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Dust versus Dust: Aluminum Therapy and Silicosis in the Canadian and Global Mining Industries



Abstract: *By the 1930s, silicosis – a debilitating lung disease caused by the inhalation of silica dust – had reached epidemic proportions among miners in the gold-producing Porcupine region of northern Ontario. In response, industrial doctors at the McIntyre Mine began to test aluminum powder as a possible prophylactic against the effects of silica dust. In 1944, the newly created McIntyre Research Foundation began distributing aluminum powder throughout Canada and exported this new therapy to mines across the globe. The practice continued until the 1980s despite a failure to replicate preventative effects of silicosis and emerging evidence of adverse neurological impacts among long-time recipients of aluminum therapy. Situated at the intersection of labour, health, science, and environmental histories, this article argues that aluminum therapy represents an extreme and important example where industry and health researchers collaborated on quick-fix “miracle cures” rather than the systemic (and more expensive) changes to the underground environment necessary to reduce the risk of silicosis.*

Keywords: mining, silicosis, industrial hygiene, science, health, environment, labour, extraction, lung disease, medicine

Résumé : *Dans les années 1930, la silicose, maladie pulmonaire débilitante causée par l'inhalation de poussière de silice, avait atteint des proportions épidémiques chez les mineurs de la région aurifère de Porcupine, dans le nord de l'Ontario. En réaction, les médecins du travail de la mine McIntyre commencèrent à tester la poudre d'aluminium comme prophylactique possible contre les effets de la poussière de silice. En 1944, la McIntyre Research Foundation, nouvellement créée, se mit à distribuer de la poudre d'aluminium dans tout le Canada et exporta cette nouvelle thérapie dans les mines du monde entier. Cette pratique se poursuivit jusque dans les années 1980, même si elle ne parvenait pas à prévenir la silicose et si l'on commençait à avoir des preuves d'effets neurologiques indésirables chez les personnes ayant reçu une thérapie à l'aluminium pendant de longues années. Situé au croisement de divers champs de l'histoire – le travail, la santé, les sciences et l'environnement –, l'article soutient que la thérapie à l'aluminium représente un exemple extrême et important où l'industrie et les chercheurs du domaine de la santé ont collaboré à des « remèdes miracles » rapides*

plutôt qu'à des changements systémiques (et plus coûteux) à apporter au milieu souterrain pour réduire le risque de silicose.

Mots clés : exploitation minière, silicose, hygiène industrielle, science, santé, environnement, main-d'œuvre, extraction, maladie pulmonaire, médecine

On 6 October 1924, Ontario Department of Health clinician Dr. A.R. Riddell cut into the body of Canada's first official silicosis victim. As he opened the chest, the lungs bulged out. A dense fibrous tissue coated their surface – one and a half centimeters thick in places. The upper part of the lung should have been spongy and pink, but it was bluish grey in colour, and when Riddell submerged a piece in a beaker of water, it sunk like a rock. Glands had been nearly obliterated by fibrosis and were so hardened that they were difficult to cut.¹ When he had been alive, Riddell's patient had told him about his work in the dusty crusher room of a northern Canadian mine before government-mandated X-rays had revealed dark cotton-like shadows in his lungs. Two months after his conversation with Riddell he was dead, and thousands of miners just like him would face the same fate. Although his name is lost to the record, the gory details of his disease-ravaged organs remain on display in the pages of scientific journals where a medical debate about silicosis and its "cures" was about to take place. The miner's anonymity and the involuntary medicalization of his body are apt symbols for the character of silicosis treatment as it would unfold over the next seventy years.

Silicosis is caused by the inhalation of silica dust, or silicon dioxide, the world's most common mineral. First distinguished from other miners' lung diseases in 1871, it became most prevalent in occupations such as brick production, granite cutting, sandblasting, ceramics, foundry work, construction, and especially hard rock gold mining.² In the early twentieth century a silicosis crisis emerged in tandem with industrial-scale hard-rock gold mining operations. The industry developed new technologies, including heavier mechanical drills and powerful dynamite, along with cyanide treatment methods that separated tiny amounts of gold from large volumes of ore, allowing for the exploitation of lower-grade deposits. These new forms of drilling and blasting produced large quantities of dust in the underground environment. The danger was not immediately obvious because silicosis develops slowly and can be complicated by a dazzling number of external factors and co-occurring lung conditions such as tuberculosis and cancer. Workers exposed to silica may feel no symptoms until fifteen to twenty years after consistent exposure to its dust, and medical professionals consider silicosis onset within a ten-year window to be a rapid

1 A.R. Riddell, "A Case of Silicosis with Autopsy," *The Canadian Medical Association Journal* 15, no. 8 (August 1925): 839–841.

