory of a graduate student, I spotted an impertinent sign which pretty well summarized the present state of those entrusted by industry to abate its effects on the environment. The little sign read as follows: "When you're up to your waist in alligators, it's difficult to remember your original objective was to drain the swamp". When it's your job to help industry get in tune with the environment, you end up being assauited from all sides.

American industry has accepted the challenge to reduce its pollutional load as rapidly as is economically practical and technologically feasible. Industry is one of the most flexible entities in our society. Society supplies its capital, workforce; society purchases its products; industry has to be responsive to society in order to exist. Industry has, therefore, learned to play the game according to the rules which

are set out by society. When the rules are changed, industry must and will adjust to that change.

Contrary to most presentations, I will begin with my conclusions and criticisms and subsequently to this will present the reasons for my conclusions and criticisms. There are six important factors from a bird's eye view of what I call the "swamp" - the environmental problem. They are as follows:

Epidemiological studies are needed to establish validity of the threshold limit value concept. According to the industrial hygiene news report, the past failures on the part of industry to conduct these studies in sufficient depth and magnitude is probably responsible for the vulnerable position in which industry finds itself today. In attempting to meet the challenge from those who claim widespread unsafe work conditions throughout the American industry, the asbestos industry, including Raybestos-Manhattan, Inc., and Johns-Manville Corp., with the cooperation of the U. S. Public Health Service did an 8 to 9 year epidemiological study and environmental studies of the work-site of the asbestos textile employee. This study was done with great expense to the industry with the complete cooperation from the industry to this government agency. The study consisted of a chest x-ray, lung function studies, physical examination, and environmental evaluation of dust exposure, and up to the present date this study has not been completely published.

Although the study itself at the plants has been finished for quite some time, the results are not forthcoming. It is my understanding that the results of the x-rays of our employees have not been completed because of the lack of diligence of one or two of the radiologists who are assigned to read the x-rays and come up with their

diagnoses. It, therefore, appears to me that one of the most essential ingredients to the establishment of a true TLV lies in this study which encompasses actual work place and a truly objective study done by an agency other than industry. This study has been entirely neglected in ascertaining from a complete study the results necessary to determine a TLV, and I cannot understand the haste in not waiting for the results of this particular study.

There is a joint responsibility of the research toxicologists working with animals in the laboratory and the occupational physicians in industrial hygiene working with an actual population in the factories and other places. This would demonstrate beyond a shadow of a doubt whether the populations exposed to the toxic substances are kept below the established TLV where there is in fact a method to predict the possible ill health that comes from this exposure. I do not believe that there are any studies at the present time which provide valid information from which to alter the base TLV. There are no lung or abnormalities which are peculiar to and solely related to asbestos in singular studies. The many studies which are presented show the abnormalities to occur with persons who have not had any exposure to asbestos. In order to derive a TLV it would seem to me that one would need a figure which would apply to the working population exposed to this asbestos that would indicate a level from which an acceptable amount of asbestosis would occur during a working life time.

In January, 1963, we entered into a cooperative study with Dr. Lewis Cralley and Dr. Marcus Key of the U. S. Public Health Service and did in fact, begin this study which related to the workers' smoking habits, related to the workers' health history, and to the workers' environment. The study was completed but the results are not forthcoming, and I do not

understand the urgency in establishing a permanent TLV before the completeness of this particular study is presented and criticized. Isolated reports are of no value in the establishment of a TLV because as I have stated before, the findings in isolated reports occur in people who do not have any contact in asbestos or asbestos related industries.

