JUDGMENT ON THE PROBLEM OF TOTAL BAN OF ASBESTOS BY THE RUSSIAN GROUP OF GOVERNMENTAL EXPERTS

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EXPERTS

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INTRODUCTION

Directive 1999/77/EC on asbestos ban adopted on 26 July 1999 by the European Council affected negatively asbestos industry of Russia where a great number of workers was employed causing serious socio-economic impact to the Russian economy in general and to chrysotile asbestos branch, in particular, involving adversely other branches related to the fabrications of products based on it.

It seems necessary to note that the states – members of the European Council enjoy their inviolable right to decide on what materials, or substances, they are to use at their territories irrespective of economic, political, social, and other prerequisites, and that the EC decision on asbestos ban exceeds the limits of the internal EU problem. Guided by the EU opinion the world's community treats it as the only true one.

Chrysotile asbestos has been mined for more than one hundred years in Russia. The use of chrysotile asbestos compared with other substances and products did not give any grounds for the disastrous spread of diseases though one cannot deny chrysotile adverse effects if it is used uncontrollably.

Taking the latter into account, we think it reasonable to present an opinion that speaks in favor of the lack of sufficient grounds for the further ban of chrysotile asbestos. This opinion is based on multi-year experience of Russia and other countries that contributed to its controlled use.

Beneath general provisions are given that represent approaches of leading occupational health centers and competent authorities of Russia whose aims are directed to health promotion of workers and general population, and who are responsible for decision-making concerning further use of materials and products for national economy.

1. STATE OF THE PROBLEM

Asbestos is a general trade name of minerals that can occur in the form of a fibrous bundle. They are elastic and strong, have low density and high friction co-efficient, chemically resistant, possess high adsorptive ability, low electric conduction and low heat conduction.

Two groups of minerals can be distinguished that differ by chemical composition, technological properties and biological effect. They are serpentines and amphiboles known under commercial name as “asbestos”.

The history of asbestos application goes far into the past centuries, however, its industrial utilization started almost a century ago. At present more than 3000 products and materials are fabricated with the use of asbestos. Naturally the use of asbestos reached its peak in the previous century. By the 1980s the annual world’s asbestos output was four million tons.

The growing asbestos demand, especially in Europe where no sufficient reserves of the mineral had been prospected led to the attempts of chemists and technologists to develop materials with the properties similar to those of asbestos.

Medical specialists have been attracted by asbestos since 1907 when Dr. H. Murray, described some specific lung disease now known as asbestosis that he found in a worker who had been exposed to extremely high asbestos concentrations in the air.

It should be stressed that growing world’s asbestos production of the 1950s and 1960s occurred with no appropriate sanitary, hygienic and technical protection measures developed to safeguard the health of a worker. In other words, asbestos was used with insufficient responsibility on the part of the state, employers and competent authorities. Amphiboles the ban of which at present is strict and well grounded due to their high health impairment risks were widely used at that moment. No pure chrysotile asbestos was used in any country of the globe except for Russia. It is not surprising that research works of the scientists well recognized nowadays were published in the 1950s. They were Dr. I. Selikoff, Dr. R. Doll and later Dr. J. C. Wagner as well as others who formed the world’s opinion about asbestos-induced diseases such as asbestosis, lung cancer, pleural and peritoneal mesothelioma. Their findings were proved by numerous epidemiological, clinical and experimental studies conducted in many countries including Russia.

The data on adverse effects due to uncontrolled asbestos use, especially, amphiboles, alerted international organizations such as the World Health Organization, the International Labour Organization and others. Thanks to the ILO initiative, a group of experts developed Code of Practice on Safety in the Use of Asbestos in 1984. Then the ILO session of 1986 adopted Convention no. 162 and Recommendations no.172 On Safety in the Use of Asbestos. These documents were developed by the representatives of all continents, governments, non-governmental organizations of the world’s community as well as by the countries that mine, process and consume asbestos, by the opponents and advocates of asbestos. Only one ban was confirmed by no.162 Convention. It was the ban for the use of amphiboles, especially, in a sprayed form. The procedure of controlled use was developed for other types of asbestos.

However, due to various reasons including economic ones, provisions of the ILO Convention no. 162 were not backed. Many countries among them are some EU member-states have not yet ratified it.

The results of uncontrolled use, especially it concerns amphiboles, can be found even now. They serve as a reason for numerous media publications opinioned so that along with amphiboles any type of asbestos, even chrysotile asbestos, (serpentine) is very dangerous for the health. Appeals devoid of factual grounds towards restricted or total ban of chrysotile asbestos also appeared in the press. Efforts of some interested circles and mass media information gave rise to panics of the general population.

Two facts can be treated as a serious methodological mistake in those publications: the accent in many of them is made on the results of uncontrolled asbestos use that continued many years in all industries and in common life; and the fact that types of asbestos are not differentiated. We still keep in the memory the years when crocidolite, amosite and other asbestos amphiboles that were scientifically proved to possess much higher biological aggressiveness compared with chrysotile asbestos were used. The fact that insulation workers in dwellings and public buildings sprayed those dangerous to health types of asbestos as fireproof coverings, heat and noise absorbers can be found as a barbarity at present. Health of the general population was jeopardized along with elevated health risks of the working contingents (however, due to various reasons those dangerous to the health types of asbestos and technologies were not used in Russia.). As a result, high occupational morbidity and mortality risks became inevitable. Asbestos workers suffered from asbestosis, lung cancer, pleural and peritoneal mesothelioma and other cancers. Taking into account long latency period lasting more than forty years, occupational cases of lung cancer and mesothelioma diagnosed today are the result of high improperly controlled levels of dustiness in the air of the 1960s and 1970s when the most dangerous types of asbestos were freely and widely used.

Unlike other countries of the globe, Russia mines and processes only chrysotile asbestos (excluding the primary stages of mining). But Russia could not avoid a significant morbidity increase from 1940s to 1950s in the asbestos industry as well. Hundreds of cases of asbestosis and chronic dust bronchitis were diagnosed at that time and, after one or two decades, cases of pleural or peritoneal mesothelioma and lung cancer were marked. However, it should be of note that the incidence of asbestos related mesothelioma and lung cancer in Russia was much lower than it was depicted by foreign mass media. One could accuse the public medicine of Russia of the unwillingness to reveal “the skeleton in the cupboard” (such were specific times of the Soviet epoch), poor methodology or equipment. In reality, these arguments are beneath any criticism. The facts speak well for the contrary. The Russian Academy of Medical Sciences initiated a joint American-Finnish-Russian collaborative study in 1995 «Health and Exposure Surveillance of Siberian Asbestos Miners and Millers» funded by the US Department of Health and Human Services under Cooperative Agreement No. U60/CCU 011193. A research program performed over the period of 1995–1997 at the Uralasbest Company in Asbest City in the Ural Region by the Finish Institute of Occupational Health (FIOH), US National Institute of Occupational Safety and Health (NIOSH), RAMS Institute of Occupational Health in Moscow and Medical Research Centre for Prevention and Health Protection of Industrial Workers in Ekaterinburg, Russia, did not reveal any significant differences in the approaches, quantitative and qualitative assessment of working conditions and in the evaluation of workers' health. Examined enterprise produces more than 25% of asbestos in Russia. It was an amazing fact to the foreign researchers, but only single health changes due to asbestos exposure were found after a big cohort of 2003 workers with contact to high dust concentrations in the air lasting tens of years had been appropriately examined. The results of this international collaborative study convinced our foreign partners in the efficiency of dust control methods and diagnosis methods applied in Russia (Tossavainen et al, 1999).

More thorough attention deserve the materials that serve as a basis for the conclusion of equal biological action of amphiboles and chrysotile asbestos, and extremely high danger of the latter for the health of humans. The greater part of these documents is based on the assessment of occupational and non-occupational asbestos contacts in leading industrial countries. If they do not arouse any doubts, then chrysotile asbestos ban must be the only acceptable solution.

It is doubted, for instance, whether European countries indeed accumulated great experience in the assessment of occupational and non-occupational long-term exposure contacts with chrysotile asbestos.

It is a well-known fact that a great number of research has been performed worldwide on groups of workers who contacted amphiboles, such as crocidolite and amosite («European Communities – Measures Affecting Asbestos and Asbestos – Containing Products» / Report of the Panel / World Trade Organization / WT/DS135/R (00-3353) / 18 September 2000; «Recent Assessments of the Hazards and Risks Posed by Asbestos and Substitute Fibres, and Recent Regulation of Fibres Worldwide.» // European Commission DJ III, Environmental Resources Management. / Oxford. November 1997; etc….). All of them testify to the increased incidence of cancer morbidity, in particular, respiratory cancers and malignant pleural mesothelioma.

Numerous studies of the latest decade have appeared that indicates a high risk of cancers due to the contacts with chrysotile asbestos. Many authors do not recognize any difference between amphiboles and chrysotile asbestos. They deliberately use the word “asbestos”, which is a general commercial definition, in their works, noting that “asbestos” is still present in our life and, as a result of it, “global asbestos epidemics” of cancers has not been removed.

For instance, the data on asbestos-induced malignancies developed in the recent years from Australia, Germany, Norway, Sweden, the UK and Finland are very much alike. They are all connected with chrysotile asbestos due to some reasons.

It is indicated that industrial use of amphiboles was officially ceased in Europe more than two decades ago. The fact is underlined that more than 95% of asbestos used on the globe falls on chrysotile asbestos. It was accented at the Asbestos Symposium for the Central and Eastern European Countries held in Budapest in 1997 that the production of all the types of asbestos had been increased till the end of the 1970s. In accordance with the data showed at the Symposium, somewhere between 1963 to the mid of 1970s the amphibole consumption was at a level of 5% to 7% from the total output of asbestos. It was in 1978 that total reduction of asbestos consumption started on the globe. At that time 3.8% of crocidolite, 1.3% of amosite, 0.2% of anthophyllite was used in the world. This was the reason guided by which researchers found it possible to bound all the so-called “asbestos induced pathologies” to the exposure to exclusively chrysotile asbestos (Rantanen J., 1997; Lemen R. A., Castleman B. I., 1997; Nicholson W. J., 1997).

In the same time only chrysotile asbestos is mined in Russia. More than 60% of it has been used and is being used now at the domestic market. Total output of chrysotile asbestos makes up not less than 50% from the world's production. Russian asbestos is mainly delivered to the countries of Eastern Europe and to Asia.

But Canada remains the biggest exporter of chrysotile asbestos. The EU countries and the USA traditionally imported only Canadian chrysotile asbestos. Import of asbestos (crocidolite and amosite) from Australia and Southern Africa and some other countries continued till the mid of the 1990s despite the official ban of amphiboles. It was reported at the same 1997 Budapest Symposium that 269 thousand tons of amphiboles (crocidolite and amosite) were produced and exported to the Western Europe and the USA from South Africa in 1978. Other sources state that export of amphibole asbestos only from South Africa continued till mid 1990s (Kendall T., 1998; Harington J. S., Mcglash N. D., 1998, etc).