2 For the origins and identification of silicosis, see Alberto Baldasseroni and Francesco Carnevale, "The Genesis and Development of the Scientific Concept of Pulmonary Silicosis during the Nineteenth Century," in Paul André Rosental, ed. *Silicosis: A World History* (Baltimore: Johns Hopkins University Press, 2017), 30–63.

development of the disease. Some chronic cases may be asymptomatic (i.e., nodules exist on the lungs, but they produce no signs of illness), but others may result in progressive and massive fibrosis, a scarring and thickening of the lungs that makes it difficult to breathe. Less common is the acute form of the disease, which may form in a few short weeks or years after a particularly large exposure to dust. More typically, silicosis progresses as an insidious form of slow violence, severely impairing workers' quality of life, and often causing premature death as their lungs decline and eventually cease to function.³

The Canadian silicosis crisis coincided with the peak of the gold rush in the Porcupine region, near Timmins, Ontario. By the end of the 1920s, three enormous mining complexes (Hollinger, Dome, and McIntyre) were producing more than ninety percent of Canada's gold. In the postwar period, from 1919 to 1929, Ontario tripled its production to over 1.6 million troy ounces of gold.⁴ This achievement marked unparalleled industrial expansion and the rapid transformation of labour in the Canadian north over the course of a single decade. It also produced a great deal of dust in the underground environment, as drilling, blasting, and digging into lower grade hard-rock ore bodies with high silica content placed miners at extreme risk for contracting silicosis.⁵

The scale of the emerging silicosis crisis prompted fears in the Canadian mining industry of serious financial damage, worker panic, and labour shortages. Like many of their international counterparts, industry leaders began looking for a way to treat silicosis. An official "silicosis committee" first sat down in the late 1920s and included representatives from Canada's most powerful mining companies, American doctors, and the Workmen's Compensation Board. Together they examined chest X-rays, compared the evidence from multiple mining states, and debated the findings of existing scientific research. They were disappointed

3 For a general, medical overview of silicosis, see Chi Chiu Leung, Ignatius Tak Sun Yu, Weihong Chen, "Silicosis," *The Lancet* 379, no. 9830 (2012): 2008–2018; David Rosner and Gerald Markowitz, *Deadly Dust: Silicosis and the Politics of Occupational Disease in Twentieth-Century America* (Princeton: Princeton University Press, 1991). On slow violence see Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press, 2013).

4 Troy ounces are a measure specific to precious metals. One troy ounce is equivalent to 1.09714 ounces. *Twenty-ninth Annual Report of the Ontario Department of Mines* (Toronto: King's Printer, 1920), 2, <http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/ARV29/ARV29.pdf>; and *Thirty-ninth Annual Report of the Ontario Department of Mines* (Toronto: King's Printer, 1930), 2, <http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/ARV39/ARV39.pdf> (accessed 17 December 2020). On Ontario's economic development in the 1920s, see Viv Nelles, *The Politics of Development: Forests, Mines & Hydro-Electric Power in Ontario, 1848–1941*, 2nd ed. (Kingston and Montreal: McGill-Queen's University Press, 2005).

5 For technological developments in the Canadian industry, see Jeremy Mouat, *Metal Mining in Canada, 1850–1940* (Ottawa: National Museum of Science and Technology, 2000). For a historical overview of the early period of silicosis in Canada, see Nancy Forestell, "And I Feel Like I'm Dying from Mining for Gold': Disability, Gender and the Mining Community, 1920–1950," *Labour: Studies in Working-Class History of the Americas* 3, no. 3 (2006): 77–93.

with the results. In an era that had been marked by miraculous medical discoveries such as insulin, penicillin, vaccines, and vitamins, silicosis science lacked the same kinds of heroic victories. The group dubbed its results “not very definite” and proposed establishing its own research foundation, eventually named the McIntyre Research Foundation (MRF) to address the problem.⁶

Nothing the Canadians had done to this point differed significantly from measures already employed by other countries with silicosis outbreaks, especially in their efforts to control dust production from drilling and blasting, and to properly ventilate the underground environment. But in 1938 McIntyre Research Inc. (as it was briefly called) invented the world’s first apparent medical preventative treatment for silicosis in the form of aluminum powder. The MRF manufactured its newly dubbed McIntyre Powder from finely ground aluminum oxide that miners inhaled in their change rooms with the assurance that it was a prophylactic against silica dust. Early experiments with animals and small numbers of people suggested that aluminum powder was indeed effective as a protective measure against silicosis, possibly even a therapeutic agent for those who already had the disease. The MRF began advertising McIntyre Powder as a supplement to engineering solutions in the fight against silicosis, approving its widespread use in silica dust-plagued industries in 1944 (see [Figure 1](#) and [Figure 3](#)).

