

Consultation Report to Dean David Eidelman

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September 23, 2012

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Context

Asbestos is a complex substance with a thorny history and the issues at hand are a case study for the thesis that scientific investigations take place within particular social and political environments. Data sets do not emerge in vacuo and are subject to the interpretations and the perceptual filters of multiple agents and recipients with varying agendas and interests. The allegations of research misconduct received by the University, and referred by Dean David Eidelman to the Research Integrity Office, touch on a number of entangled questions. Indeed, nothing in the arena of asbestos is simple.

We start with the substance itself. Asbestos refers to a series of impure minerals with variable crystalline properties composed of different silicate compounds. The serpentine form of asbestos is known as chrysotile while the physical form known as amphibole includes amosite, crocidolite and tremolite¹. The materials relevant to the issues that concern us are fibrous and can be woven into fire retardant textiles that have found widespread industrial uses including fireproof fabrics, brake linings, gaskets, roofing compositions, electrical and heat insulations, paint filler, chemical filters, reinforcing agent in rubber and plastics, component of paper dryer felts, diaphragm cells, and cement reinforcement. The use of asbestos by humans extends back about 4500 years though the major impetus to its application was the industrial revolution of the 19th century. Its protean applications led to a major deployment of this long lasting fibrous material throughout the world².

The enormous expansion of the uses of this unusual material, whose world-wide annual use was, until recently, on the order of 2 million metric tons, led to the growth of a major industry in the mining and extraction of asbestos fibers with major centres of production in Canada (particularly in Quebec), the United States, Russia, South Africa, Italy and Brazil. The resultant multinational companies gained considerable economic force and became major employers in rural mining towns. Moreover, they cultivated and gained political power to accompany their considerable financial clout.

The toxicity of asbestos was evident in the early part of the 20th century and organized epidemiologic data were available over fifty years ago. The carcinogenic potency was reported in the mid 1930's. One of the reasons for the distinctions made amongst the different forms of asbestos is their differing carcinogenic potencies, though it is relevant to note at the outset that all forms of asbestos are associated with malignancies in humans.

The increasing burden of evidence pointing to a causal link between asbestos and illnesses of workers exposed during mining, milling and other occupational contexts led to an exponential rise of litigation. Miners and their families became plaintiffs, companies hired coteries of lawyers, and scientists became consultants and expert witnesses. Datasets were now the subject of scrutiny by forensic specialists and thoughtful policy debates on safety levels were inflected

by the enormous financial stakes at play for all parties. Finally, a voluminous literature has been produced on the subject, much of it scientific, and accompanied by large numbers of more polemical books and papers by advocates of one or other adversarial position.

It is in this conflicted arena that the debates have evolved and continue to rage over fifty years and more. This is also the backdrop to the allegations of research misconduct received by the University in the winter of 2012 and that led to the request to this Office.

Process

In March of 2012, you requested guidance as provided in section 4.2 of the Regulations Concerning the Investigation of Research Misconduct with specific reference to the following question in your letter to me of March 26: “whether there is a basis for the allegation that research on the health effects of asbestos at McGill was improperly influenced by industry.” Given the importance of the issues at hand and the fact that a broad array of allegations were received by the University from Dr. David Egilman and colleagues, whether directly or via the mainstream media, accompanied by letters from many academics and other interested parties, I opted to broaden the scope of my work.

The allegations in question were noted in the following:

A letter to the Chancellor and Principal, dated February 2, 2012 with a number of signatories.

A letter to Dean Eidelman, dated February 10, 2012 with additional signatories.

A letter to Drs. Fuhrer and Eidelman, dated February 11, 2012 signed by Dr. David Egilman containing several specific questions and referring the University to his publication of 2003. The allegations are also described in a power point presentation authored and made available by Dr. Egilman.

In response to a request for information from my office addressed to Ms. Kathleen Ruff, a senior analyst with the Rideau Institute, and a co-signer of the documents noted above, she provided additional materials outlining a variety of questions regarding the work of Prof. Corbett Macdonald. She has been helpful in providing newspaper clippings and other useful documentation.

I also wrote to Dr. Egilman to arrange a meeting to ascertain his concerns. He indicated that he had already provided a great deal of information to the University but offered to come to McGill to present a seminar if we could pay half his travel costs³. In the event, that did not prove feasible.

I should note that I have had access to additional files at the University. In particular, there is correspondence from a review of allegations presented by Dr. Egilman to the University in 2002 and later detailed in his paper of 2003. A review at that time by the Office of the Vice Principal

Research under the procedures in effect at that time did not reveal any evidence of research misconduct. As well, I have reviewed the report prepared by Prof. Rebecca Fuhrer in response to a request from your Office.

Additional useful information was available in older files, including documents and letters by Prof. Macdonald. I have benefitted from fruitful discussions with several colleagues at McGill and have had a number of helpful meetings with one of the academic signatories to the allegation letters noted above.