The only published epidemiological study that is in existence today and which the NIOSHA has used as a criterion for establishing the lower TLV for asbestos is the British study. I am sure that you have gone over this many, many times, and there are many criticisms of this report as it is a very limited amount, approximately 290 men, and there is some question about the reliability of the dust counts. There is conflicting use of both crocidolite and chrysotile in this mill as we can all tell that with crocidolite there is an increased fibrosis, asbestosis, carcinoma, and mesothelioma. It is a known fact that this mill was exceedingly dusty from 1920 to 1950, and that this TLV which is derived from the studies of the British epidemiological study is really a goal rather than a strict measure to go by. From the British study the emergency five fiber standard was derived. The British themselves do not operate at a level of two fibers per cc and consider it mostly as a goal rather than to indicate that it is a strict TLV to be enforced. This is evidenced by its notation that respirators must be worn when the fiber count reaches 12 fibers per cc, and now 10 fibers per cc.

There is at the present time an ongoing study in Canada to indicate that the 7 fibers per cc to most probably 5 fibers per cc is a safe level without fibrosis or asbestosis.

It is also disappointing to me that a group such as the ACGIH, which reviewed the initial information and came up with the suggestion

of a 5 fibers per cc as a threshold limit value or emergency standard was in essence supposed to review the current literature again in the spring was not even consulted in the final production of a TLV. This committee was headed by Dr. Stokinger, who is one of the foremost toxicologists in the world today. The ACGIH lists of threshold limit values that have usually been set are not at levels to produce a zero response, but at levels below which the response constitutes no threat to health. I do not understand why this particular group was bypassed.

Another standard in the TLV is based on the 30 year working period as a life working time of an individual in the asbestos-textile group. In researching our employment status, we find it to be approximately 30 to 35 years as a safer level and that anybody in the area of 40 years of working time is rather rare and of such a small percentage of our working population to be significant.

Another factor is the consideration of a TLV for insulation workers as compared to textile workers. It is my impression from the statistics that are revealed in the insulation workers by notable researchers in the field that these people are exposed to very high dust levels. One draws this conclusion from the fact that they have the highest instances of asbestosis of any group of asbestos workers, and the highest instances of carcinoma both bronchogenic carcinoma and the rare mesothelioma. It appears to me that there is a double standard here, of which one value is being placed for the textile worker to function under and absolutely no monitoring to be done on the insulation worker at the worksite. It is entirely feasible to monitor the insulation worker at his worksite. Usually the dustier the work place, the shorter the time of monitoring. A one hour cycle could be easily accomplished by a lapel device for measuring dust. As I said, the dustier it is the shorter one has to

place the individual monitoring device on the worker. Because of the lack of controlling devices on the insulation worker, and the numerous other exposures that these people have from going from one job to another, it would seem that a greater and closer monitoring of the insulation worker would be indicated.

The next criticism is the economic factor and the economic impact on the industry. The asbestos textile industry has actively been pursuing the goal of control of asbestos emissions using the best available technology of the times. Everyone agrees that the naturally occurring fibers classified as asbestos are indispensable in our modern technological society. Asbestos has many uses, provides protection against fire, and deterioration in scores of products in our daily use. It saves countless lives and billions of dollars in property damage. It is used in schools, houses, theatres, offices, and other public buildings, ships, spacecraft, brakes on automobiles, trucks, busses, and trains. All are dependent upon asbestos as a vital component of safety through their brake linings.

It is estimated that it adds to the nation's economy to the extent of two billion dollars and does involve the livelihood of perhaps 200,000 wage earners and their families. The economic contribution of the asbestos industry to the nation's economy, therefore, is substantial, outside of playing the various life saving roles in our society. To quote the National Academy of Sciences, "Asbestos is too important in our economy and technology for its essential use to be stopped". Therefore, if one places an unrealistic TLV, it would place an economic burden on the industry which would result in annihilation. It is obvious from the trend of the industry that such things are already beginning to take place. There is now a plant in the process of completion in Mexico

where there is no difficulty with environmental controls.

There would be a rapid and large influx of Japanese materials without any environmental encumbrances. Some companies have sought to decrease their production of certain products by elimination from 30 phases down to 9 phases which resulted in a corresponding decrease in one plant from 250 people to 75 people. One company has sold a complete plant because of the difficuly in environmental controls.