In a time of crisis, McIntyre Powder offered a glimmer of hope. Over the next thirty years, the MRF entertained inquiries from scientists in dozens of mining states, promoted their powder at international conferences, created a network of representatives and supporters around the world, signed dozens of contracts with dust-producing industries, and set about distributing its treatments to miners on almost every continent. In Canada alone, companies administered aluminum powder daily to 16,000 workers in 1949.⁷ Internationally, the number of exposed workers remains incalculable; figures exist only for a few years in a few jurisdictions. For example, in Mexico in 1956, the MRF declared 1.25 million treatments were given.⁸ In Australia, 2,337 miners or seventy-two percent of Western Australia’s total underground workforce took McIntyre Powder by 1958.⁹

The MRF wasted no time celebrating the spread of aluminum therapy, claiming a large measure of credit for the slow decline of silicosis cases after the Second World War. The MRF advocated tirelessly for dust control as the first line of defence against silicosis, distributing McIntyre Powder on a non-profit basis and often framing it as a philanthropic gift to workers at risk from silica dust.¹⁰

6 Meeting of the Silicosis Committee, n.d., General Superintendent’s files 1926–35, file 10, series F 1350, Archives of Ontario [hereafter AO].

7 McIntyre Research Foundation Annual Report, 1949, file 2, container B244379, series F 1352–3, AO.

8 McIntyre Research Foundation Annual Report, 1956, file 2, container B244379, series, F 1352–3, AO.

9 Beris Penrose, “‘So Now They Have Some Human Guinea Pigs’: Aluminum Therapy and Occupational Silicosis,” *Health and History* 9, no. 1 (2007), 64.

10 Typical was a comment from McIntyre Research Ltd. Vice President Balmer McNeilly, who called the motivations of the organization “purely altruistic.” See Meeting of the Board of Directors, McIntyre Research Ltd., 10 May 1946, file 111–2, container 2, series F 4170–2, AO.



FIGURE I “McIntyre Powder Canister,” Timmins Museum.
Photograph courtesy Janice Martell.

At first glance, the story of aluminum powder seems to align with the industrial health crusades of the early twentieth century that historians have justly celebrated as heroic and visionary attempts to mitigate the health and environmental hazards of the “dangerous trades.”¹¹ But the MRF was not merely a disinterested and benevolent research organization ensconced on the side of the angels. Instead, the aluminum therapy program aided the efforts of the Canadian mining industry to seize the initiative on workplace health issues, providing a breakthrough technology the industry could cite as evidence it had the silicosis situation under control, with no need for alarm among organized labour or industrial health activists, and no need for overt regulatory measures such as an air quality standard for silicosis.¹² If, as historians Gerald Markowitz and David Rosner argue, silicosis was the most important disease of the early twentieth century because it threatened the idea that industrial progress improved quality of life, the MRF’s discovery of a technological antidote offered

11 Arthur McEvoy, “Working Environments: An Ecological Approach to Industrial Health and Safety,” *Technology and Culture* 36, no. 2 (1991): 145–173; Robert Gottlieb, *Forcing the Spring: The Transformation of American Environmentalism* (Washington: Island Press, 1993); Angela Gugliotta, “Class, Gender and Coal Smoke: Ideology and Environmental Injustice in Pittsburgh, 1868–1914,” *Environmental History* 5, no. 2 (2000): 165–193; David Stradling, “Dirty Work and Clean Air: Locomotives, Firemen, Environmental Activism, and Stories of Conflict,” *Journal of Urban History* 28, no. 1 (2001): 35–54.

12 On the latter point, see Dieter Grant Hogaboam, “Silicosis in the Ontario Hardrock Mining Industry, 1921–1975” (master’s thesis, Queen’s University, 1975), 98–119 and 115–116.

the possibility of not only mitigating the disease but also preserving the prevailing economic order during a period of global labour unrest.¹³ Having lifted the death sentence associated with silica exposure (or so it seemed), McIntyre Powder reinforced industry's legitimacy on industrial health issues, suggesting that, when it came to the health of workers, the interests of capital and labour were one and the same.

In practice, the aluminum therapy program went hand in hand with the projection of managerial authority over workers. The MRF and allied companies adopted paternalistic policies such as the denial of workers' basic right of medical consent, the imposition of control over workers' environments, failure to account fully for the health risks of introducing a new dust into workers' bodies, and zealous opposition to unions that objected to the treatment. Such devotion stemmed partly from the fact that the MRF was more than a fierce ally of the Canadian mining industry: it *was* the industry. A 1955 list of the MRF's directors includes men who were also serving as presidents and directors at McIntyre Porcupine Mines, Belleterre Mines, Castle-Trethewey Mines, and the Aluminum Company of America.¹⁴ In spite of the well-known risks associated with dusty environments and workers' health, the foundation's officials displayed overt hostility to external scientists who were skeptical of aluminum dust therapy, even while they admitted (privately and publicly) they could not be sure that the powder had any effect on the progress of silicosis.¹⁵