I have of course had reason to review many of the publications and books in this field, including those by Prof. Macdonald and his co-workers as well as many materials provided by Ms. Ruff and her colleagues.

Allegations and findings¹

1. Initiation of asbestos studies by Prof. John Corbett McDonald (JCM) and colleagues:

The allegations claim that the original studies were “initiated between Prof McDonald and the asbestos industry⁴” and carried out at the behest of the industry whose goal was to control the research agenda and the resultant data. It is further claimed that JCM’s published comments that the Government of Canada was involved at the outset of the studies are misrepresentations.

Findings: A chronology for the period 1964-1974⁵ prepared by JCM describes a series of activities in the latter half of 1964, that is, a few months after JCM moved from the UK to McGill. He notes a visit from Dr. Christopher Wagner, a scientist at the Pneumoconiosis Research Unit of the UK, during which Wagner suggested that JCM undertake research on asbestos risks in Quebec. The backdrop for this was a paper reporting the recommendations of a working group convened in New York in October 1964 under the auspices of the International Union against Cancer (UICC)⁶. Amongst the recommendations emanating from that meeting is a suggestion that chrysotile studies be undertaken in Canada⁷. In fact, JCM was invited by the UICC to attend that meeting and subsequently joined the UICC Working Group on Asbestos and Cancer. JCM reported visits by other former colleagues from the UK soon after that meeting in New York, urging that him to undertake the studies recommended by UICC.

JCM notes in the chronology that in March 1965, he was invited to become a member of the National Study Group on Asbestos convened by the Canadian Department of National Health and Welfare and was asked to serve as Principal Investigator for epidemiological studies in

¹ Allegations have been categorized into the noted subsets for ease of reference. Categories may contain several related allegations. No distinctions are made amongst allegations noted in Dr. Egilman’s publications, his letters to the University, those in letters and emails from Kathleen Ruff and her co-signatories, and those cited in the mainstream media. I have endeavoured to review all those cited.

Quebec. He described exploring the feasibility of studies with the Quebec government and the mining industry. On July 30, 1965, JCM wrote to Dr. EWR Best, the Joint Chair of the Epidemiology Sub-Committee of the National Study of the Biological Effects of Asbestos of the Department of National Health and Welfare⁸. He enclosed a proposal submitted to the Quebec Asbestos Mining Association (QAMA), an industry group and to the National Study Group in Ottawa to establish a research unit to undertake epidemiological studies on asbestos. He requested approval from the government committee as well as financial support from “Federal/Provincial⁸” funds and described a need for “negotiation with the QAMA.⁸”

Independent corroboration is available in the minutes of a meeting of the Steering Committee of the National Study of November 2, 1965⁹. These indicate JCM’s membership on the Committee and provide details on the review of the proposal he had previously submitted. The Committee reviewed the JCM proposal for an epidemiological research unit and noted that the UICC had “strongly recommended¹⁰” a study in Canada. The Epidemiological Subcommittee was “very favourably impressed¹¹” by the study JCM submitted. The Steering Committee “encouraged¹²” JCM to set up the proposed unit and asked him to proceed to develop his plans for research. Funding was not discussed.

At the same meeting, the Steering Committee was informed en passant about an intention of QAMA to establish an “institute¹³” and declined to offer an opinion, pending further information.

The minutes of a meeting of QAMA of November 29th, 1965, recorded a recommendation that the “epidemiological survey” proposed by JCM be supported¹⁴. Ironically, the same paragraph notes the intent of QAMA to “conduct the necessary research instead of doing it through universities or letting it fall into the hands of the Government¹⁵. ” A record of industry discussions dated December, 1965, indicated the commitment of QAMA to set up a “Research Institute for Occupational Health in Montreal¹⁶. ” The intent is not to build laboratories but “sponsor¹⁷” research. The record noted an upcoming meeting of the Board of QAMA in January, 1966 at which the JCM survey proposal was to be discussed. The same meeting noted a desire to accept Government financial help and also displayed the companies’ objectives as the “desire to preserve the industry on which their business depends¹⁸. ” Finally, the minutes noted the Committee for a National Study set up by the Federal Government and that JCM was a member of that Committee. One must note that these minutes of meetings of QAMA were not publicly available at the time and were later released in the course of litigation.

The chronology prepared by JCM is consonant with these documents. He recorded that the National Study Group was informed by QAMA in April, 1966 of its intent to establish an independent “Institute of Occupational Health”. JCM reported being notified in October,

1966 of a research grant to McGill University for a three year period of support. Details of the research support are provided in the following section of this Report.