The most alerting problem of the day as it has been recognized by many industrial countries that are non-asbestos producers or exporters, concerns assessing occupational and general exposure as vast quantities of friable construction and heat insulation products made of banned amphibole asbestos used in the previous years have not been dismantled or removed from industrial and general objects till present.

Finland was the biggest in the 1970s producer of anthophyllite in the Europe. For instance, even now Russia uses Finnish-made ships equipped with fireproof anthophyllite-containing friable coverings.

Accordingly, the greater part of asbestos research that indicated the equal danger of chrysotile and amphiboles was made in the developed countries, but the percentage of amphibole asbestos used there was much higher than 5%. Sufficient volume of amphiboles has been used and is still used even in the countries that put under a ban any asbestos products actually in all the industries where it had been applied before.

Many researchers disregard the type of asbestos used in the country. It occurs very often due to a lack of information. The problem of reliable, or at least, approximated assessment of former exposure levels is thought as very actual throughout the world. However, only in rare cases these data may be available. In a recently performed study on the assessment of occupational exposure levels in males of France in the twentieth century, though it was perfectly planned, there is a serious drawback: types of asbestos are not taken into account. It was noted in the study that even French Asbestos Association was not aware of the ratio of imported to France types of asbestos (Goldberg M., et al, 2000).

One of the arguments in favour of extremely high cancer risk caused by chrysotile asbestos is that morbidity levels due to pleural mesothelioma do not show a decrease at present and there has been found its higher incidence in the 1990s in spite of the formal ban of amphiboles put in the 1970s. This was one of the reasons that accelerated the ban of chrysotile asbestos. Close consideration of the word’s literature references arouses certain doubts in relation to the validity of the ban.

The fact that morbidity level of malignancies due to occupational and non-occupational asbestos exposure does not decrease in Europe though thirty years have passed since amphiboles were banned, can be explained by the duration of the latent period of asbestos-induced diseases that may last more than fifty years. The end of the 1970s showed a peak of asbestos use. It means that the results of uncontrolled use of amphibole asbestos are to be felt for more than a decade. Great attention is not paid exclusively to working contingents. For instance, “epidemics” of malignant mesothelioma were registered in the regions of Australia and South Africa rich in crocidolite. More than 50% of cases with pleural mesothelioma are attributed to non-occupational asbestos exposure in the UK.

All the data on comparative biological activity of amphiboles and chrysotile asbestos, validity of epidemiological results and conclusions may be argued if they are not confirmed by the factual information.

A study was performed in South Africa for the aim to clarify how asbestos may affect patients with cancers and to find out correlation of carcinogenic risks with the level of proved asbestos exposure, its source (occupational or non-occupational) and the type of asbestos. Out of 123 cases with pleural mesothelioma investigated in the study not a single one was revealed that could be bound to the exposure to merely chrysotile asbestos. The finding of the study was that the ability of crocidolite and amosite to cause pleural mesothelioma was much higher compared with chrysotile asbestos (Rees D., Myers J. E., Goodman K., et al., 1999).

A study of Italian researchers devoted to the assessment of mesothelioma prevalence in Europe shows several times lower levels in Eastern Europe than in Western Europe and Australia (Bianchi C., et al, 2000).

A grant was given by the EU for a study entitled ”Prevention of asbestos-induced diseases in Hungary, Estonia, and Karelian Republic of the Russian Federation” for the period of 1997-1999. 326 industrial, public and residential buildings were examined in Tallinn, Petrozavodsk and Budapest to understand the volume of asbestos used in them; concentration of respirable asbestos fibers was measured at 43 working places; retrospective assessment of possible and actual exposure levels in 500 patients with cancers in different countries was made; concentrations and types of fibers were measured in 25 samples of lung tissues delivered from Hungary, 20 samples from Estonia and 20 samples from Karelia. The same approach was applied to assessing morbidity levels of pleural mesothelioma in these three countries.

The Finnish Institute of Occupational Health and the Justus-Lieb University of Giessen (Germany) performed the main bulk of delicate research. The countries were purposefully chosen for the study because they used chrysotile asbestos imported only from Russia.

One of the results dealt with the incidence of mesothelioma. According to the data of the researchers who participated in the study, the incidence of mesothelioma per one million people was 8 cases a year in Hungary, 3-4 cases in Estonia and Karelian Republic. The number of cases equal to the ones registered in other European countries was found only in Hungary. Twofold excess of mesothelioma cases in Hungary compared with Estonia can be explained by extremely high incidence of the disease in those administrative districts where asbestos-cement enterprises that used amphibole asbestos were located.

One of the indices that can prove or disprove the statement on equal danger of amphiboles and chrysotile asbestos is the content of fibrous particles in lung tissues. The above study showed the content of chrysotile fibers longer than 1 µm in a gram of dry lung tissue to exceed $1x10^6$ in one case out of 20 (5%) in Karelian Republic, two cases out of 20 (10%) in Estonia and four cases out of 25 (16%) in Hungary. German researchers discovered amphibole fibers (amosite, crocidolite and anthophyllite) only in the Hungarian samples. Thus, the fact that exposure to amphiboles strongly correlates with morbidity increase of pleural mesothelioma, not with Russian chrysotile asbestos, has been proved once more.

Actually in all the studies performed in the countries of Western Europe, the USA, Japan, China and others amphibole fibers in human lung tissues are registered. As a rule, their prevalence over chrysotile asbestos fibers is significant. It is true for the persons with occupational contact and for the general population as well (Dodson R. F. et al, 1999, 2000; Tossavainen A., 1994; Tossavainen A., et al 1997; Tuomi T., et al, 1987; Tuomi T. 1992; Dufresne A., et al; 1996; De Vust P., et al 1988; Karjalainen A., et al 1994; Kohyama N., 1993; Roggli V. L., 1995; Rödelsperger K., 1995; etc).

In accordance with the data of foreign researchers, concentration of amphibole fibers in the lung of mesothelioma patients exceeded the one of chrysotile fibers; amphibole concentration was almost the same in the lungs of asbestosis patients and lung cancer patients.

A study was performed in the course of already mentioned American-Finnish-Russian collaborative project of health effects due to the use of chrysotile asbestos in Russia. It concerned the measurements of fibers in lung tissues of the Uralasbest workers and the residents of the nearby city (Tossavainen A. et al, 2001). The highest concentrations were found in lung tissues of those who had long occupational dust contact. The level of 1.0×10^6 f/g showed excess in 95% of cases in this group. Similar to analogous studies, no correlation was found between the length of service and the number of chrysotile asbestos fibers in lung tissues. It can be explained by an ability of chrysotile asbestos fibers to be easily dissolved in lung tissues. Concentration of chrysotile fibers in the samples of lung tissues from Asbest City correlates with the data of the studies performed in the Canadian deposits of chrysotile asbestos.

The following levels of chrysotile concentration were registered in workers who mined chrysotile asbestos in Canada: 6.7×10^6 f/g in asbestosis patients and lung cancer patients (n = 25); 9.1×10^6 f/g in asbestosis patients (n = 38); 3.9×10^6 f/g in patients with mesothelioma (n = 12). Mean concentrations of tremolite fibers in the lungs of the examined workers are almost analogous: 5.7, 12.8 and 12.1×10^6 f/g, respectively.

Those without occupational exposure in Canada who were born prior to 1940 (n = 23) showed 0.42×10^6 f/g concentration of chrysotile asbestos and 0.41×10^6 fibers/gram of tremolite fibers, whereas those who were born after 1940 showed, respectively, 0.16 and 0.17×10^6 f/g (n = 26).

Mean concentrations in lung tissues of 39 workers who processed Canadian chrysotile at ATI plant were 4.2×10^6 f/g of amphibole asbestos, 1.6×10^6 f/g of mullite and 33.5×10^6 f/g of chrysotile asbestos.

The level of 1×10^6 f/g of all types of asbestos showed excess in 33% of cases in exposed cohorts of urban population of Finland (n = 64), in 18% of cases it was found in subjects most likely exposed to asbestos (n = 134), 1% were those who were probably exposed to asbestos (n = 80). The study on the same cohorts revealed bilateral pleural plaques in males aging 33 to 69 in 58% of cases. Analogous impairments were found in more than 80% of subjects lung tissues of whom contained more than 1×10^6 f/g of all types of asbestos longer than 1 μm. According to the minimal estimates, 43% of cases with plaques and 24% of other impairments were associated with the level of more than 1×10^6 f/g. Occupational exposure to asbestos (mainly, to anthophyllite) caused these impairments, general environmental should be much less blamed.

Non-occupational contact to asbestos in the Russian study dedicated to the environmental exposure and the influence of asbestos-containing products in dwellings and public buildings was mainly produced by lower lung concentrations of chrysotile asbestos – 2.6×10^6 f/g on the average. In 43% of samples concentrations did not exceed 1×10^6 fibers/gram (from 0.1 to 0.9×10^6). In other 39% of samples concentrations did not exceed 5.0×10^6 fibers/gram. That is 82% of samples did not show excess of limits established for the general population without occupational contacts with asbestos in such countries as Japan and Germany. However in two samples concentration of chrysotile asbestos fibers reached considerable values: 10.6×10^6 and 14.6×10^6. These levels may be explained by a sudden contact that occurred shortly before the death with asbestos or asbestos-containing products that are numerous in Asbest City. Another explanation is that occupational contact with asbestos or asbestos-containing products had not been documented. No correlation was found between the age and the level of chrysotile asbestos fibers.

Silicate fibers containing silica, magnesium, calcium, iron were found in some Russian samples. Fibers of commercial amphibole asbestos (amosite, anthophyllite and crocidolite) were not found by the Russian study in contrast to foreign results. Partially non-chrysotile fibers were represented by tremolite. No such fibers were found in 50% of cases in the group with occupational asbestos contact and in 65% of cases in the group with no occupational contact. In other cases, unlike Canadian and other foreign autopsy studies, the levels of mineral fibers including tremolite were registered by an order less then the corresponding concentrations of chrysotile asbestos. It should be stressed once more that amphibole fibers (tremolite, crocidolite, anthophyllite and others) due to their physical properties and chemical composition when penetrated into the respiratory tract remain there during the whole life of a human. The group of examined persons with occupational contact to chrysotile asbestos exceeds by tens of times the one without occupational contact showing relatively lower content of tremolite fibers. These facts do not allow to state categorically that technogenic exposure to the environment of chrysotile asbestos mining, milling and processing enterprises is the source that contributes to the accumulation of amphibole fibers in the lungs of workers and the general population in Asbest City. It is possible to suppose that background pollution of the ambient air due to natural weathering of rocks or some other factor not revealed by the study can be the source of amphibole fibers.

No amphiboles were found in the analogous studies jointly performed by American and Russian researchers (Shchebakov S. V. et al., 2000).

The above facts give rise to doubts concerning the validity of statements that attribute merely chrysotile asbestos exposure to outbreaks of asbestos-induced diseases in European countries of recent decades.

As an alternative to asbestos fibers products made of natural minerals and chemicals have been proposed such as basalt, ceolite, mullite and other fibers. No prejudice would be seen in connection to these asbestos substitutes but some circumstances have been revealed.