As a broader point of intersection between labour and environmental history, the aluminum therapy program was emblematic of a shift in Canada and the United States, beginning in the 1920s, in the political control of the industrial hygiene movement from ground-level activism towards management solutions based on science and technology. Historians have suggested various reasons for this changing power dynamic, most notably management's desire to control workers' compensation costs and entrench corporate volunteerism rather than strong public regulation as a means to control industrial hazards.¹⁶

13 Gerald Markowitz and David Rosner, "Why Is Silicosis so Important?" In Paul André Rosental, ed. *Silicosis: A World History*, 14–29.

14 Francis B. Trudeau, "The Objectives and Achievements of the McIntyre Research Foundation," *American Medical Association Archives of Industrial Health* 12, no. 1 (July 1955), 2.

15 As late as 1980, MRF President W.B. Dix fell back on the idea that even if there was no rigorous scientific proof of effectiveness, anybody subjected to aluminum therapy knew that it worked. See W.B. Dix, Response to the Minister of Labour on the Effects of Aluminum Prophylaxis," 28 April 1980, container 10, series F 4170–8, AO.

16 For an overview of this shift, see Christopher C. Sellers, *Hazards of the Job: From Industrial Disease to Environmental Health Science* (Chapel Hill: University of North Carolina Press, 1997); Eric Tucker, "Making the Workplace 'Safe' in Capitalism: The Enforcement of Factory Legislation in Nineteenth Century Ontario," *Labour/Le Travail* 21 (Spring 1988): 45–85; Eric Tucker, *Administering Danger in the Workplace: The Law and Politics of Occupational Health and Safety Regulation in Ontario, 1850–1914* (Toronto: University of Toronto Press, 1990); and Mark Aldrich, *Safety First: Technology, Labor, and Business in the Building of American Work Safety, 1870–1939* (Baltimore: John Hopkins University Press, 1997). For the connection

While some technical approaches to the silicosis problem, i.e., wet drilling, the use of water as a dust suppressant, and improved ventilation were benign, aluminum therapy illustrated the malign effect of applying paternalistic corporate science to industrial health problems. Obsessed with engineering a quick fix for the silicosis problem, mining company doctors, engineers, and some university researchers introduced a new form of airborne dust to the workplace without fully assessing the health risks, particularly to bodily functions other than the respiratory system. They refused to heed the more precautionary approach of miners and their representatives in the labour movement, who openly resisted the use of aluminum powder from at least the 1950s onward because they worried about the unknown health effects of aluminum dust in the work environment. Even as aluminum therapy came under intense criticism with the resurgence of grassroots industrial health activism in Canada during the 1970s, the MRF fought tooth and nail, clinging fiercely to an out-of-date technological optimism even as it was expiring in other intellectual and political circles.¹⁷ With stubborn devotion to the cause, the MRF refused to consider that their miracle cure might constitute a workplace hazard, an oversight that continues to echo in the present day as former miners seek compensation for neurological conditions they associated with aluminum exposure.

FROM CRISIS TO CURE: THE RISE OF CANADIAN SILICOSIS SCIENCE

Outside of Canada, silicosis crises emerged in industrial mining states starting at the turn of the twentieth century. In South Africa, new technology generating more dust, increasingly confined underground spaces, and enormous migrant workforces combined to create the perfect conditions for a silicosis epidemic.¹⁸ Tasked with investigating rising worker debilitation and death, South Africa's 1902–1903 Weldon Commission identified silicosis as a major problem and recommended dust reduction measures in the mines.¹⁹ It would take another decade

between workers' compensation costs and improving industrial safety conditions in the early twentieth century, see Javier Slivestre, "Improving Workplace Safety in the Ontario Manufacturing Industry, 1914–39," *Business History Review* 84, no. 3 (Autumn 2010): 527–551, and James C. Foster, "The Western Dilemma: Miners, Silicosis, and Compensation," *Labour History* 26, no. 2 (1985): 268–287.

17 For an overview of the resurgence of industrial health activism in Canada in the 1970s, see Lloyd Tataryn's *Dying for a Living: The Politics of Industrial Death* (Toronto: Deneau and Greenberg, 1979). For historical accounts, see Robert Storey and Wayne Lewchuk, "From Dust to Dust: Asbestos and the Struggle for Worker Health and Safety at Bendix Automotive," *Labour/Le Travail* 45 (Spring 2000): 103–140, and Robert Storey, "From the Environment to the Workplace ... and Back Again? Occupational Health and Safety Activism in Ontario, 1970s–2000+" *Canadian Review of Sociology/Revue Canadienne de Sociologie* 41, no. 4 (2004): 419–447.