Another important point that I think is most pertinent to the establishment of a realistic threshold limit value, as we are using basically the British study as a basis for our threshold limit value, is that the British economy is certainly different than ours, and that we would then expect an influx of British products and Japanese products with which our industry could not compete. It seems to me that this would be a severe economic impact, which would require the re-location of machinery, and in some instances, actually the total rebuilding of the machinery and perhaps the building of entirely new plants. The walls of some factories and the construction would have to undergo extensive alterations. I doubt if the engineering ability exists at the present time without a great deal of financial outlay and technical know-how to accomplish the 5 fibers presently set in the emergency standard.

In some areas, we already are at 5 fibers and even 2 fibers or less, and are constantly trying to achieve lower dust levels. We have been working on this problem since 1937 and have accomplished a great deal. I understand from competent authorities that it may even take 2 years to get to the 5 fibers, and the feasibility of getting to 2 fibers seems impossible as one company put it, annihilation.

My conclusion from the economic impact would be to consider the question as to whether 2 is safe or 5 is safe. We realize, of course,

that 12 is too high, somewhere between 5 and 7 appears to be a safe level that would give us the lowest amount of asbestosis, perhaps lower than the British are able to accomplish with their so called 2 fibers per cc.

At this point, I would like to introduce a study that we have done at our plant and we will insert at this particular time the studies that are done relative to the relationship of dust, time exposure, and pneumoconiosis at our plant. It seems impossible and creates a great danger to our society if we are drawn into this feeling of false security.

There is no data of which I am aware which will answer the question of what atmospheric level should be selected as a standard. The mortality death is available, but environmental data is not available. In essence, the medical authorities are confronted with the problem of selecting an atmospheric concentration number without benefit of an exposure response or definite information as to the environmental condition which appeared to have resulted in these selections. There seems to be some confusion among some of the authorities whose judgment has been used in the establishment of the emergency TLV as to what the conditions were 20 to 30 years ago. We have dust counts available in the 1930's to show the dust counts exceeded in some cases between 30 to 50 million parts per cubic feet. In 1935, it remained the same, but in 1937 with the installation of the flow of air into a collecting system, there was a remarkable drop in the dust of the textile plant. The drop was so much that in the 1940 era we approached approximately a 5 million count in the spinning and weaving areas with a 2 million parts per cubic feet of air in the carding area. As we have only recently begun counting the fibers per cc, it is difficult to relate

these two.

We feel that nothing has changed appreciably in the last 20 years to make us feel that we have increased in our dustiness, but with the wetting down of various procedures and the vacuuming procedures, that our dust counts have become remarkedly lower. I do not agree with the paper published by Williams, et al, that in 1930 in one of his plants that he was below 5 million particles per cubic foot. I would imagine that there is a zero missing and it should be more like 50 million particles, or somewhere between 30 and 50 million particles per cubic foot. If you could get below 2 million particles per cubic foot considering all the equipment we have in our plant it would be most unusual. We agree that the asbestos dust should be strenuously controlled, and it is strenuously controlled in our working environment in order to prevent asbestosis.

In the criteria document there is a reference to the fiber count dependability. In those that were received at our factory, these were promptly rechecked and the relationship was shown that the consistency existed in our method of fiber counting so that we were consistent throughout. The fiber counts in the areas which were dusty remained the same and were considerably lower than those done by the USPHS. We also criticized the lower dust counts which we knew should be higher and these were repeated and found to be consistent with our previous dust counts over the many years in these particular areas.