Comments: The documentation supports JCM's descriptions in various publications that he was implicated in the Federal planning for epidemiological research in asbestos and made a concurrent application to the Department of Health and Welfare and QAMA. These facts were all disclosed to the Steering Committee for the National Study and it, in turn, was responsive to the recommendation from the UICC that Canadian studies be initiated. He was encouraged by the Committee and also received endorsement from the National Cancer Institute of Canada. At the same time, it is clear QAMA's interests were designed to protect the asbestos industry with the implication that if it funded the research, it would thereby control the outcomes or their dissemination. This does not by itself demonstrate that the research was controlled or that its dissemination was influenced by QAMA. (More on the question of research independence in the next section). While I can well appreciate the stance that one must view the motives of the asbestos industry with suspicion, I can find no evidence to support the allegation of misrepresentation on the part of JCM regarding the origins of his research project on asbestos.

These documents also serve to clarify another allegation leveled at JCM and his team. The epidemiological research unit JCM described is simply his team of research scientists. It is quite clearly distinct from the Institute of Occupational and Environmental Health established by QAMA (and only recently disbanded). The offices of IOEH were in downtown Montreal and it had no affiliation with the University. Finally, there is no connection between it and the Institute of Occupational Health established at the University and that is now part of the Department of Epidemiology, Biostatistics and Occupational Health.

2. Relationship of JCM to asbestos industry

The allegations claim that JCM gave "false information¹⁹" and denied "connection with any asbestos company²⁰." Further, it is alleged "that the asbestos industry...was vitally interested in and involved in creating the parameters and every aspect of the research project...²¹" Finally, McGill is asked to "end the long-standing collusion...with the deceptive, unethical practices of the asbestos industry.²²"

Findings: The first technical matter that needs to be addressed is the funding mechanisms for the research support. That is, the grants were provided by the Institute of Occupational and Environmental Health to the University. It is also the case that the IOEH was set up by QAMA, an association of which the asbestos companies were the members. Thus, while there is no direct connection to the asbestos industry, it is apparent that the funds originated with these companies. It is also clear that JCM made no attempt to hide this connection. In

the chronology mentioned previously, JCM noted that of the \$1.1M of research funds for the epidemiologic research on asbestos received for the eight years beginning in 1966, the majority was provided by research grants to McGill from the IOEH (the rest by grants from the Department of National Health and Welfare and the US Public Health Service)²³. More important for the scientific record are the acknowledgements for this support in the publications of data, whether from JCM²⁴, members of his research group (e.g. Gibbs and Lachance²⁵) or the major review of the birth cohort published in 1997²⁶ that cited support from the IOEH of QAMA, as well Health and Welfare, Canada. This was also the case in the non-scientific record. For example, an interview with CBC radio includes the following from JCM in response to a question about the financing for the studies: “The biggest single contribution is...from the combined asbestos mining industries of Canada²⁷.”

There is no evidence (nor was it alleged), that JCM was employed by or consulted to the asbestos industry. He did not serve on any industry advisory boards and made clear his need to maintain a distance from the funders. As early as 1966, JCM noted in a letter requesting access to the chest films of asbestos workers that, “there is no question whatever of collaboration with the Industrial Hygiene Foundation [an industry-sponsored group] in our studies. I am very aware of the absolute necessity for our inquiries to be free from any suggestion of bias toward either employer or worker...²⁸” This is not to suggest that the industry was reluctant to make its position clear. In response to such an overture in 1970, JCM wrote to the CEO of the Asbestos Corporation as follows: “...it is important that there should be no doubt about the objectivity of our research. There are always people who like to suggest that our work will only be sponsored so long as we obtain the results which industry wants. I am happy to say that I have been able to refute such allegations with a clear conscience. If I could not do this, our findings would soon lose their credibility²⁹.” Finally, in response to a request to appear on a television program, JCM replied, “I personally would have no objection to participating in any kind of ‘live’ discussion on the health effects of asbestos on radio or television; provided that the programme was not sponsored by the industry. If it were so sponsored, neither my university nor the College of Physicians would approve and, moreover, I think it would undermine the objectivity of all the research we have done. I am not keen on films or taped productions because the producer, by editing, can change the entire meaning of what is said³⁰.” He concludes by offering to participate in a live discussion with his fellow scientists, including one (Selikoff) who was said to be his critic.

Comments: There is little doubt that the asbestos industry hoped to support research that provided data attesting to the safety of asbestos. As well, it is clear that the research funding for epidemiologic research by JCM and colleagues included support from IOEH, which via QAMA was linked to the industry. At the same time, however, JCM did not attempt to hide these connections and sources of support. It is the case that he referred to these as “indirect³¹”, as it indeed they were. Furthermore, there is no evidence that the design of the