Asbestos ban followed together with the intensive development of technologies for the production of man-made mineral fibers (MMMF) that have not been so thoroughly studied as asbestos fibers. Despite the available data on MMMF negative biological effects, the majority of countries has not developed health and work safety measures for the workers and general population as it happened with asbestos protection. Unclear is what economic and environmental effects may occur due to the development of MMMF production enterprises. Asbestos serves as a good example. The earliest signs of health hazards due to the use of asbestos appeared 90 years ago. The first epidemiological studies on lung cancer and mesothelioma of workers in contact with asbestos were performed in the 1930s-1940s. However, they did not influence either safety approaches for the work with asbestos, or the use of asbestos. The first safety measures that led to the restriction of amphiboles appeared about 30 year ago somewhere in the 1970s-1980s. This indicates a gap of 30-50 years between the first scientific data on adverse health effects due to the use of some dangerous substance and the official recognition of this fact, between efficiency of introduced control system and prevention of harmful exposure of a substance and effective protection of workers and general population. After the period of 85 years since the first data appeared on dangerous health effects due to the use of uncontrolled asbestos the International Labour Organization was able to adopt Convention no. 162. This time gap between scientific findings and official decision-making carried away numerous human lives and damaged health of many people. It may so happen that the history of amphibole asbestos will be repeated. Due to it, the data that contributed to chrysotile asbestos ban and the data on the introduction of MMMF need a thorough analysis.

At present no substitute exists with technological properties equal to asbestos.

Not a single of them has been studies to such as extent as asbestos, which today is absolutely predictable and a well-studied product. Preventive measures developed for the work with asbestos allow avoiding its negative health impacts for a human. It means that asbestos can be properly controlled in industry and common use.

Medical specialists, biologists, hygienists all over the world will have to start everything from the beginning when they have to develop certification procedure for hundreds of chemical fibrous mixtures, minerals and man-made fibers which tens of years later may show much dangerous effects to the human health than natural chrysotile asbestos.

The latest events show the situation with asbestos may be repeated on a new phase. It has been found in some experimental, clinical and hygienic studies that MMMFs such as rock wool, glass wool, mullites, ceramic fibers, slag wool and others have almost analogous with asbestos fibrogenic and carcinogenic properties.

Glass wool products such as blankets and coverings are present at the market in hundreds of forms. They are advertised as environment friendly man-made mineral and organic fibrous substances. Products made using these fibers claim to be asbestos substitutes that are devoid of asbestos aggressive properties. Why do MMMF producers forget that their products are xenobiotics that are not at all indifferent to the environment and humans with regard to long-term effects.

Epidemiological data have been collected on increased mortality levels due to malignancies of various localization, especially, of skin and lungs in workers who produce glass wool, mineral wool, slag wool, basalt if their length of service is more than 20 years. Severe skin impairment, even cancers, were registered in the Russian MMMF industry.

Some US agencies think aerosols of mineral wool, ceramic fibers and other have a potency to develop lung cancer.

These fibers can cause more rapid and severe development of lung diseases than asbestos fibers.

Health effects due to MMMF exposure served as an object of several studies.

Some studies showed the level of exposure 1 fiber/ml and less, however, lung fibrosis was found (Kilburn K. H., et al, 1992; Hughes J. M., et al, 1993.). It exceeded the one identified by American, Finnish and Russian researchers in patients with multi-year occupational contact to chrysotile asbestos when occupational dust exposure was tens of times higher at Uralasbest Company where asbestos was mined, milled and processed (Kovalevsky E. et al 2002).

Some industrial countries adopted very strict standards for man-made mineral fibers with properties close to asbestos. For instance, in Quebec (Canada) safe exposure level for mineral wool (glass wool, rock wool, slag wool) is 2.0 f/ml, 1.0 f/ml for mineral fibers, 1.0 f/ml for synthetic organic fibers.

Joint report of National Research Council and National Academy of Science of the USA has assessed standards for the exposure to synthetic vitreous fibers, rock fibers, slag fibers and ceramic fibers. The report reviewed standards of exposure levels for synthetic glass fibers to be used in the US Navy. Two permissible levels were proposed. 1 f/ml was initiated by the US DOL OSHA, 2 f/ml – by the NIOSH. The US Navy adopted 1 f/ml standard proposed by the ACGIH in January 1999. It was concluded by the report that this value may be insufficient for health protection if there is an exposure to RCF and some other synthetic glass-like fibers that are resistant to biological media. A stricter standard was proposed for such fibers (Wedge R., 2001).

Some reviews of experimental studies that assess the indices responsible for the ability of fibers to penetrate into the lungs provoking development of malignant tumors state that the most important thing is the primary length of fibers and their resistance to biological media. Analysis of numerous experimental studies shows the same cancer-producing potential of all MMMFs. Short fibers also should be measured as well as all the particles found in the lungs because their removal can seriously be impeded. Optimal biological effect due to intrapleural administration was reached by administering shorter fibers than the ones that could be inhaled (Moolgavkar SH, et al, 2001).

Experimental works aimed at the assessment of the EU requirements for studying carcinogenic potential of inhaled fibers show that the fibers that can not be well dissolved meet the EU requirements, whereas other fibers with a short half-life should be treated otherwise (Moolgavkar SH, et al, 2001).

There is no aim to cite all the data of the world's literature on the matter. We can find hundreds of scientific publications concerning adverse health effects of fibrous asbestos substitutes for only last decade. However, these brief references show the necessity of performing more studies to prove what is preferable - asbestos substitutes or chrysotile asbestos itself. Short-term screening test are needed prior to long-term studies as well as types of experimental studies are to be chosen to reflect more precisely health exposure risks of asbestos substitutes. It is clear that epidemiological studies should be conducted both on cohorts with occupational exposure to MMMFs and on persons who represent the final chain of their utilization. The data on present exposure levels of MMMFs is incomplete. The data are necessary on health effects of fibers newly produced, processed and externally used for a long time. Adequately, the data on health effects due to long-term and short-term exposure can be inferred.

The question arises: why applicable is the principle of controlled use for less studied and may be rather aggressive substances whereas for the well-studied chrysotile asbestos the only solution is to be put under total ban?

Russians as well as some foreign experts find such a position erroneous: let it be other fibers, not chrysotile asbestos. This policy leads to chaotic use of asbestos substitutes with improper attention to control and safety at work measures.

Cellulose may serve as an example that in accordance with the recent data is capable of producing mesothelioma or sarcoma (Cullen R.T., et al. 2002).

Asbestos substitutes are called otherwise as "less harmful substances". It is strange, as their carcinogenic properties have been well proved. The same is true about asbestos. But why nobody calls it "a less harmful substance"? Synthetic vitreous fibers (SVFs) are also thought to be less harmful and more friendly with the environment. They are actively advertised through authoritative international organizations, however, their negative health impacts of production and consumption for the working and general population are passed over in silence. Violent and indiscriminate accusations like such ones as "mortal danger" with regard to all types of asbestos, including chrysotile, and all types of occupational and non-occupational contacts and levels of exposure often perform for the countries that do not have their own health and safety studies on asbestos and it's fibrous substitutes. Special international programs must be developed to organize in such countries their own safety at work programs aimed at the beneficial and healthy use of fibrous asbestos substitutes.

It is clear today that the workers and general population will be protected if regulations and standards equally strict for all the types of fibers of both natural and man-made origin will be developed. As it has been mentioned, competent bodies of many industrial countries where various asbestos substitutes have long been used share this opinion.

The ILO Code of Practice on Safety in the Use of Synthetic Vitreous Fibers used for insulation (glass wool, rock wool and slag wool) published in Geneva by the ILO in 2001 convincingly demonstrates such a reasonable approach.

It should be noted that all the measures aimed at providing safety in the use of synthetic fibrous products do not possess any specificity and meet the requirements to be observed in occupational contact with asbestos and asbestos-containing materials. Earlier, in 1984, the ILO published the code dealing with safety in the use of asbestos that coincides in many aspects with the newly composed ILO code on SVF safety.

A mere fact that these two ILO codes correspond to each other may serve on the one part as an indirect acknowledgement of a possibility to introduce controlled use of chrysotile asbestos, on the other part is a recognition of hazardous properties of man-made fibrous products that are not at all less harmful than the asbestos ones.

Biological effects of synthetic fibers and the products made out of them have much less been studied compared with the studies performed on various types of asbestos. In particular, no data is available on long-term effects of occupational contacts with MMMFs (excluding glass fibers). Some synthetic fibers have been found to be potential carcinogens.

It is important to stress that biological effects of MMMF are based very often on experimental results whereas relevant asbestos studies are confirmed by epidemiological findings.

Decision-making on preferences in the use of substitutes (PVA, aramid, cellulose, etc.) as well as asbestos ban has been made guided by insufficient data on such important indices as dosage, size of particles, their resistance in the body.

The role of dose has been widely recognized. Without solid data on qualitative parameters there is no chance to get clear epidemiological results. They should be planned with regard to other concurrent factors and dose-effect relationship.

However, no data are found on dose-effect relationship in all the IARC classifications of vitreous fibers. It can be explained by the absence of sufficient and reliable data on exposure control results and by the imperfection of monitoring. Available in such studies data shows exposure levels several times lower 1 f/ml. At this low exposure levels we can not find any health effects.

ASTEC program developed in Europe in 2002 and supported through EU grants may serve as a proof to the above statement. ASTEC is aimed at harmonization of dust measurements and dust control and improvement of prevention in the sphere of dust-induced pathologies.

It is not surprising, therefore, that arguments appeared in favour of “threshold absence” and the fact that definite conditions are needed for the realization of properties potentially inherent to any substance is underestimated.

Attempts were made by Russian representatives in 1998 to attract the attention of the EC (in Strasbourg) and the EU consultative committees (in Brussels) to the results of asbestos health studies performed in Russia when the decision on total asbestos ban was proposed. However, the Russian experience was neglected in the report entitled “Dangers of asbestos for workers and the environment” that was made by the Chairman of the EC Committee on Social Protection, Public Health and Family. When the EC Parliamentary Assembly in April 1998 formally discussed total asbestos ban, they also ignored the Russian experience. The same happened when the EC IP/99/572 Directive adopted on 27 July 1999 was discussed. It put under a ban starting from 1 January 2005 the use of all types of asbestos including chrysotile asbestos even in the form of asbestos-cement products. It is important that the Russian representatives had already presented to PACE during that hot period of asbestos discussions their considerations in the form of «Memo on the use of chrysotile asbestos» (no.8008 from 29 January 1998) and «Russian Position concerning the Report of the Social Health and Family Affairs Committee of the Parliamentary Assembly of the Council of Europe» / Doc. 8015 AS/Inf (1998).

It should be noted that Russian methodology of hygienic standards and Russian dust control methods applied, in particular, to chrysotile asbestos crucially differ the foreign ones. Russian unique more than 50 years lasting experience of occupational and non-occupational assessment of health exposure to asbestos almost free from amphibole admixtures needs to be accounted for by the EC when final decision will be made on total ban.