The point that I am trying to make is that we are often very critical of our counts and are repeating dust counts constantly to insure their reliability. Even by our own dust counting experts there is a 10% to 15% error in counts done by him. An occasional dust counting on an occasional visit to a plant by an agency leads them to believe, most assuredly, that their counts are valid. Therefore, we

feel that on the basis of the consistency of our counting that we would place more credance in a consistent report of both the higher levels and the lower levels remaining the same done by our engineers. This particular discrepancy of the USPHS higher counts, being too high, and the lower counts, being too low, was pointed out to them not to be especially critical of them, but to point out that there must be a marked difference in the reliability of their (USPHS) countings, and that we are as constantly critical of our own counts just as we are of theirs (USPHS).

There is a decided difference in the approach to counting if one uses the British standard of the sampling device that was used and contrasted with the personal sampler on which our present standard is set. We find outside of the 10 to 15% set differences that one makes in personal counts that there is a decided difference in the reduction in the British count as compared to the American count. The British tendency is to underestimate the amount of fibers per cc and to some authorities, it runs as high as approximately 15 to 25%. It, therefore, arrives at a lower standard than would have been the situation had they had a personal sample. This would increase their standard to approximately 4 fibers per cc, had it been derived on a 50 year working place exposure.

I have left the last point of carcinogenes as the last factor, because it is common knowledge that asbestos is considered a co-factor in the production of bronchogenic carcinoma and the development of mesothelioma. Many authorities have documented the establishment of trace metals being responsible for bronchogenic carcinoma, others have very definitely tied in smoking directly with bronchogenic carcinoma, but the problem still remains unsolved.

The problem of mesothelioma in the asbestos textile industry intrigues me in that I have searched diligently through 51 years of record at our plant and find 2 cases, one of which there was no autopsy done and there was a clinical diagnosis of mesothelioma with metastases through all parts of the body. The first case revealed no asbestosis in the previous x-rays of this patient. The second case was a mesothelioma of the abdomen, autopsied with metastases to the lungs and pleura. Pathological examination of the lungs revealed no asbestosis present although this employee had been exposed for 17 years.

I would assume that in 51 years of exposure to asbestos and especially since in the early years here we used crocidolite in our product, that one would see an enormous amount of mesothelioma over this length of time. To have two questionable mesotheliomas, one undiagnosed, the second, an abdominal mesothelioma, which is consistent with what might occur in the general population is remarkable.

I have also reviewed 19 cases of mesothelioma at our Medical University and find that there is no occupational connection between the 19 that are listed in the pathology department of autopsied patients. There is no occupational history in related industries from which even a trace of asbestos could have been acquired. In none of the autopsied reports are there lung sections showing any asbestosis present in the tissue. It is my opinion that a standard relating to the mesothelioma is impossible to derive.

The co-carcinogenic aspect of bronchogenic carcinoma must strongly be considered, but a standard cannot be derived as to bronchogenic carcinoma. This then leaves us with the scientific deduction for the reduction of asbestosis in the industry. I believe that a standard strictly enforced of 5 fibers per cc to a limit of 10 fibers per cc at which

time one should wear a respirator with a margin of about 7 as the safe level, perhaps a level of from 5 to 7 being realistic from a health standard. I would anticipate a remarkable drop in the asbestosis, and perhaps even below the British 1%.

There are other variables that one considers, the personal susceptability of the individual, the fact that he smokes, and his other related medical history has a great deal to do with his susceptability to asbestosis.

I believe strongly that on the present scientific data that is available that it would be unrealistic to set a standard below 5 fibers per cc. I believe that the standard should be from 5 to 7 fibers in which the industry could operate with the greatest medical efficiency and safety.

Although to accomplish the 5 fibers would be a great economic impact on the industry, it could be obtained in a matter of 2 years. I do not envy the individual who has the responsibility of setting this standard, but as a physician of some 20 years' experience, I cannot help but feel that responsiblity goes with maturity and judgment. Honest comments made in the atmosphere of compassion for fellow workers in the asbestos industry and the problems of industry itself should not be taken lightly.

I hope this brief summary of the asbestos health problem has been of interest to you and this additional information will be a resource to select a realistic TLV for the benefit of all concerned.