research, its conduct, and its reporting was influenced by the industry. Such arms-length funding mechanisms or even direct funding arrangements are common in support from other industries, including pharmaceutical and chemical companies. An individual researcher may choose to shun support from certain industries because of a particular moral position. Second, it may also be the case that certain types of funding require additional oversight in its deployment—however, this was not common during the period in question. While one may regard such funding as tainted, that per se does not provide any evidence that the researchers or the research was inappropriately influenced by the funding providers. One interesting comparison case that emerged from the voluminous documentation is that the laboratory of Dr. Irving Selikoff, who is sometimes characterized as a hero of the plaintiffs in asbestos cases, was the recipient of direct support from the industry. An industry publication includes a photo of Dr. Selikoff with the Vice President of Johns Manville examining specimens in the laboratory³². A citation from court records in 1979 note that Dr. Selikoff approached the Company requesting support for an electron microscope and other hardware³³. It further states, “...since he had no capabilities in industrial hygiene on his own environmental staff, that Johns-Manville furnish someone who could head this program at the medical school.³⁴” This is not to impugn the work of Dr. Selikoff but to provide a heuristic comparison. It may be that Dr. Selikoff became the ‘hero’ of one side of the debate and JCM the other, not because of their sources of support, but rather the effect of the supposedly contradictory outcomes of their research. Both laboratories were equally at risk of industry influence, yet there is no evidence that either was so affected.

Thus, the documents do not support the allegations that JCM’s research was influenced or undermined by the sources of funds, the claim that he denied these sources, nor that the University acted in collusion with the asbestos industry.

3. Chrysotile and its risks

The allegations are that JCM “promote[d] the use of chrysotile asbestos³⁵,” and that he stated that his research “showed that asbestos was not harmful.³⁶” Dr. Egilman’s article alleges that JCM “put forth several myths³⁷,” and that he and his colleagues “manipulated data.³⁸”

Findings: JCM collected and analyzed data on the risks posed by asbestos in an occupational setting for the subsequent development of malignancies. He and his team demonstrated clearly that all forms of asbestos increase the risk of lung cancer. They also showed that asbestos exposure increases the risk for mesothelioma, albeit not to the same degree as for lung cancer. In early reports, JCM and his group reported the findings of cases of mesothelioma as well as lung cancer and noted that his findings of incidence are lower than those identified in New York and London but of the same order of magnitude as reports from the Soviet Union and Italy³⁹. Soon thereafter, the Mt Sinai group⁴⁰ corroborated JCM’s hypothesis that the risk of lung cancer in Quebec occupational exposure is much higher than the risk of mesothelioma and noted that, “Mesothelioma appeared with greatest frequency as

a cause of death in factory workers and was relatively uncommon among miners and millers.^{41,,}

These variations in risk, especially for mesothelioma, led to many investigations on the relationship of different forms of asbestos and risk for malignancy. At a conference in 1985, JCM summarized the cancer risks from exposure from various asbestos fibers and studied in thirty different cohorts worldwide⁴². In eight different studies of persons exposed to chrysotile (including those from Quebec), there were 15 mesotheliomas amongst 6246 deaths, whereas in 224 deaths following crocidolite exposure, there were 24 cases of mesothelioma—almost a fifty fold difference in rate⁴³. By contrast the ‘excess’ lung cancer deaths in the chrysotile cohorts were 133, a dramatic increase over mesothelioma incidence. JCM commented as follows, “This again, supports the idea that at least amphibole at death is more closely associated with mesothelioma than chrysotile. This does not mean, of course, that chrysotile does not carry any risk, but appears to support the general view of a much greater risk with amphibole⁴⁴.”

This differential risk, for which JCM was criticized, was corroborated by many other groups and is underscored by a major meta-analysis published in 2000 that concludes that, “the exposure specific risk of mesothelioma from the three principal commercial asbestos types is broadly in the ratio 1:100:500 for chrysotile, amosite and crocidolite respectively.⁴⁵” These data and conclusions were noted by IARC (International Agency for Research on Cancer), whose report cited that the “best estimates for the relative potency of chrysotile ranged from zero to about 1/200th that of amphibole asbestos.⁴⁶” A very recent statistical analysis concluded that “...the mesothelioma producing potential of chrysotile is low...⁴⁷” In this regard, it is important to note a recently produced statement from the Joint Policy Committee of the Societies of Epidemiology regarding asbestos. The statement calls for “a global ban on the mining, use and export of all forms of asbestos.⁴⁸” The documentation for the statement was prepared, at least in part, by individuals who are signatories to the allegations we have received. It is not surprising that it contains critiques of JCM’s work but, significantly, agrees with his findings on chrysotile, noting, that “The general consensus today is that chrysotile is less potent than amphiboles for the induction of mesothelioma.⁴⁹”

Some of the controversies in this contested field stem from the choice of language to describe the data derived from the research. A close reading of the publications by JCM and colleagues reveals careful analyses of their data and their comments on chrysotile are based on their numbers. In an editorial by Liddell in 1997, he uses the term “essentially innocuous⁵⁰” to describe chrysotile and this has, understandably, led to a great deal of criticism. At the same time, the actual publication in 1997 describing the overall summary of the birth cohort studied by JCM and colleagues provides some context for the choice of phrase. The abstract of that publication notes the following: “Thus it is concluded from the viewpoint of mortality that exposure in this industry to less than 300 mpcf.y has been

essentially innocuous, although there was a small risk or (sic) pneumoconiosis or mesothelioma. Higher exposures have, however, led to excesses, increasing with degree of exposure, of mortality from all causes, and from lung cancer and stomach cancer...⁵¹,

Comments: The material available supports the idea that the asbestos industry was motivated by its particular business interests and hoped that by supporting research at McGill, Mt Sinai and presumably elsewhere, it might help generate data supportive of its position. That is not a particular surprise and the voluminous legal records and commentaries testify to that.