Concerns have been arisen with regard to the trend marked during the recent years to the unilateral consideration of the asbestos problem. For instance, a number of closed for free discussion asbestos meetings have been held like on diagnostics of asbestos related diseases in Finland 1997, 1999, Asbestos Symposium for the Asian Countries held on 26-27 September 2002 in Japan and some others. Only advocates of total asbestos ban and representatives from countries were do not perform deep research on health effects due to its use are invited to these meetings. There was made an attempt in 2002 in Russia to organize a free discussion on asbestos under the auspices of interested governmental bodies and the Russian Academy of Medical Science (RAMS). But, unfortunately not a single international organization (ILO, ICOH, WHO) participated in the Conference. So did the countries - supporters of the total asbestos ban. More than 22 countries-consumers of asbestos took part in the conference. All of them unanimously supported an opinion on hasty EC decision on total ban of asbestos. The conference participants agreed that issues regarding the usage of all natural and man-made fibrous products and their safety in production and general environment require additional experimental, clinical and epidemiological studies and further technological improvements, i.e. taking control and responsibility for the use.

The conference participants delegated the conference organizational committee to refer to the WHO and the ILO with the proposals:

- to create an international expert group in order to hold special meetings under the WHO and the ILO by the final decision is accepted by the EU and take analysis of scientific data concerning safe use of natural and man-made fibrous products in different conditions with the requirements listed in the ILO no. 162 Convention “Safe use of asbestos” and other corresponding international documents.
- to develop an international research program for the period of 2003-2007 to specify questions for the discussion in a framework of the above issue.

It was previously proposed by Russian parliamentarians in PACE in 1998 to develop international group of experts with different points of view on the problem danger of asbestos and other fibrous products for performing joint studies. It could serve to the aim of health promotion of all people contacting asbestos and asbestos substitutes, may help to develop unified methodological approaches to conducting joint researches of asbestos. RAMS was ready to be one of coordinators, study performers and advisers to this international group of experts. However, the Russian proposals though accepted by the PACE were not implemented.

2. SAFETY IN THE PRODUCTION AND USE OF CHRYSOTILE ASBESTOS IN RUSSIA

2.1. Field of chrysotile application in Russia

Deposits of serpentines and amphiboles exist in Russia. But only chrysotile asbestos is traditionally mined and processed. All the 41 asbestos enterprises interact with each other and are composed of 3 asbestos mining and milling enterprises, 24 asbestos-cement plants, 9 asbestos-technical plants, 2 asbestos pressboard manufactures and 3 technological institutions. The total work force is 38.5 thousand workers, technicians, and engineers. The greater part of these enterprises is located in the urban areas. It means that more than 400 thousand people, thus, display a keen social interest to their proper and steady functioning.

More than two thirds of asbestos produced in Russia is used for asbestos cement products such as slates and tubes. These products are compositional and consist of Portland cement (80%-90%), chrysotile asbestos (10%-20%) and water. Colored slates contain 2.3% - 4.2% of dyes from the total mass. Chromium oxide, ferrous red lead and red oxide are used as dyes. The next most important asbestos application is fabrication of asbestos textiles and shoe brakes. Fabrication of asbestos technical products and asbestos textiles such as shoe brakes, fillings, threads, blankets, ribbons, cards has been till recent years one of the largest branches in the asbestos industry both in Russia and abroad. The same was true for heat insulators and noise absorbers made of asbestos.

It should be noted that apart from the greater part industrial countries (the USA and many European countries) no brittle asbestos products were used in the construction and finishing of dwellings, public buildings, other non-industrial objects in Russia. Relatively small number of asbestos cement products was mounted in the construction works.

2.2. Some physical, chemical, medical, biological, technological properties of chrysotile asbestos and asbestos-containing dust

The bulk of asbestos minerals can be distinguished as constant. This can not be said about different mixtures that are found at every deposit (WHO, 1986). It is well known that chrysotile asbestos mined in Italy had amphibole mixture called balanzerite, Canadian chrysotile also contains amphiboles called tremolite, etc.

Russian chrysotile asbestos practically does not have amphibole mixtures.

Unique asbestos properties made it indispensable in a number of industries. Chrysotile asbestos is resistant to alkyds but an attack by weak acid destroys it. Chrysotile breaks down if exposed to body tissue liquids and, thus, more rapidly is removed. Amphiboles are resistant to acids and remain longer in the body causing prolonged effects.

Some conditions may help to develop occupational asbestos-induced pathologies. These conditions are long-term inhalation of asbestos dust in concentration tens and hundreds of times exceeding present day standards, or maximum allowable concentrations (MACs).

Biological effects of fibrous particles depend to a great extent on their ability to retention, deposition and elimination from the body. This process occurs in accordance with one and the same scheme both for amphiboles and chrysotile asbestos administered to the human respiratory tract. However, there exist some distinctions explained by physical and chemical properties of amphiboles. First, amphibole fibers do not break down due to the exposure to biological media. Second, high resistance of amphiboles to acid means that they are not destroyed in deep parts of respiratory organs as it happens with chrysotile fibers unstable to acids. Naturally, no elimination of amphibole fibers from lungs due to their dissolving occurs. This is most probably an explanation of the fact that amphibole fibers are longer delayed in the respiratory tract compared to the chrysotile ones.

The first experimental assessment of biological effects at Bazenovskiy chrysotile asbestos deposit was carried out in the 1940s and 1960s by M. Vilenskiy (1940), L.Tartakovskiy (1956), F.Kogan (1963). An ability of chrysotile asbestos and other serpentines to develop fibrosis were studied. As a result, MAC for asbestos dust with less than 10% content of asbestos appeared at a level of 4 mg/m^3. By this MAC value carcinogenic properties were not regarded.

It is known that pure chrysotile asbestos has actually one and the same structure and similar chemical composition. Researchers of Ekaterinburg Medical Centre think that different biological effects of one and the same type of asbestos mined in different deposits can be explained by different mixtures, for instance, higher content of asbestos-like mineral called nemalite/brucite, by free SiO_2, etc.

Biological effects of Bazhenovskiy deposit found near Asbest City in Sverdlovsk Region, compared to asbestos of other deposits, were studied in numerous experiments on general toxicity, mutagenicity, carcinogenicity, an ability to produce fibrosis, allergic effects, etc. (F.Kogan, 1953; F.Kogan, 1966; L.Elnichnikh, 1974; L.Piliov, 1975; A.Deminov, 1981; V.Gurvich, 1983; S.Koshanskiy, 1997). It was found that all the samples are capable of producing in the lungs of experimental animals clear sclerotic changes. Dusts of Bazhenovskiy and Dzhetigarinskiy chrysotile asbestos showed the same fibrogenic effects. Dust of Ak-Dovurakskiy deposit turned the most fibrogenic compared to other samples.

Assessment of more than 50 types of industrial mineral dusts was performed in short-term tests including Bazhenovskiy chrysotile asbestos and its numerous modifications (forsterite, chrysotile, etc.) and serpentine: lizardite, serpentinite, etc. (Vanchugova, 1989). More data on mutagenic effects of chrysotile asbestos were obtained in the 1990s with regard to twenty industrial, common and pharmaceutical factors.

Biological aggressiveness of asbestos products has also been well studied. It has been shown that all the dusts displayed moderate toxic effects. Significant difference was not found in basalt or asbestos composites in the parameters of acute toxicity. Toxic effect of dust depends mainly on percentage of phenol and formaldehyde content. All the samples showed fibrogenic properties, though to a less degree than chrysotile asbestos mined in the Bazhenovskiy deposit. Dust of asbestos products made out of non-asbestos composites did not differ by fibrogenic effects from asbestos dust. All the samples showed ability in experimental conditions to induce malignancies. Asbestos and non-asbestos composites showed no significant difference in inducing malignancies.

Biological effects of asbestos-containing heat insulation materials were studied in the 1960s such as asbestos pressboard, vulcanite, asbestos vermiculite (Svirskiy, 1968). Clear fibrogenic activity was found that coincided with carcinogenic potential of these products. Vulcanite and asbestos vermiculite showed more pronounced carcinogenic effect that may likely be due to adsorbed PAU, co-carcinogenic effects of lime or du to the action of silica fluorine sodium that may be part of their composition.

2.3. Approaches of Russia to hygienic setting of standards and to the control of chrysotile asbestos in the air of working zones and the ambient air; methodology of rating and control

Health promotion of working population is the basis of economic welfare of any society. It is one of the most important tasks of occupational health. Occupational morbidity levels are a direct result of poor working conditions and show clearly medical, social, economic, legal and other aspects that help to provide high life standards.

As it is known the main principle of the ILO no. 162 Convention is controlled asbestos use that prevents possible asbestos harmful influence on human health.

As a starting moment, control is needed over the rate, duration, exposure level, type of job and working conditions (ILO no. 162 Convention, article 1, item 3).

However, some well-known factors noted by the WHO expert group in 1989 impede the simplest task related to the control of working conditions in the manner required due to the ratification of the ILO no. 162 Convention. Besides, solid substantiation and improvement of permissible levels and limits of asbestos exposure seem of particular importance.

Factors to be accounted for in establishing hygienic rating:

- Long latent period between the onset of exposure and the developed effect that followed it;
- Absence of complete hygienic data (results of ambient air control) that should cover the long latent period for judging about health effects due to harmful factors;
- Differences in the biological action of different fibers (it is not the size of fibers that should be accounted for, though it also important; it is lower harshness of chrysotile asbestos comparing with amphiboles);
- Ignorance of carcinogenic mechanisms;
- Difficulties in the extrapolation higher doses and exposure levels to the low ones (Documents of the WHO groups of experts on Occupational exposure limits for asbestos, WHO/OCH/89.1.).

All these factors, no doubt, are true in relation to the basic value that would serve as a basis for hygienic rating.

It is important to state those pathogenic mechanisms of asbestosis and asbestos-induced respiratory pathologies are inseparable from asbestos fibrous structure. In accordance with well-known Stenton's hypothesis (1972) biologically harshest are thin and long asbestos fibers. Shorter fibers are thought to possess less hazardous effects. It was attempted to calculate totally accumulated exposure dose of respirable fibers. It turned that for asbestosis it was 25 f/ml x years, for lung cancer it varied from 15 f/ml to 100 f/ml x years.

Asbestos exposure assessment in Western Europe, Middle East, Africa, Asia, the USA, Canada and Latin America is performed by calculating the number of fibers in a certain volume of air (f/ml). It is noteworthy that foreign researchers prefer to take into account only one rather conventional dust fraction of “respirable” fibers.

Development of asbestos pathologies in Europe when thirty and even forty years after the latency period was over, as a response to primarily uncontrolled saturation of Europe by amphibole asbestos, indices of asbestos-induced pathologies started to grow. Especially it concerned respiratory lung cancer and mesothelioma. That situation led, first, to several revisions toward stricter values by which occupational exposure is limited, second, helped to pay attention to indices of rating.

Based on the latest epidemiological data, the EU Council of Ministers in 1994 declined proposals made by the PACE to impose a ban on asbestos as the majority of countries preferred its control use in accordance with the requirements of the ILO no. 162 Convention. But it was recommended to reduce chrysotile asbestos exposure level from 1.0 f/ml to 0.6 f/ml.