18 Jock McCulloch, "Air Hunger: The 1930 Johannesburg Conference and the Politics of Silicosis," *History Workshop Journal* 72, no. 1 (Autumn 2011): 118–137.

19 Jock McCulloch, *South Africa's Gold Mines and The Politics of Silicosis* (Rochester: Boydell & Brewer, 2012), 15. See also Jock McCulloch and Paul André Rosental, "Johannesburg and Beyond: Silicosis as a Transnational and Imperial Disease, 1900–1940," in Paul André Rosental, ed. *Silicosis: A World History*, 64–104.

for the government and mining companies to implement these recommendations. In 1905, Western Australia looked at the Kalgoorlie mines and concluded that miners were being exposed to dangerous amounts of dust due to inadequate ventilation.²⁰ Outcomes included categories for different stages of disease, examination schedules for miners, and modest compensation programs before the First World War.²¹ In the United States, insurance companies started sounding the alarm in 1908, and initiated a Public Health Service investigation in collaboration with the Bureau of Mines in 1911.²² In 1914, Anthony J. Lanza conducted a landmark investigation on the lead and zinc mining regions in Missouri, Kansas, and Oklahoma that emphasized environmental factors as causes for industrial disease. Further statistical work in 1919 by Frederick L. Hoffman on miners in Barre, Vermont, contributed to solidifying silicosis scientific and social policy.

As part of the international mining community, the Canadian industry participated in discussions about lung disease but took very little action before the 1920s. Canadians often saw themselves as immune from the rest of the world's industrial problems. For example, in 1912, Canadian Mining Commissioner Samuel Price's report on the eight-hour day asserted that underground environments were safe for workers. He wrote that "the mines in Ontario, I believe, are naturally as healthful as any in the world."²³ The state of Canadian silicosis thinking began to change in tandem with the rapid expansion of gold mining production and employment (and hence the number of workers exposed to silica dust) in the decade after the First World War.²⁴ In 1922 Thomas Sutherland, the Chief Inspector of Mines for Ontario, returned from a fact-finding mission to South Africa with a recommendation to combat the potential spread of silicosis through dust control and medical exams. In 1924, the Ontario Department of Health organized a preliminary examination of eleven miners who had worked for five years or more in the Porcupine area. Nine out of eleven had signs of silicosis. Dr. Riddell's anonymous patient described in the introduction to this article was among them. A year later, the department organized a second survey of 235 miners and found seventy-five

20 Marcus James, "The Struggle against Silicosis in the Australian Mining Industry: The Role of the Commonwealth Government, 1920–1950," *Labour History* no. 65 (November 1993): 75–95.

21 James, "The Struggle against Silicosis," 78; McCulloch, *South Africa's Gold Mines*, 38–39.

22 Rosner and Markowitz, *Deadly Dust*, 25–27.

23 Samuel Price, *Report re. Limitation of the Hours of Labor of Underground Workmen in the Mines of Ontario* (Toronto: L.K. Cameron, 1913), 11.

24 Between 1918 and 1929, Canadian gold production increased from 700,000 to just over 1.9 million troy ounces annually, with the annual value of production increasing from just over \$15 million to \$35 million. G. David Quirin, *Historical Statistics of Canada, Section P: Mining*. Statistics Canada, <http://www.statcan.gc.ca/pub/11-516-x/pdf/5220017-eng.pdf>. In Ontario, the number of employees working in the gold mining sector increased from 2,188 in 1919 to 6,462 in 1929. See *Twenty-ninth Annual Report of the Ontario Department of Mines*, 2, and *Thirty-ninth Annual Report of the Ontario Department of Mines*, 2.

had well-developed cases of silicosis and forty-seven had early signs of the disease.²⁵

In 1926, the Ontario government recognized the emerging medical consensus that silicosis was primarily an occupational disease caused by silica dust, declared it compensable under the Ontario Workmen's Compensation Act, and amended the Ontario Mining Act to require routine chest examinations for all miners who worked in dusty environments. That same year, company doctors in the Porcupine area examined four thousand miners and found ninety-eight compensable cases. Depending on the severity of their cases, miners received \$500–\$1,000 compensation and removal from underground work.²⁶ At the time, medical authorities thought silicosis might stabilize within five years if miners were placed in non-dusty environments.²⁷