However, that per se does not demonstrate that JCM was supportive of the position taken by the industry, nor that he was in collusion with or controlled by them. In fact, the statements by JCM and colleagues were generally carefully worded and explicitly supported by their research findings. In that regard, there has never been an allegation of data manipulation or falsification, nor any findings to indicate such misconduct (disputes regarding methodology are discussed below). In fact, the early conclusions of JCM and his group have been corroborated and supported by the scientific community since then. His findings of lung cancer risk, the synergistic harm from smoking, and the differential toxicity of various forms of asbestos are now widely cited since they have been reproduced by many other groups. Finally, there is no convincing documentation that any of his descriptions of the research data were motivated by anything other than a careful understanding and presentation of his work.

One must, at the same time, distinguish between the scientific interpretations of data and the use of such data to motivate and support different interests, be they of the industry, the plaintiff bar or those who wish to develop social and public policy. One of the interests of JCM and other scientists was to understand the mechanism underlying the carcinogenic potential of asbestos and the findings of differential risks of various forms became an entrée for interesting scientific comparisons, both epidemiologic and biologic (see further sections). For the industry, differential risks became an opportunity to save an industry by claiming to produce ‘pure’ chrysotile asbestos, forgetting the lung cancer data and drawing attention to mesothelioma. For those interested in social policy, distinguishing amongst fibers became an exercise in splitting hairs that led to confusion in the legal and public debates. It is clear that all these issues have become conflated and need to be clarified and articulated in order to move forward with a more reasoned approach to this important issue of public health.

4. Methodologies and analyses

Allegation: In his article of 2003⁵², Dr. Egilman presents an extensive analysis to support his claim that the methods used to assess asbestos exposure were flawed, thus supposedly undermining the entire cohort study and its conclusions.

Findings: The method in question is indeed an old process called the midget impinger used to assess the dust particles in an occupational environment. It of course measures all particles and fibers, not specifically those containing asbestos, and is, at best, a surrogate or correlate

of airborne asbestos fiber exposure. A more modern method, the membrane filter method, measures fibers by microscopic visual counting. JCM understood the drawback of the methodology and acknowledged this in his initial research proposal. He noted both the reason for using the data collected by the impinger method and its shortcomings, as follows: “Systematic surveys by the same observer have been carried out annually in the mines and mills since 1950. The impinger method used is not wholly satisfactory but at least there is an objective and reasonably standardized comparison of available dust conditions in a considerable variety of locations in all the companies.⁵³” As Dr. Egilman describes, Gibbs and Lachance published a comparison between the two methods and noted a low correlation between the two⁵⁴. In fact, they then cautioned against using the membrane filter method to set safe exposure levels, simply because the epidemiologic risk factors had been analyzed using the old method and the conversion factors were not precise enough to set appropriate occupational risk guidelines. In those instances where JCM compared his data to other groups who had used the more recently available method, he was careful to state his assessments in guarded terms. Finally, as Dr. Egilman pointed out, the membrane filter method is itself an imperfect tool as assessed by Dr. Nicholson of the Mt Sinai group⁵⁵.

Comments: Given that JCM and colleagues were studying the occupational exposure of a birth cohort that entered the work force long before the study began, they did not have the opportunity to carry out prospective measures of exposure and were forced to either use the data available or not initiate the study. They clearly understood the drawback and assessed their data accordingly. Although the new method was available when the study began, collecting prior exposure data using the new method was not possible. Furthermore, abandoning the old method when the study began ran the risk of making impossible the calculation of cumulative exposures over many decades, something clearly crucial to assessing carcinogenic risks. Finally, there is no documentation or evidence presented to support the claim that the “research methods were fatally flawed.”⁵⁶ Indeed, the results of the research and its conclusions have been replicated many times by other groups, and reviewed by many generations of competent peer reviewers.

5. Identification of mines

Dr. Egilman, in his analysis of an article in Science by JCM and Allison McDonald⁵⁷, noted that the suggestion that tremolite, a form of asbestos, may be responsible for the carcinogenic properties leading to mesothelioma, depends on the distinction between “central and peripheral” mines described in that article. He alleged, or at the least, implied, that the fact that the mines were not specifically named in that or subsequent articles reflected an attempt to deceive and the apparently omitted citation undermines the confidence in the “tremolite hypothesis” and casts doubt on the peer review process that permitted the publication of ten articles in five different journals⁵⁸.