In 1968 the USA adopted counting method based on the exposure level equal to 12 f/ml. The value was several times revised. In 1980 it was 0.2 f/ml for crocidolite, 0.5 f/ml for amosite, 2.0 f/ml for chrysotile asbestos. Starting with 1986, the level of 0.2 f/ml was adopted for all types of asbestos.

In Great Britain time-weighted exposure levels are 0.5 f/ml and 0.2 f/ml. Respectively, for crocidolite and amosite.

No. 162 Convention asserts the necessity of asbestos dust control and measurement in the air by “gravimetric or any other equivalent method” (Article 2, item “c”).

Gravimetric indices have been used in Russia since the 1950s for the rating of all the dusts that are capable of developing fibrosis (E.Khukhrina, V.Tkachiov, 1968) asbestos-containing dust included. In accordance with the legal documents and standards adopted by the Russian Ministry of Health the whole mass of airborne dust should be controlled, not a disperse aerosol fraction of the so-called “respirable particles” as it is generally accepted abroad. It is extremely important to regard when an attempt is made to use or compare the Russian data of dust control with the foreign ones.

The basis of controlled chrysotile asbestos use in Russia as in other countries should be its legal provision based on health data of workers.

Russian MAC values of asbestos dust in the air of working zone that were approved in 1989 in accordance with clinical, hygienic and epidemiological data with regard to possible carcinogenic properties of asbestos need control to be performed of mean shift concentrations measured in the air of respirable dust mass.

For asbestos and mixed dusts if they contain more than 10% of asbestos MAC value of 2mg/m^3 was established in Russia. Since 1989 maximum single time concentration (MSTC) of 2mg/m^3 has been used for dusts with more than 20% of asbestos content, 0.5 mg/m^3 is a mean shift concentration (MSC). It takes into account the necessity to prevent long-term malignancies. Respectively, with more than 20% asbestos dust content, MSTC is 2 mg/m^3 MSC is 1 mg/m^3; in less than 10% asbestos dust content MSTC is 4 mg/m^3, MSC is 2 mg/m^3. These dusts refer to III Class of Danger and are labeled with “K” letter for their ability to be carcinogens and “F” letter for the ability to arouse fibrosis.

In Guidance 2/2755-99 of Occupational Hygiene, Russia, Moscow, 1999, controlled dust load levels were proved by the results of complex clinical, hygienic and epidemiological studies. Their control provides prevention from exposure to asbestoscontaining dusts and other fibrogenic dusts. Classification of jobs with dust contact by possible classes of danger is given in this standard, too.

Classification of working conditions, dust loads on respiratory organs and MAC / CLDL (control level of dust load) multiplicity excess has also been developed in Russia with regard to the content of airborne aerosols that may possess fibrogenic effect (asbestos dusts included). DL on respiratory organs is a real or predicted value of dust total exposure dose inhaled by the worker during a real or imagined occupational contact.

Though European researchers are still in doubts whether threshold value for chrysotile asbestos exists or not, in Russia dust load on respiratory organs has been accepted as a threshold value. It seems important to repeat again that DL is a total exposure dose of the whole dust mass for the whole time of occupational contact (not more than 50g).

The legal basis for further improvement of asbestos standards is no. 52 Federal Law from 30 March 1999 “On sanitary-epidemiological welfare of the Russian population” compiled with regard recent crucial changes in policy, economy and social life of Russia.

Based on no.52 Federal Law some documents have been approved:

2.2.3.757 – 99 Sanitary Regulations “Use of asbestos and asbestos-containing materials” that cancelled former no.5808 regulations of 1991;

2.1.2/2.2.1.1009–00 Standard ”List of asbestos-cement products recommended for use”, 2001;

Letter no. 1100/3232-1-110 of Chief Deputy Hygienist of the Russian Federation from 9.11.2001 entitled “Asbestos products recommended for production and use at transport, equipment, industrial and common life commodities”;

010-2000 “Regulations on safety at work in the production of asbestos and asbestos-containing products”, 2000.

Methodological documents on hygienic assessment and expertise of products made of mineral fibers either of natural origin or man-made has been developed along with unified assessment method of biological effects with regard to fibrous dusts. A document regulating removal of asbestoscontaining wastes has also been compiled.

It is necessary to stress that the value oriented exclusively on “respirable fibers” can not be a standard. It can be only the indicator of the fact that fibers of some fraction are found in the sample because the size of the fraction is not so much determined by true biologically grounded ‘respirability’ of fibers as by the resolving capacity of optical microscopy. How can this “valid” standard be used in the world and be so popular? It is much more popular than the slogan “Even one fiber can kill”. Nowadays all hygienists are trained to measure “respirable” fractions. It seems so reliable and authoritative that no one wants to think over its essence.

Numerous data have been obtained on properties of asbestos and man–made fibers with regard to their biological and health effects (Man–made mineral fibres \\ Environmental Health Critera, WHO, Geneva, 1088), their diameter, length, shape, chemical composition, electrical charge, mass and number. As a results of deep generalized analysis of dose-effect correlation, M.Lippmann (1988) arrived at a conclusion on the greatest importance of the parameters given in the Table that help to develop fibrosis and malignancies due to the contact to fibrous dust.

Asbestos-related diseases	**Indicators of exposure to asbestos**
Asbestosis	fibers with L more than 2 μm, D more than 0.15 μm
Mesothelioma	fibers with L more than 5 μm, D less than 0.1 μm
Lung cancer	fibers with L more than 10 μm, D more than 0.15 μm

Thus, on the one hand it is a way to further hygienic improvement of asbestos rating with the more efficient control of it in the ambient air; on the other hand, restrictions of phase-contrast optical microscopy (PCOM) for these aims are clearly seen. The fraction of measured by PCOM “respirable” fibers makes up about 4% from the total number of fibers in the air, whereas other 96% actually remain uncounted (Report of the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario. / Ontario, 1984). Among uncounted fibers can be the ones that are very biologically important but optically are invisible. These data prove to the necessity to count all the fibers, not “respirable” ones, and to use appropriate methods for these aims in combination with gravimetry would be a logic, efficient and integral way out, the more so that more than five decade since the 1950s it has been effectively used in Russia.

We are sure that generally accepted counting methods based on PCOM are not convincing (L.Elovskaya, 2002). The method does not measure all the fibers that influence shifts of a biological effect, it masks the data on dosage, impedes control of dose-effect relations and is not efficient for prevention of adverse effects.

Relatedness to asbestos, of lung cancer or mesothelioma, can not be clarified with the help of PCOM method because the fibers responsible for the development of these pathologies are not characterized by it in any way (M.Lippman, 1998).

No condition, to say nothing of all the main conditions of the international community can be implemented by this method. For instance, one can not count all the fibers with the length equal or exceeding 5 μm using PCOM. Long enough fibers, to say nothing of the fibers less than 5 μm, can not be counted if their diameter is less than the resolving capabilities of the optical microscopy. They are simply invisible.

At a present day level of knowledge the recommendation to use the method combined with the EC willingness to proclaim total asbestos ban may be regarded as a complete absence of a wish to identify a true reason of why occupational malignancies attribute to chrysotile asbestos exposure. As if there is a purposeful intention to create obstacles, at least, for the near future, to those who want to look into the problem of true asbestos danger.

To add to it, inhaled air contains both the fibers that are counted by PCOM and the shorter ones, which are neglected by the PCOM methods. These shorter fibers when rated by the number of fibers in one milliliter of air are not counted though they represent a substantial “load” for the eliminating parts of respiratory organs, which the body is not indifferent to at all. This question waits to be solved, too. It is also important for the organization of safe working conditions in case of less than asbestos studies man-made fibrous products, especially, with ultra thin biologically active fibers invisible and uncounted by PCOM methods. Their length to diameter ratio may significantly increase 3:1 (silica carbide, for instance has a 60-80:1 ratio). So, all the particles and their parameters are important in the inhaled air, not their selected fractions.

Advantages of the Russian hygienic rating and control that regard the whole mass of inhaled air combined with complete parameters of disperse and other physical and chemical properties that make up a disperse phase of an aerosol allow to implement efficient prevention of dust - induced pathologies.

Gradually with years the world has started realizing the importance of rating dusts with regard to the whole mass, especially actual to those that possess fibrogenic properties. Growing understanding of physiological, biological and pathogenic role played along with fine also by coarse airborne fibers has also been noted.

2.4. General and Industrial Environment

The main criterions for the assessment of working conditions characterized by dustiness have been parameters of mean shift concentration (MSC) since 1989. Control and real dust loads are calculated based on MSC data.

Long-term assessment of dust levels at asbestos production enterprises served as a basis for calculation of asbestos-containing dust loads (individual dust loads expressed in grams, and total doses of fibers expressed by the number of fibers accumulated during all the years of occupational contact with asbestos and its dusts). Then the data are compared with workers' health indices.

Based on the comparison critical figure of total exposure dose, or dust load (DL), was developed. It is equal to 50 g of asbestos-containing dust to be accumulated during the whole period of occupational contact. Appropriate standards were developed using this approach.

In accordance with the Russian law, the employer has to observe control DL level. Control DL level goes out of the awareness of the permitted DL value in both cases when MSC of asbestos dust are/are not controlled. It should not exceed 50.0 g for aerosols with more than 20% of asbestos. In accordance with the DL value, control DL is calculated and preventive measures are developed for the prevention of asbestos-induced pathologies (2.2.3.757-99 Hygienic Regulations "Use of asbestos and asbestos-containing materials").

High and extremely high asbestos concentration in working zone air (compared with MAC values) may contribute to the development of asbestos-induced pathologies.

During the first decades of the past twentieth century, especially after World War II, dust levels at asbestos mining and processing enterprises remained rather high in Russia (hundreds of mg/m^3). In the 1960s dust levels decreased to MAC values established at that time.

Despite the heaviest economic crises in Russia, domestic asbestos industry has improved during the recent decade. It concerns technological advances in asbestos mining and processing, automation, removal of wastes, dust prevention. Thus, dust levels in all the stages of asbestos processing and application were stabilized. In accordance with the results of American - Finnish - Russian measurements, dust concentrations by gravimetric method and by counting are within the limits or slightly exceed the domestic MAC values. As a result, newly registered occupational cases have stabilized, and in 1993 was 1.77 cases (per 10000) compared with 1.75 cases in 2000.

Russian researchers both in the regions where enterprises are located and in big urban areas have accumulated assessment data of asbestos fibers in the atmospheric air.

It was found in urban areas that the content of asbestos fibers in the air did not exceed the level of 0.001 f/ml.

In dwellings and public buildings where asbestos cement products were used concentrations of asbestos fibers remains by one order lower than MAC value (0.06 f/ml) and they do not depend on seasonal changes. In 30%-70% of measurements no asbestos fibers were found. Analogous levels were registered earlier in more than 93% of building in France where asbestos products were used. Mean concentrations in public and industrial buildings in the USA based on hundreds of measurements were 0.00027 f/ml. It is very likely that these levels of fibrous dusts which residents are exposed to can not possess risks of developing asbestosis or mesothelioma.