The truth was that the government and industry had only just begun to glimpse the seriousness of the situation. In 1931, the previous years of exposure caught up with the mine workforce and the number of severe cases – along with the cost of the compensation claims – soared to the point that the silicosis compensation fund was running a \$1.5 million deficit.²⁸ The financial costs associated with silicosis panicked the mining companies. A memo from the Dome mining company pointed out that the South African government was able to reduce its costs because its mines employed Indigenous workers. This was an option the Canadian mines did not have: “One fact we must not lose sight of. The figures given for the Rand did not include amounts expended on native labor ... with us we have no such cheap native labour to be compensated for at lower rates so that every silicotic case we have means expenditure on the maximum basis.” At a meeting of the silicosis committee, mine managers told horror stories about South African mines forced to channel one hundred percent of future profits to compensation costs, despite racist policies which limited compensation for non-white miners.²⁹

In 1932 the manager of the McIntyre Mine, R.J. Ennis, organized a meeting of experts to search for a medical intervention. Ennis also arranged for Sir Frederick Banting, Canada's world-famous discoverer of insulin, to assemble a team that might work on the problem at the University of Toronto's Banting Institute. While several academics officially sat on the ad hoc silicosis team, only one of them, professor of pathology Dudley Irwin, played any significant role in the anti-silicosis research program. Irwin's key research partners on the project were J.J. Denny, McIntyre Mine's chief metallurgist, and W.D. Robson, a McIntyre company doctor. While their first experiment—placing thirty-three guinea pigs in the mine for a year to see what would happen—might not have

25 Jabez Elliot, “Silicosis in Ontario Gold Miners,” *The Canadian Medical Association Journal* 14, no. 10 (1924), 930.

26 “Development of Program for the Prevention of Silicosis at Ontario Gold Mines,” no date, container 5, series F 4170–3, AO.

27 “The Campaign Against Silicosis,” *The British Medical Journal* 1, no. 3664 (March 1931), 548.

28 “Development of Program for the Prevention of Silicosis at Ontario Gold Mines,” no date, container 5, series F 4170–3, AO.

29 Meeting of the Silicosis Committee, n.d., Silicosis, General Superintendent's Files 1926–35, container 10, series F 1350, AO.

won them any scientific prizes for originality, they were surprised that post-mortem exams for silicosis came up empty. They imagined that some type of gas in the mine might have been acting to inhibit the progress of silicosis in the guinea pigs, and suggested there may have been an airborne substance that could act as a prophylactic against the ravages of silica dust.³⁰

During this period, many medical researchers believed the chemical reaction that produced silicotic fibrosis occurred simultaneously with the dissolution of silica dust in the lungs. Although we now know that silica does not dissolve in the process of causing fibrosis, based on the prevailing wisdom, Irwin, Denny, and Robson reasoned that inhibiting the solubility of silica with a non-toxic substance could block the development of silicosis. They believed that the so-called nascent hydrogen in aluminum hydroxide would block “unsatisfied” oxygen atoms from interacting with lung tissues.³¹ In March 1936 Denny and Robson demonstrated under laboratory conditions that aluminum could inhibit the solubility of silica. They quickly followed up with a rabbit study, exposing six animals to silica dust and seven others to silica and aluminum dust, killing individual animals at six-month intervals and sending them to the Banting Institute for pathological study. The results showed the silica-only animals with early to advanced silicosis, while the silica-plus-aluminum animals showed minor to non-existent signs of silicosis. A research team at the University of Toronto conducted more intensive animal experiments and reached similar results. In addition, their work showed that aluminum appeared not to cause lung damage even with exposures of up to seventeen months. In 1937 Denny, Robson, and Irwin published the initial results of their “classic” studies in the *Canadian Medical Association Journal*. Based on the discovery, Denny won a research award from the Canadian Institute of Mining and Metallurgy, while Robson and Irwin won the University of Toronto’s McCharles Award for “marked contribution in scientific research of a practical nature.”³² After celebrating their success, the newly formed MRF applied for a patent for aluminum powder in 1938 and sent memoranda on their discovery to the Transvaal, Great Britain, and the United States.³³

For the next stage of the research, the foundation pushed for an independent clinical trial of the newly dubbed McIntyre Powder. In 1941, two investigators from the Queen Alexandra sanatorium in London, Ontario, Drs. G.W. Crombie

30 William B. Dix, “Twenty-Seven Years’ Use of Aluminum Powder to the Silicosis Prevention Program of the Ontario Gold Mining Industry,” presented at the Safety and Ventilation Symposium, Mines Accident Prevention Association of Ontario, 6 November 1970, container 6, series F 4170–3, AO.

31 Nascent hydrogen is a state that was thought to be different from molecular hydrogen, but which has since been discounted.