Findings: The article in question is a letter to Science in 1995 and is one of a series relevant to the question that flows naturally from the data accumulated in the study. It was clear that asbestos is very toxic and carcinogenic and that lung cancer is a major consequence of occupational exposure. In the major publication in 1997 of results from the cohort of 11,000 Quebec miners and millers followed until 1992, just over 8000 had traced causes of death. Of these, 657 died from lung cancer and 38 from mesothelioma⁵⁹. At the same time, the occurrence of mesothelioma, even in these numbers, is unusual. Thus, JCM and other investigators searched for clues to causality and the biologic mechanisms of carcinogenicity. In an earlier letter to Science⁶⁰, JCM referred to the data from his and other studies suggesting differential carcinogenic potencies of various asbestos fibers and immediately noted the clear data on the lung cancer correlations for chrysotile. At the same time, these various data sets included too few cases of mesothelioma to permit a statistical distinction of toxicity amongst the various asbestos types. With the passage of time, more cases had been studied by 1995 to permit a follow up to those initial suggestions. In the 1995 letter, JCM noted that the majority of cases came from Thetford Mines, rather than Asbestos. It had been suggested that this may be due to the known higher levels of tremolite content in the product of mines in the former region. He then proceeded to a detailed study of those 24 cases via a case referent analysis in which each case is compared to a set of comparators, that is, individuals without mesothelioma. He discovered a substantial difference in risk between those persons who had worked in one of five mines in a local area he denoted area A or central compared with those who had worked in a set of ten mines, grouped as area B or peripheral. In order to suggest factors to account for this difference, he referred to published work from his colleagues who had observed higher concentrations of tremolite fibers in the lungs of miners who had worked in area A mines compared with those in area B.

These analyses are presented in much greater detail in a follow up publication in 1997 with presentation of all 38 cases of fatal mesothelioma, each with its specific study reference code, employment status, year of birth etc⁶¹. Careful comparisons are presented, between mines in Thetford Mines and Asbestos, between miners and asbestos factory workers, and within the site subgroups within Thetford Mines. Again, JCM refers to five mines in Area A and ten mines in area B. In this instance, the lung fiber data were acquired from the autopsy material of those identified cases. Again, there appeared to be a predominance of tremolite fibers in those dying of mesothelioma in Thetford Mines.

It is the case, as Dr. Egilman described, that the individual mines are not identified in any of these publications. There are no available records that would resolve this conundrum. At the same time, a publication in 1994⁶² on the mineralogical characteristics of chrysotile reprints a map derived from a book entitled *Asbestos: Its Origin, Production and Utilization* and published in 1959⁶³. The map of the asbestos mining areas of southern Quebec depicts a grouping of four mines near the centre of Thetford Mines (labeled King Mine, Bell Asbestos Mines, Johnson's Asbestos Co, and Beaver Mine) and eight others further removed from the

centre. Whether these are the mines in area A and B cannot be determined at this point. Nonetheless, the map also depicts geological heterogeneity amongst these sites.

Comments: It is useful to place the tremolite issue in context. While the question of which type of fiber is more or less carcinogenic for mesothelioma (compared, say, with lung cancer) has importance for the biologic understanding of causality for this and other lung diseases, and, may also be significant in litigation, the broader picture remains the same—namely, all types of asbestos are toxic. It is also noteworthy that JCM took pains to always refer to the data itself and was careful in his conclusions. In the letter to Science in 1995, he noted that the difference in tremolite concentration “suggests⁶⁴” that mesothelioma is “mainly or perhaps wholly” due to amphibole fibers. In 1997, he noted that, “The tremolite hypothesis, if correct,...⁶⁵” I cannot find direct identification of which specific mines were in areas A and B and all the published data are coded both for subjects and mine. It is therefore not possible to make these linkages by name. However, that per se is no basis to presume that the analyses that JCM and his colleagues performed are flawed. All the numbers track clearly from paper to paper over a span of many years and each case included or not included in a given analysis is accounted for and explained clearly. The findings are consistent with those of others in the research community, including those who may have been characterized as competitors or critics of the McGill group.

Given that much of this report deals with data and its robustness, it may be useful to note a power point slide apparently prepared by Dr. Egilman and provided to me by one of the signatories to the allegations. This slide deals specifically with the issue of the mines described above and is entitled “It’s the moving mines in Quebec!” A review of the slide shows it to be completely flawed. The number of mines (15) in that slide is correct but the split of 9 and 6 is not, and the assignment of 9 high tremolite and 6 low tremolite mines is reversed compared with the actual data. Lastly, the publication cited in that slide to a figure of 21 contains no actual number of mines but refers only to mining companies⁶⁶.

I can find no basis for questioning the analyses published by JCM and colleagues on the risk of work exposures in different mines, despite the difficulty in assigning specific names to the different mines in question.

6. Conclusions and Recommendations

To begin to make sense of a very complicated and tangled web of data and history, requires that each set of issues be examined separately, all the while acknowledging that they have become intertwined. I have identified the following set of questions.