Not a single sample of the atmospheric air and indoor air of public and residential buildings made either by Russian researchers, or by foreign ones who in 1997-1999 performed a study ordered by the EC "Prevention of asbestos-induced diseases in Hungary, Estonia and Karelian Republic" did not find asbestos fibers of amphibole group.

As a result of our studies, it was convincingly proved again that PCOM method could no be used for evaluation of asbestos contamination of the ambient air of residential areas.

Russian findings reliably show that asbestos cement roofing products even in conditions of sharp shifts of external temperatures, harsh acid and alkyd industrial discharges in the air have never been a serious source of emission of fibrous particles. This fact does not depend on the season, terms of roof service (70 years is maximum time of service) though in the opinion of analytic roofing specialists time of service of asbestos cement products vary from 30 to 40 years. In contrast, the data exist that corrugated roof plates made of other that asbestos materials break down and become spongy in 1-2 years due to volatile ash in their composition. Levels of fibers in buildings and nearby them built by asbestos technologies are not higher than in the districts without asbestos cement roofing.

Russian researchers showed changes occurred with the surface and composition parameters of chrysotile asbestos fibers due to exposure to environment and cement base. It has been supposed that the layer formed on the surface of chrysotile asbestos fibers that consists of hydrated clinker minerals, calcium hydroxide or carbonate, must reduce biological effects of chrysotile asbestos. This hypothesis has likely been proved by the studies on the capability of different dusts based on chrysotile asbestos and asbestos cement destruction products to activate free radical reactions. This still more strengthens the theoretical basis of possible controlled use of domestic chrysotile asbestos for the production of asbestos-cement products and for their safe use by general population. Chrysotile asbestos subjected to three-year atmospheric destruction is 10 times less active (by the speed of reaction, or time of maximum luminescence) compared with commercial chrysotile asbestos. It is of note that Portland cement dust is three time more active that the original commercial chrysotile asbestos. It should be underlined that chrysotile asbestos is 300 times less active if it is subjected to atmospheric destruction, it is 900 times less active in the asbestos-cement products compared with the dust of non-commercial chrysotile asbestos milled to highly disperse state. The latter can serve as additional evidence in favour of measurements of both conventional respirable" fractions and the fibers less than 5 μm which as it is found by the test possess an ability to form free radicals.

In contrast to the above, friendliness to the environment of construction products made from asbestos substitutes causes doubts. The most serious problem in Sweden is a syndrome of allergy causing buildings, the number of occupational pathologies of construction workers who use asbestos substitutes has increased for the latest five years in Germany. These countries were among the first ones to refuse asbestos-containing products in construction.

Improvement of working conditions, modernization of technological lines and industrial process, effective technical and preventive measures influenced to a greater extent ambient air of urban areas with nearby asbestos mining, milling and processing enterprises. For instance, dust level in the atmosphere of Asbestos City decreased from 0.1mg/m^3 - 0.3mg/m^3 to 0.01mg/m^3- 0.03 mg/m^3.

Steady dust prevention program reduced lung cancer mortality in Asbestos City by 26% compared with residents of other cities of Sverdlovsk region.

It is known that cancer mortality indices of urban areas can not depend only on the levels of asbestos dust in the ambient air. One can not deny the absence in it of industrial carcinogens such as the ones emitted by metallurgic enterprises, oil and steel production industries. Great carcinogens are automobile exhausts, etc. Besides, cancer mortality indices of general population are influenced by social and economic conditions such as coverage by qualified medical service, bad habits, and other numerous factors.

Findings obtained by epidemiological cancer studies in ATI workers of Moscow asbestos-technical products plant compared with morbidity levels and standardized mortality risk (SMR) in ATI workers and Moscow residents serve as a confirmation of the above.

Length of service in all the examined workers was from 20 to 50 years and more in conditions of exposure to asbestos-containing dust on MAC level or 2-4 times higher than MAC level (64.7% of them had 40 years in occupation). Distribution by age, length of service and occupation was uniform in all examined groups. High incidence of upper respiratory pathologies and other health deviations were registered. However, workers in contact with chrysotile asbestos dust not higher than MAC level showed lower cancer risks than Moscow residents did (though those were former MAC values that took into account fibrogenic properties, and thus, were less strict than the present ones).

It means that many other factors influence people's health besides asbestos and that domestic MAC values are reliable protectors.

Foreign data of a series of epidemiological studies on non-occupational asbestos exposure nearby asbestos production enterprise showed increased risks for mesothelioma and lung cancer among general population. Though it is not enough clear from the study what type of asbestos was produced there. Starting with 1960 when Kiviluto (Finland) revealed high incidence of pleura calcification nearby anthophyllite deposits, this research gained popularity in many countries (Bulgaria, Austria, the Czech Republic, South Africa, etc.). Results of these epidemiological studies were rather controversial and unreliable due to a great number of factors that could not be excluded.

It should be noted as a conclusion that it is impossible to remove asbestos as well as many other natural minerals from people's life. As many other minerals exposed to natural processes in the atmosphere, corrosion of the earth's surface, weathering and washing away, asbestos fibers go to the environment and are carried by airborne flows to all the corners of the world.

2.5. Medical provisions in conditions of controlled use of asbestos

More than 100 years medical and hygienic studies are performed at Bazhenovskoye deposit of chrysotile asbestos.

It was in the far away 1899 when mining engineer A. prospecting Bazhenovskoye for asbestos said that "women-workers who mill asbestos suffer from small abscesses of fingers because asbestos needles penetrate into the skin", also "very often they complain of eye diseases due to asbestos dust" (Semenchenko, 1902). Sergey Bogoslovskiy was the first Russian statistician who paid attention to asbestos hazards. At the 10th N.Pirogov's Congress of Russian physicians that was held in Moscow in 1907, Dr. S.Bogoslovskiy made a report "To the Classification of Jobs" where he mentioned the main harmful factors of asbestos deposits which workers had to undergo at that time. He also wrote a monograph entitled "System of Occupational Classification" published in 1913 containing data on health effects due to exposure to asbestos.

Controlled use of chrysotile asbestos is performed through governmental legal documents. The most important of them are state standards and regulations by which safety criteria of environmental factors are established necessary for favorable life and work conditions.

Complex evaluation of clinical, X-ray, endoscopic, and histologic researches determines diagnosis criteria of health exposure to chrysotile asbestos dust. Prevention measures are introduced after individual dust loads are compared with health indices.

In accordance with the order of the Russian Ministry of Health "On preliminary (prior to work) and regular medical examinations of workers" all the persons in occupational contact with asbestos have to be examined.

Preliminary examinations are necessary to be determined if health of a worker corresponds to the working conditions of asbestos-containing aerosols.

Regular medical examinations are performed for the aim of obtaining dynamic health data due to exposure to hazardous industrial factors, their prevention and timely diagnosis of occupational pathologies (early diagnosis of primary signs).

When workers evade from regular examinations or do not fulfil recommendations of their physicians or medical commissions that summarize the results of examinations, they must not be admitted to work.

A team of doctors participating in the preliminary and regular examinations consists of a physician, ear, eye and throat specialist, and dermatologist. A consultation of an oncologist may be advised in the course of a regular or preliminary examination separately. Frontal and side chest roentgenogram is obligatory as well as test of external breathing, and clinical tests. All these tests and procedures are adopted by the appropriate regulations and edicts of the Ministry of Health of Russia.

Adolescence of less than 18 year old, pregnant women, and some other categories of citizenship are not allowed to work in conditions of asbestos dusts exposure of any origin in accordance with Law of the Russian Federation on Safety at Work (article 6, chapter 11).

Additional medical precautions aimed at work prohibition in conditions of exposure to asbestos and asbestos-containing products are total dystrophic and allergic diseases of upper respiratory organs, distorted nasal septum, hyper plastic laryngitis, chronic bronchitis, pulmonary, and cardiovascular pathologies, congenital abnormalities of respiratory organs and myocardium, chronic skin diseases.

Regular medical examinations of asbestos-contacting workers are carried out every year. Repeated chest x-ray test is performed once in three years. If length of service if from 3 to 10 years it is performed once in two years. If length of service is more than 10 years, it is performed every year.

After regular examination is over, the analysis of results is made and follow-up (prophylactic) groups are formed:

Group1 are healthy workers with individual DL not exceeding control level.

Group 2 are workers with some function health deviations: long lasting coughs, acute respiratory inflammations, deviations of some indices of external breathing test, x-ray chest changes, persons with exceeded dust control DL exposure.

Group 3 are occupational patients.

Group 4 are patients with chronic general diseases who need expertise to decide on their work in hazardous conditions with regard to the level of individual dust loads.

Of particular attention are the workers of Group 2, or the so-called risk group to develop an occupational pathology. They are recommended to be examined in the occupational health center for appropriate expertise.

All the workers in occupational contact with asbestos remain lifelong period in a prophylactic group.

Epidemiological study of a cohort compiled of 4639 persons exposed to asbestos in concentration tens of times exceeding MAC values found only 19 workers (0.41%) with diagnosed lung cancer, 110 workers were diagnosed fibrosis.

At the same time by the results of American-Finnish-Russian study and by earlier conducted research it was found that among general risk factors for developing fibrosis due to increased concentration of chrysotile asbestos the most important are tobacco smoking, alcohol abuse, extra weight, chronic bacterial infection, hereditary cardio-vascular, endocrine, respiratory, locomotive changes, injuries of organs, muscles, bones and others.

It has been recently clear that occupational pathologies, their development and complications are explained by industrial and general environmental factors, and by individual features (Kuzmina L., 1999; 2001; Milishnikova V., 1996).

Occupational diseases have been proved to be specific indicators of hereditary predisposition to chronic pathologies of organs and body systems that are developed in a combination of congenital and external risk factors.

Integrity of genetic and external exposures gives individuality to pathogenic processes.

Research on biological markers of susceptibility and resilience to industrial aerosols is of particular importance for individual risk prognosis to develop an occupational disease. The data are also used for prevention measures, treatment, rehabilitation, and employment of workers with specific body phenotype.

All mentioned above may be attributed to risk of asbestos related diseases including cancer (Spitsin V., 2000)

Numerous studies testify to the fact that asbestosis patients in comparison with general population and occupational control groups differ by polymorph protein systems responsible for proteolysis, humoral immunity, by protection responses of lung tissues, and by cell energy process. It means that asbestosis may predominantly be developed in persons with determinate genotype. Biological asbestos effects can be revealed by the primary (before the contact started) state of immunity and immune regulation.

Biological markers of susceptibility and resilience to asbestos exposure confirm the fact that controlled asbestos use can be implemented.

Besides, results of examination of 2000 occupational lung patients showed in more than 78% of them different defects of bronchi and pulmonary system, their incidence rates exceeding by some types the ones found in the general population (Milishnikova V., 1990, 1995).

Time of developing asbestos-induced diseases in persons with defects of bronchi and pulmonary system does not depend on the levels and duration of exposure to asbestos aerosols, but on how pronounced the anatomic abnormalities are in them.

The above postulate stresses the importance of comprehensive studies of reasons and conditions that lead to health impairments. Only one factor can not be blamed as it happened with asbestos.