32 Thelma Craig, “Science Fights the Death Dust,” *Maclean’s*, 1 November 1939, 13, 33–35.

33 A.D. Campbell to the Ontario Mining Association, 18 May 1940, “Re. Aluminum Powder and Silicosis,” container 9, series F 4170–8, AO; J.J. Denny, W.A. Robson, and D.A. Irwin, “The Prevention of Silicosis by Metallic Aluminum,” *Canadian Medical Association Journal* 37, no. 1 (1937): 1–11; J.J. Denny, W.A. Robson, and D.A. Irwin, “The Prevention of Silicosis by Metallic Aluminum,” *Canadian Medical Association Journal* 40, no. 3 (1939): 213–228.

and J.L. Blaisdell, proceeded with an X-ray study of 125 workers exposed to aluminum in a Pittsburgh paint factory. Although the workers had worn respirators for the previous four years, Crombie and Blaisdell felt confident that aluminum exposure prior to that would serve as a useful metric for assessing the possible danger the metal posed to the lungs upon inhalation. They confidently declared that “even large amounts of aluminum powder had no harmful effect. It did not cause lung damage nor favour the development of tuberculosis.”³⁴ Confident that aluminum powder was safe, the foundation enlisted Crombie, Blaisdell, and another doctor, G. MacPherson, to conduct a clinical trial over the next three years at St. Mary’s Hospital in Timmins. The (odd) logic behind the trial was that if McIntyre Powder had a therapeutic or even curative effect on those who had already developed the disease, then its value as a prophylactic could be reasonably assumed. Out of the thirty-four silicosis patients who received aluminum therapy during the trial, nineteen seemed to show improvements in symptoms, such as shortness of breath, coughing, and chest pain, while twelve showed improvements on respiratory function tests. If, as Crombie suggested, aluminum powder could not cure silicosis, the St. Mary’s trials suggested that it could impede the progress and development of the disease in some patients.³⁵ J.W.G. Hannon’s concurrent clinical trials among ceramic workers in Washington, Pennsylvania, also provided encouragement and corroboration for the work in Timmins, with ninety-four percent reporting some improvement after aluminum therapy.³⁶ In many ways, these trials set a low bar for proof because they relied on small sample sizes, lacked control groups, failed to account for a placebo effect on self-reported improvements among study subjects, and did not assess the effectiveness of aluminum over a period commensurable with the decades-long developmental period for many cases of silicosis. The research nevertheless provided the scientific basis for the widespread adoption of aluminum therapy across Canada beginning in 1944.³⁷

34 Quoted in W.B. Dix, “Brief to the Royal Commission on the Health and Safety of the Workers in Mines in Ontario,” 5 February 1975, container 6, series F 4170–3, AO.

35 D.W. Crombie, J.L. Blaisdell, and G. MacPherson, “The Treatment of Silicosis by Aluminum Powder,” *Canadian Medical Association Journal* 50, no. 4 (1944): 318–328; Ontario Mining Association, “Findings of Porcupine Clinic and Adoption of Aluminum Therapy,” no date, container 5, Series F 4170–3, AO.

36 J.W.G. Hannon, “Aluminum Therapy in the United States,” *Transactions of the Canadian Institute of Mining and Metallurgy* XLVII (1944): 180–184.

37 On the issue of a controlled study and a placebo effect, an article by William Weber from the August 1959 issue of the magazine *Modern Castings* mentions a study by Dr. Berry where all nine workers in a control group that breathed pure air (but thought they were breathing aluminum through a respirator) reported improvement in their silicosis symptoms, while Berry thought six were unchanged and three were worse. A typescript copy, which was critical in general of aluminum therapy, was found in container 5, series F 4170–3, AO. Berry’s article concluded the patient reports of improvement due to aluminum therapy should be regarded as subjective. See John W. Berry, “Aluminum Therapy in Advanced Silicotics,” *American Review of Tuberculosis* LVII, no. 6 (June 1948): 557–573.

MCINTYRE POWDER, INTERNATIONAL SCIENCE,
AND WORKER DISSENT ON THE WORLD STAGE

Early reception of aluminum therapy was cautiously optimistic, and companies in the United States, Mexico, and Western Australia widely adopted McIntyre Powder throughout the 1940s and 1950s. Chile and Great Britain established small pilot projects using McIntyre Powder treatments during this same period. But the MRF's new visibility also meant that McIntyre Powder faced criticism from independent scientists for the first time. In 1941, Dr. Leroy Gardner of the famous American tuberculosis laboratory at Saranac Lake, New York, expressed enthusiastic interest in conducting his own tests with aluminum powder. The MRF balked, citing its doubt in Gardner's ability to find miners who would travel to the lab, let alone garner sufficient support from industry funders. When Gardner quickly secured 1,000 patients at an iron ore mine and considerable financial backing from the insurance industry, the real reasons for the foundation's hesitation came out. Correspondence between MRF members reveal a fear of "backfires" (i.e., cases that appeared to disprove McIntyre Powder's effectiveness) and a desire to keep Gardner from publishing before McIntyre researchers could get their own papers out. The MRF eventually conceded – sending samples of its Powder after Gardner signed a restrictive legal contract.