- a. Is there any plausible support for the allegations of research misconduct leveled against JCM and colleagues? Following review of the documentation presented, the data available in the published literature, and materials available at the University, I was unable to find any support for these allegations. The financial

support from the industry was acknowledged in publications and there is no evidence to suggest that the sponsors influenced the data analyses or the conclusions. In fact, JCM noted an excess of lung cancers in asbestos workers in the earliest papers and reports and this could not have been a happy outcome for the asbestos companies. JCM's findings and conclusions have been replicated by other groups and their robustness has endured many critical analyses and legal inquiries. In fact, the recent statement by the combined epidemiology societies notes the gradient of toxicities of different types of asbestos fibers and refers to this as the current consensus, thus corroborating what the McGill group foreshadowed almost forty years ago.

Thus, I find no warrant to initiate further investigations of the allegations that we have received.

- b. Did the asbestos industry launch its research programs with its own interests in mind? To frame the question in those terms is to invite the obvious answer. Indeed, the documents made available during the many years of legal discovery make it clear that by supporting JCM and his group, and for that matter, the group at Mt Sinai led by Dr. Selikoff, the asbestos companies hoped to develop information that would vindicate their claims that asbestos, in certain forms and treated in certain ways, could continue to be used with safety. This is not surprising as such. One must acknowledge that other sources of support were not as readily available as they ought to have been and moreover, the researchers were aware of the pitfalls of the relationship they had accepted. It is all the more important to recognize that the research by JCM and other groups throughout the world generated the information that led to the near complete disappearance of the asbestos industry in the developed world and the universal recognition of the toxicity of the product. It is also clear that the industry attempted to misuse the research data to its own purposes in policy debates throughout the world and in setting standards for occupational exposures. However, it was these very same studies that permitted and permeated the litigation and policy statements clarifying the toxicity of the product.
- c. Did McGill University collude with the asbestos industry in promoting the use of asbestos and in opposing the recommendations of the UICC? These are amongst the allegations leveled at the University, albeit with no documentation or plausible evidence. The review of the materials described previously lends no credence to these allegations and claims. The University has an obligation to protect the rights of its faculty members to pursue their research objectives and to promulgate the

results in a responsible fashion, through the peer reviewed literature and in other public forums.

At the same time, one must recognize the perceptions in some quarters, including amongst some members of the academic community, that the University has a “history of complicity with the asbestos industry.” The fact that I cannot find any evidence to support such statements may not in itself reassure those who share these perceptions. There may thus be a need for the University both to protect the academic rights of its faculty members, both past and present, and to enact its societal role as a public voice of influence and attendant responsibility. How it may consider doing so is briefly addressed below.

- d. Is asbestos a toxic material? The answer from IARC and other organizations is clear in stating that asbestos, in all its forms, is toxic to those who mine and process the materials. While the more specific questions of whether certain fiber types are more or less correlated with different tumor types are of clear biologic and epidemiologic interest, the overall policy debates must shift to the societal costs and benefits of continuing the use of this material. The consensus position amongst those who do research in this field is that the production and industrial use of asbestos must cease. That is, the risk to occupationally-exposed individuals is clear and compelling. While some try to make the case that the benefits of asbestos in the developing world outweigh the risks, it is also likely that such continuing uses dampen initiatives to develop safer alternatives both for the developed and developing worlds.
- e. Should the University engage in the social policy debates and what actions may be appropriate at this time? In one sense, simply by having questions raised at Senate, the University is already engaged in the public arena on this issue. What other actions Senate may wish to pursue is of course a matter for that body to debate. Options available to the University include the following:
 - i. A public statement that the University wishes to correct the mistaken perceptions that it has condoned or supported the production, sale or export of asbestos and to assure the public that while it protects the right and responsibility to carry out research in this field, it does not support the use of this toxic material. Of course, whether the University should comment on such matters of public concern must be debated in the appropriate forums.
 - ii. In this regard, one may point to the example of tobacco in which the Board of Governors instructed its investment committee to avoid taking

investment positions in tobacco companies. Perhaps this is a course to be considered by the University community.

- iii. The University may choose to highlight its concern by sponsoring an academic conference to review the current evidence on asbestos and its toxicities, initiatives to develop safe substitutes, in particular for the developing world, and the engineering challenges of dealing with the burden of asbestos in old buildings throughout the world. A conference may be very appropriate for an educational institution and would engage the considerable expertise on campus in this arena of research.

There may be other approaches that the University community may wish to develop. In any event, it seems clear to me that to simply dismiss the allegations without addressing the larger issues of public concern would be to miss an important opportunity for social engagement. Some who signed the letters of allegations chose to focus on Professor Macdonald, while others understood the policy issues at stake in a much broader frame. We must not perpetrate a similar conflation of issues and confusion of objectives.