Research of asbestos related pathologies was carried out in the course of American–Finnish-Russian collaborative study on health effects of exposed to chrysotile asbestos workers of the Russian Federation. Active or former workers of the Uralasbest Company were examined either in the local outpatient service, or in the occupational health hospital. In 2003 workers x-ray screening results were analyzed; in 1770 workers complex clinical and functional examinations were performed; in 497 workers EBF tests and blood gases were done.

To assess the primary health and how asbestosis and other respiratory, intestinal, cardio-vascular, endocrine and other pathologies progressed, an analysis of visiting a doctor was performed by the patients' histories. Assessment of results was conducted comparing the data with the occupational experiences starting with the onset of occupational contact and ending by such factors as length of service in the exposure to asbestos dust, dust levels at working places, sex, age, tobacco smoking.

The results showed functional impairments of a cardio-vascular system to correlate tightly with hypoxemia. As hypoxemia signs, x-ray asbestosis signs, complications (for instance, chronic bacterial infections), other concurrent pathologies were growing, hypertrophy and dilatation of the right ventricular were developed as well as hypertension of the pulmonary circulation, which at last chronic lung heart was formed.

Follow-up (prophylactic) groups were composed with regard to functional respiratory and cardio-vascular impairments. The same concerned prescribed treatment, general preventive measures, measuring of capability to work function, expertise estimates in relation to the disease prognosis, development of individual long-term prevention and rehabilitation.

Specialists of the RAMS Institute of Occupational Health proved to the fact that long term exposure to asbestos dust unlike other industrial aerosols when analyzed by endoscopy is manifested by a combination of endobronchitis with tracheobronchial dyskinesia and dystonia of trachea and bronchi membrane wall in more than 60% of patients.

Two thirds of asbestosis patients show deformation and axial deviation of a bronchial tree due to sclerotic process of the lung tissue.

Samples of lung tissues taken in alive humans showed development of structural changes that differed from other types of dust exposure if these subjects were exposed to increased asbestos concentrations containing aerosols for more than ten years.

So, long term exposure of increased asbestos concentrations causes specific mucous impairments of bronchi and in respiratory parts of lungs. Along with it catarrhal inflammation is formed in the mucous membrane of bronchial tree.

In accordance with the clinical morphological data, diffuse fibrosis of interalveolar septa without granulomatosis signs in bronchi and lungs with perivascular sclerosis should be treated like diffuse fibrosis-like alveolitis, which by x-ray is seen as asbestos with all the clinical signs inherent to it.

In accordance with multi-year clinical findings, clear manifestations of asbestosis by clinical, x-ray and functional data vary from 10 to 18 years in conditions of increased industrial exposure to aerosols containing chrysotile asbestos.

Asbestosis due to exposure to chrysotile asbestos has asymptomatic and long lasting character (if it is not complicated).

More than 90% of asbestosis patients as a result of exposure to chrysotile asbestos show for significant time unimpaired indices of breathing function. As the disease is progressing, changes of indices occur that characterizes volumetric parameters. In patients with complicated asbestosis rate changes are observed.

The main diagnostics method of asbestos fibrosis is x-rays. Clinical, x-ray, hygienic and epidemiological studies performed for more than 25 years in the RAMS Institute of Occupational Health testify to the fact that the main place in the structure of asbestos-induced diseases of lungs and pleura belongs to asbestosis, or parenchyma asbestos fibrosis of lungs and pleura. This form of asbestos-induced pathologies is mainly noted in ATI workers, whereas chronic dust bronchitis is registered in workers of mining and milling asbestos enterprises and in asbestos cement (ACI) production.

One of the first domestic researchers of asbestos were M.Kovnatskiy and M.Vilenskiy who in 1930-1932 studied incidence rates of asbestosis at the “Soyuzasbest” enterprise. They found incidence rates of asbestosis at ”Soyuzasbest” to be significantly lower than at the same enterprises of Great Britain.

The first Russian studies aimed at clinical, x-ray, morphological, and epidemiological criteria of asbestosis diagnosis, its incidence rates and prevalence in occupational groups of all asbestos processing stages were performed on large contingents of workers exposed to high dust concentrations of chrysotile asbestos.

When research and development were conducted by Sverdlovsk Institute of Work Hygiene and Occupational Diseases and the RAMS Moscow Institute of Work Hygiene and Occupational Diseases in 1947s-1960s, pathological morphology and x-ray morphology of asbestosis symptoms were studied and stages of chrysotile asbestos fibrosis described with relation to years in occupational and experienced lung pathologies. Even so many years ago it was found that moderate asbestosis of lung prevailed and it was formed for a period of 21.1 years on the average. Despite these data, foreign researches of those years show clear asbestosis that developed for less than 10 months but sometimes-long development lasting to 15 years was noted.

Follow-up studies of pleural impairments conducted during 10 - 20 years showed in 18.3 ± 4.9% of asbestosis patients their gradual progress.

It may be concluded analyzing all the obtained data that fibrogenic properties of chrysotile asbestos are clear. Occupational contact to chrysotile asbestos leads to parenchimal fibrosis of lungs and pleural impairments. At the same time, chrysotile asbestos fibers compared to all the known types of asbestos shows the least carcinogenic and fibrogenic hazards as at chrysotile asbestos production plants only moderate forms of asbestos interstitial fibrosis, pleural impairments and single lung cancer cases were registered.

For the aim of scientific substantiation of x-ray lung changes due to occupational contact and exposure levels of chrysotile asbestos dust, researchers of the RAMS Institute of Occupational Health performed mass health screening of workers. X-ray test was of particular importance in the study. Analysis of roentgenograms was made in accordance with the ILO International classification of pneumoconiosis (ILO, 1980). The data showed that at workers at all the stages of asbestos production in conditions of increased MAC values of dust in the air of the working zone moderately expressed diffuse parenchymal fibrosis and benign pleural impairments were seen at the roentgenograms.

Incidence rates and severity of fibrosis in lung tissues strongly correlate in occupational contact with chrysotile asbestos with dust loads counted with regard to the total dust mass for the total period of work in occupation.

Comparison of hygienic and x-ray data revealed their reliable correlation.

Cumulatively, with regard to all asbestos production complex (mining, milling processing ATI, ACI) correlation was found between parenchymal diffuse changes in lungs and pleural fibrosis on the one hand, and with length of service and exposure dose, on the other hand.

Severity of parenchymal lung fibrosis manifested by x-ray and hygienic data depends on dust load and mean exposure dose (MED) of respirable asbestos fibers lasting 10 to 15 years if life time dose was more than 100 g with MED more than 25 f/cm^3 multiple by years.

Comparative clinical and x-ray examinations of ATI workers before and after its reconstruction (before 1960and after it) showed incidence rates and severity of asbestos fibrosis reliably higher before the reconstruction works were over 39.4% and 5.3%, respectively (2/1-3/2 and 1/1 -/1/2 profusion, ILO, 1980). 2 cases of lung cancers were found in the ATI workers before 1960. No mesothelioma cases were registered.

All the above means that chrysotile asbestos controlled use is possible, which should be done in strictly controlled conditions in limited duration of occupational contact and introduction of appropriate efficient preventive and health control measures.

It is to be noted that asbestosis due to occupational exposure to chrysotile aerosols does not show acute onset of progress and exudates including hemorrhage ones in the pleural cavity are absent, unlike other fibrosis forms developed as a result to exposure of other types of asbestos.

During dynamic clinical control of 800 workers with long length of service, only 28.9% were diagnosed asbestos induced pathologies (asbestosis and occupational bronchitis). Half of them showed chronic non-specific lung pathologies of bacterial genesis (bronchiectasia, polysegmentary pneumofibrosis, etc.).

Occupational bronchitis also shows gradual development: no intoxication symptoms, non-sharp onset, no running body temperature are noted.

The main complicated diseases for occupational bronchitis are pulmonary emphysema, lung heart, and bacterial infection.

Early diagnosis of occupational bronchitis gives positive health restoration results and rebuilds ability to work after all the health treatment and prevention measures were implemented.

The terms of complications and clinical signs of lung heart determine prognosis. Prevention is aimed at ceasing of chronic bacterial infection and cardio-vascular pathologies.

A selected group of 289 workers who for many years were exposed to chrysotile asbestos at Uralasbest Company were examined. Their length of service was 10-40 years long (66.4% had more than 20-39 years in occupation), 13.8% of them showed extra weight, 55% suffered from vegetative dystonia, hypertension, arteriosclerosis and almost half of them showed no asbestosis.

In accordance with the edict of the Russian Ministry of Health, the above patients with the above pathologies are to stop the work in conditions of asbestos dust for the prevention of functional disorders.

If a respiratory malignancy is verified by histology in a patient and occupational contact has been proved true, its relatedness to chrysotile asbestos is recognized in all the cases in Russia.

More than 30 years lasting follow-up studies of the RAMS Institute of Occupational Health shows no mesothelioma found in occupational patients exposed to chrysotile asbestos.

At the same time according Shchebakov et al. "…During 10 -year period 118 cases of mesothelioma were reported in the Urals Region, which has a population of more than 5 000 000 people, it makes up about 2.4 cases per 1 000 000 per year. In 90% of cases for the period from 1978 to 1982, the diagnosis was proved in the regional pulmonary center. No cases were registered in younger than 29 years old subjects. The average age at death was 51.9 years for males and 60.1 years for females. Of these, seven cases were reported in Asbest City, with a population of about 114 000, over 5-year period. Of the 52 regions of the Urals, the highest incidence occurred in the region where the asbestos industry is located, which is six times greater than the average (Kogan and Berzin, 1986, R.P.Nolan, unpubl. data). The nest highest rate was in the copper smelting and mining region, and the third one was in the nickel-mining region.

In a more recent study, Tomilova (1999) reviewed 41 cases of malignant pleural mesothelioma occurred in the Sverdlovsk region from 1981 to 1996. The 41 cases were diagnosed using histological criteria, cytology, chest x-ray and endoscopy-thoracotomy with biopsy. The majority of cases were between 40 and 59 years of age. Among them were five cases exposed to chrysotile asbestos, five cases occurred in the service industry, two in scientific institutions, and 11 in various occupations without exposure to chrysotile asbestos. In 14 cases, the genesis of the malignant pleural mesothelioma could not be determined. Among the many industrial districts of the Sverdlovsk region (about 5 000 000 inhabitants), the standardized rates of incidence of mesothelioma vary over a wide range, from 0.006 to 3.8 per 1 000 000 population per year. The highest rates were found in the town of Talitsa (3.8 per 1 000 000 population per year) and in the town of Beloiarsk (3.7 per 1 000 000), in the district where no asbestos mining or fabrication are located. In the Asbestos City this rate was 2.8 per year, in Sysert 2.2, in Alapaevsk 1.6, and in the regional capital of Ekaterinburg it was 0.54 per 1 000 000 population per year…".