¹ See Langer and Nolan, Ann Occup Hyg 38:427, 1994 for a mineralogical overview of chrysotile and Williams-Jones et al Can Mineral Spec Publ 5, p. 89, 2001 for geology of Asbestos, Quebec

² A useful historical overview can be found in a book by Barry Castleman, Asbestos: Medical and Legal Aspects. McGill Libraries have the 2nd edition of 1986, more recent editions have been published.

³ Email DE-AF 12-04-12.

⁴ Email from Kathleen Ruff (KR) to Abraham Fuks (AF) 12-05-07 3:57PM.

⁵ Document titled "Research on Asbestos & Health at McGill: Historical Outline", in McGill files.

⁶ Brit J Indus Med 22:165, 1965.

⁷ See also Biological Effects of Asbestos IARC Scientific Publication No. 8, 1973.

⁸ Letter from JCM to EWR Best, Dept Natl Health & Welfare, July 30, 1965 and appended Proposal.

⁹ Minutes of Meeting of Steering Committee for the National Study of the Biological Effects of Asbestos, Dept of Natl Health & Welfare: meeting of Nov 2, 1965 appended to agenda package dated March 25, 1966 for meeting of April 4, 1966.

¹⁰ Ibid, p.4.

¹¹ Ibid, p.5.

¹² Ibid, p. 5.

¹³ Ibid, p. 4.

¹⁴ Minutes of QAMA, Nov 29, 1965, provided by KR

¹⁵ Ibid, p. 9.

¹⁶ Record of Discussions at QAMA, dated Dec 31, 1965, provided by KR.

¹⁷ Ibid, p. 3.

¹⁸ Ibid, p. 2.

¹⁹ Email KR to AF, 12-05-07 1:12am.

²⁰ Ibid.

²¹ Email KR to AF 12-05-07 3:57pm.

²² Email KR to AF, 12-05-07 5:09pm.

²³ Op cit. note 4, p. 2.

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- ²⁴ Arch Environ Health 22:677, 1971.
- ²⁵ Arch Environ Health 28:69, 1974.
- ²⁶ Ann Occup Hygiene 41:13, 1997.
- ²⁷ Transcript of CBC Radio Interview with JCM, March 7, 1975. Provided by KR.
- ²⁸ Letter from JCM, Nov 22, 1966, in McGill files.
- ²⁹ Letter from JCM, June 8, 1970, in McGill files.
- ³⁰ Letter from JCM, Jan 3, 1972, in McGill files.
- ³¹ Expendable Americans, Paul Brodeur, p. 134. Photocopy provided by KR.
- ³² Industrial Pneumoconiosis Prevention and Control. Johns-Manville, 1969, p. 7. Document in McGill files.
- ³³ Cited in Beyond the Factory Gates, Peter Bartrip, 2006, p. 113.
- ³⁴ Ibid. p. 209, note 63.
- ³⁵ Email KR to AF, 12-05-22 12:30am.
- ³⁶ Ibid.
- ³⁷ Am J Indust Med 44:540, 2003.
- ³⁸ Ibid.
- ³⁹ Arch Envir Health 28:61, 1974.
- ⁴⁰ Ann NY Acad Sci 330:11 ,1979.
- ⁴¹ Ibid. p. 18.
- ⁴² McGill Asbestos Research Priorities Since 1964. Published in Mitastein, Monique. Memorias de la Reunion sobre Asbesto y Salud en America Latina. Metepec, ECO, 1987. p.137-58. Document provided by KR.
- ⁴³ Ibid. p. 148.
- ⁴⁴ Ibid. p. 140.
- ⁴⁵ Ann Occup Hyg 44:565, 2000.
- ⁴⁶ IARC Monographs 100C, 2012, p. 239.
- ⁴⁷ Brit J Can 106:575, p. 583.
- ⁴⁸ Position Statement on Asbestos, Joint Policy Committee of the Societies of Epidemiology, June 4, 2012., p. 3.
- ⁴⁹ Ibid. p. 13.
- ⁵⁰ Ann Occup Hyg 41:1, 1997, p. 11.
- ⁵¹ Ann Occup Hyg 41:13, 1997, p. 13.
- ⁵² Op. cit. Note 35.
- ⁵³ Op. cit. Note 7, p. 4 of Proposal.
- ⁵⁴ Op. cit. Note 23.
- ⁵⁵ Op. cit. Note 23, p.546.
- ⁵⁶ Op. cit. Note 23, p. 550.
- ⁵⁷ Science 267:776, 1995.
- ⁵⁸ Op. cit. Note 23, p. 544.
- ⁵⁹ Op. cit. Note 49.
- ⁶⁰ Science 249:844, 1990.
- ⁶¹ Ann Occup Hyg 41:707, 1997.
- ⁶² Op. cit. Note 1, p. 440.
- ⁶³ Sinclair, WE, 1959.
- ⁶⁴ Op. cit. Note 55, p. 776.
- ⁶⁵ Op. cit. Note 58, p. 718.
- ⁶⁶ Arch Environ Health 56:65, 2001.