It is important to regard that "… In addition to the main Bazhenovskoye chrysotile asbestos deposit, two small amphibole asbestos deposits exist in the Urals Region. Anthophyllite was mined in Sysert, which is about 125 km from Asbest City. It had a production of 900 ton/year. A small crocidolite mine, which actually produces fibrous arfvedsonite is located 150 km north of Asbest City, in Lower Tagil. It produced 100 tons/year, mainly, for military purposes…"

Comparison of the data with prevalence of pleural mesothelioma in Europe shows the necessity of obtaining reliable data on correlation between occupational and non-occupational exposure to chrysotile asbestos with no amphibole admixtures and development of malignant mesothelioma. Other etiological factors that may arise in the course of these studies can not be excluded.

Early diagnosis of an occupational disease including asbestos-induced one does not determine workers' incapability to work or quick lethal outcome.

It has been proved by rehabilitation and prevention measures introduced by Russian occupational and public health services.

The fact that complex research of already known and new hazardous industrial factors of environment with regard to vitally important physiological functions of humans continues, it is no doubt the basis of workers' safe physical potential will be built in accordance with differentiated approach to the role of each etiological factor capable of impairing health of each individual.

RESUME

The situation with expectations related to EC Directive on total asbestos ban is characterized by a great activity of different expert and scientific groups formed to substantiate the necessity of this ban. It is an extremely hurting problem as these groups impose the opinion with asbestos ban to the world's community as the only solution to the problem of safety due to occupational and non- occupational asbestos contact.

We opine it reasonable to present an opinion that speaks in favour of the lack of sufficient grounds for ban of chrysotile asbestos. This opinion is based on multi-year experience of Russia and other countries that contributed to its controlled use.

It seems necessary to note that the states-members of the European Council enjoy their inviolable right to decide on what materials, or substances, they are to use at their territories. The EC decision on asbestos ban exceeds the limits of the internal EU problem and needs additional international discussion involving all the interested parts.

General provisions have been presented in the document on approaches of leading occupational health centers and competent authorities of Russia whose aims are directed to health promotion of workers and general population.

The history of asbestos application goes far into the past centuries, however, its industrial use started almost a century ago. At present more than 3000 products and materials are fabricated with the help of asbestos.

Rapidly growing world's asbestos production of the 1950s and 1960s occurred with no appropriate sanitary, hygienic and technical protection measures developed to safeguard the health of a worker. Amphiboles the ban of which at present is strict and well grounded due to their high health impairment risks were widely used at that moment. No pure chrysotile asbestos was used in any country of the globe except for Russia.

The data on adverse effects due to uncontrolled asbestos use, especially, amphiboles, alerted international organizations such as the World Health Organization, the International Labour Organization and others. Thanks to the ILO initiative, a group of experts developed Code on Safety in the Use of Asbestos in 1984. Then the ILO session of 1986 adopted Convention no. 162 and Recommendations no.172 On Safety in the Use of Asbestos. Convention no. 162 confirmed the validity of only one ban, the one that was imposed on amphibole groups of asbestos.

However due to various reasons including economic ones, provisions of the ILO Convention no. 162 were not backed. Many countries among them are some EU member-states have not yet ratified it.

The results of uncontrolled use, especially it concerns amphiboles, can be felt even now.

Taking into account long latency period lasting more than forty years, occupational cases of lung cancer and mesothelioma diagnosed today are the result of highly improper controlled levels of dustiness in the air of the 1960s and 1970s when the most dangerous types of asbestos were freely and widely used.

It is deeply doubted whether European countries indeed accumulated great experience in the assessment of occupational and non-occupational long-term exposure contacts with chrysotile asbestos.

Actually in all the studies performed in the countries of Western Europe "commercial" amphibole fibers (such as crocidolite, amosite, anthophyllite) and "non-commercial" ones (such as tremolite) are registered in human lung tissues.

Joint American and Russian studies did not find amphibole asbestos in human lung tissues of Russian workers of the biggest in Russia mining and processing company "Uralasbest". In other studies performed by the Finnish researchers the minimal amounts of tremolite was registered there. The data obtained by the study confirm the ones on significant difference in pleural mesothelioma in European countries and Russia.

The above facts give rise to doubts concerning the validity of statements that attribute merely chrysotile asbestos exposure to asbestos-induced diseases in European countries of recent decades.

Asbestos ban will lead to further development and introduction into practices of man-made mineral fibers (MMMF) that have not been so thoroughly studied as asbestos fibers. Despite the available data on MMMF negative biological effects, the majority of countries have not developed health and work safety measures for the workers and general population as it happened with asbestos. At present no substitute exists with technological properties equal to asbestos. Not a single of them has been studied to such as extent as asbestos, which today is absolutely predictable and a well-studied product. Preventive measures developed for the work with asbestos allow avoiding its negative health impacts for a human. It means that asbestos can be properly controlled in industry and common use.

Medical specialists, biologists, hygienists all over the world will have to start everything from the beginning when they have to develop certification procedure for hundreds of chemical fibrous mixtures, minerals and man-made fibers which tens of years later may show much dangerous effects to the human health than natural chrysotile asbestos.

It should be noted that Russian methodology of hygienic standards and Russian dust control methods applied, in particular, to chrysotile asbestos crucially differ the foreign ones. Since the 1950s gravimetric indices for fibrogenic dust including asbestoscontaining dust are used in Russia.

In Guidance 2.2.755-99 of Occupational Hygiene (Russia, Moscow, 1999) controlled dust load levels were proved by the results of complex clinical, hygienic and epidemiological studies.

Retrospective assessment data of dust levels developed during the whole period of exploitation of Russian asbestos production plants served as a basis for the calculation of exposure doses on respiratory organs of workers, which allowed for their comparison with the relevant health data.

Classification of working conditions, dust loads on respiratory organs and MAC / CLDD (control level of dust dose) multiplicity excess has also been developed in Russia with regard to the content of airborne aerosols that may possess fibrogenic effect (asbestos dusts included).

Joint American- Finnish-Russian studies proved to the correctness of the methods applied by the Russian researchers.

It has been shown by the Russian experiences that the widely applied in Europe method of counting respirable asbestos fiber in the air using PCOM had some significant drawbacks that impeded solving of questions related to the extent of danger in the production and external (outside of industrial enterprises) use of asbestos.

PCOM counting do not show true number of fibers in the air, to say nothing of the asbestos fibers. These methods serve as a tentative index of the so-called “respirable fibers” of any genesis, and do not help to decide on any problems related to health and safety in the use of asbestos.

Gravimetric method of measuring all the airborne dust fractions, not exclusively the “respirable” one, is much more informative. It seems reasonable to use counting methods accepted in Europe and other regions as an additional one to the gravimetry to characterize the general dust level of the ambient air. The most advisable will be the use of electronic microscopy (which determines the type of measured fibers), not the optical one.

European researchers are still arguing on whether or not it is possible to establish a threshold value for chrysotile asbestos. But Russia has been using the advantages of a concrete threshold value in the form of dust load on respiratory organs, which is a cumulative exposure dose of the whole dust mass for the whole period of occupational contact (not more than 50 g).

Advantages of the Russian hygienic regulation and control that regard the whole mass of inhaled air combined with complete parameters of disperse and other physical and chemical properties that make up a disperse phase of an aerosol allow to implement efficient prevention of dust - induced pathologies.

More than two thirds of asbestos produced in Russia is used for asbestos cement products such as slates and tubes. It should be noted that apart from the greater part industrial countries (the USA and many European countries) no friable asbestos products were used in the construction and finishing of dwellings, public buildings, other non-industrial objects in Russia. Relatively small number of asbestos cement products was mounted in the construction works. Release of free asbestos fibers in conditions of normal exploitation seems unlikely.

Despite the heaviest economic crisis in Russia, asbestos industry has demonstrated positive shifts to further improvements of mining and processing technologies, automation, dust prevention and wastes removal.

All these moments helped to stabilize dust levels at all the stages of mining, production and use of asbestos. In accordance with the results of American-Finnish-Russian studies of dust levels by gravimetry and counting indices, all the air samples are found either within the limits of the MAC values, or slightly increase them.

In dwellings and public buildings where asbestos cement products were used concentrations of asbestos fibers remains by one order lower than MAC value (0.06 f/ml) and they do not depend on seasonal changes. No samples of atmospheric air contain amphibole fibers.

Russian findings reliably show that asbestos cement roofing products even in conditions of sharp shifts of external temperatures, harsh acid and alkyd industrial discharged in the air have never been a serious source of emission of fibrous particles.

It is known that cancer mortality indices of urban areas can not depend only on the levels of asbestos dust in the ambient air. One can not deny the absence in it of industrial carcinogens such as the ones emitted by metallurgic enterprises, oil and steel production industries. Great carcinogens are automobile exhausts, etc. Besides, cancer mortality indices of general population are influenced by social and economic conditions such as coverage by qualified medical service, bad habits, and other numerous factors.

Health protection of the general and working population is the basis of the economic welfare of the society and one of the most important tasks of the occupational health. Levels of occupational morbidity are directly explained by unsatisfactory working conditions and reflect to a full extent medical, social, economic, legal and other aspects that help to provide a healthy, merited and adequate life for people.

Complex evaluation of clinical, x-ray, endoscopic, and histologic researches determines diagnosis criteria of health exposure to chrysotile asbestos dust. Prevention measures are introduced after individual dust loads are compared with health indices.

Asbestos due chrysotile exposure shows a comparatively long development of a pathological process characterized by a slow progress. X-ray films represent diffuse interstitial fibrosis with non-sharp thickenings of diaphragmal pleura.

Occupational diseases have been proved to be specific indicators of hereditary predisposition to chronic pathologies of organs and body systems that are developed in a combination of congenital and external risk factors (tobacco smoking, alcohol abuse, and others).

Integrity of genetic and external exposures gives individuality to pathogenic processes.

Research on biological markers of susceptibility and resilience to industrial aerosols is of particular importance for individual risk prognosis to develop an occupational disease. The data are also used for prevention measures, treatment, rehabilitation, and employment of workers with specific body phenotype.

Biological markers of susceptibility and resilience to asbestos exposure confirm the fact that controlled asbestos use can be implemented.

In accordance with the results of multi-year clinical studies, asbestosis development by X-ray and functional data varies from 10 to 18 years due to increased levels of occupational exposure to chrysotile asbestos.

Mortality indices due to malignancies were reduced in the asbestos industry thanks to efficient prevention. For instance, female workers of chrysotile asbestos milling have showed more than 5 times reduced cancer risk during the recent decades.

Incidence of pleural mesothelioma even in the region where the biggest in the world chrysotile asbestos enterprise located is several times less than in the European countries.

The base of theoretical and practical methods of asbestos dust control developed in Russia allows to control health and exposure and introduce effective prevention aimed at reduction of asbestosis and other respiratory pathologies of workers in conditions of controlled asbestos use. Political and economic interests should not discredit this principle.

Russian researchers propose to form a group of international experts for the analysis of scientific data obtained in different parts of the world. Russia is ready to present data on the matter. Russian researchers represent the greatest producer of chrysotile asbestos. They have accumulated scientific data measured by decades of experience on all the aspects concerning chrysotile asbestos and they authoritatively declare no sufficient evidence exist at present testifying to the ban of chrysotile asbestos. They support intention to create an international program for regarding all the arguable questions evoked in control use of chrysotile asbestos.