Gardner's silicosis research occurred within a wider context of uncomfortable conversations about worker health, industrial science, and mining in North America orbiting Saranac in the early 1940s. It was around the same time that Gardner "accidentally" discovered that asbestos was carcinogenic following Johns-Mansville Mine-sponsored research in 1943.³⁸ Like his asbestos findings, Gardner's final publications on McIntyre Powder (edited and published posthumously) came out mostly in favour of its use, but these findings would not hold up as work by Gardner's successors progressed.³⁹ In 1953, a group of researchers from the Saranac lab presented results from animal trials showing that aluminum could cause pneumoconiosis (a generic term for inflammation and fibrosis in the lungs). Their work also showed that aluminum was not "absolutely effective" at minimizing tissue damage caused by quartz dust. They concluded "on the basis of the evidence ... that the prophylactic use of either of the aluminum preparations should be avoided whenever possible, and protection of personnel should be accomplished by means of industrial hygiene measures."⁴⁰

Saranac was not alone in its tentative relationship with the MRF and aluminum therapy. In 1945 the American Medical Association recommended holding

38 Jessica Van Horssen, *A Town Called Asbestos: Environmental Contamination, Health, and Resilience in a Resource Community* (Vancouver: UBC Press, 2016), 65.

39 Balmer Neilly to Joseph Stoval, 29 April 1941, Saranac, file 300–2, container 2, series F 4170–2, AO.

40 Phillip Pratt, Arthur Vorwld, and Morris Dworski, "Evaluation of Aluminum Prophylaxis in Various Pneumoconiosis," paper presented at the 1953 conference of the MRF, file 4.1 container B244379, Series F 1352–3, AO.

off on aluminum treatment until more research was conducted.⁴¹ A.R. Riddell and R.R. Sayers, prominent early voices in silicosis research and industrial hygiene, both came out against the MRF.⁴² Dr. G. Goralewski's research among aluminum workers in the 1930s, in Germany, indicated that exposure to aluminum dust had caused lung fibrosis, findings that echoed through the medical literature in the 1950s and 1960s, with one study noting that a patient had also exhibited signs of dementia.⁴³ In the late 1940s, Dr. Cecil Shaver, superintendent of the Niagara Peninsula Sanatorium, published accounts of lung disorders among workers who had been exposed to aluminum and silica, suggesting some possible harmful effects from aluminum or, at least, that it had no effect on the silica dust.⁴⁴ Although Shaver was careful to note that his work should not be seen as denouncing aluminum therapy because his study subjects received much higher doses of aluminum than those used to combat silicosis, years later he reflected that "I am of the opinion that the lung is a delicate organ and that we should be extremely careful about what we put in it. It seems to me a damn fool business to be putting a dust in people's lungs in an attempt to counteract the bad effects of a different dust."⁴⁵

Criticisms of McIntyre Powder would continue into the postwar period, particularly among the "holdout" mining nations such as Germany and South Africa, which never adopted aluminum therapy programs. Particularly noteworthy (and threatening to the foundation) was the work of Dr. W.T. Ulmer at the West German Silicosis Institute, whose research in the 1960s suggested that

41 For the AMA recommendation see "Aluminum in the Prevention and Treatment of Silicosis," *Journal of the American Medical Association* 130, no. 17 (April 1946): 1223. For a discussion, see "Minutes of the Meeting of the Technical Committee on Silicosis," Nov. 3–5, 1948, file 3, container B244379, series F 1352–3, AO.

42 Minutes, Board Room at McIntyre Porcupine Mines Limited, Toronto, Ontario, at 10:30 A.M. July 7, 1947, Advisory Committee, file F 1352–3–0–1, container B244379, AO; A.R. Riddell, "Aluminum Pneumoconiosis," Correspondence, *British Medical Journal* 1, No. 4556 (1 May 1948), 858.

43 G. Goralewski, "Clinical and Animal Experimental Studies and the Question of Aluminum Dusty Lung," *Archiv für Gewerbepathologie und Gewerbehygiene* 9 (1939): 676–88; S.H. Zaidi, *Experimental Pneumonconiosis* (Baltimore: Johns Hopkins University Press, 1969); the paper noting dementia was, A.I.G. McLaughlin, G. Kazantzis, E. King, Donald Teare, R.J. Porter, and R. Owen, "Pulmonary Fibrosis and Encephalopathy Associated with the Inhalation of Aluminium Dust," *British Journal of Industrial Medicine* 19, no. 4 (1962): 253–264. See also John Mitchell et al., "Pulmonary Fibrosis in Workers Exposed to Finely Powdered Aluminium," *British Journal of Industrial Medicine* 18, no. 1 (1961): 10–20; J. Warren Jordan, "Pulmonary Fibrosis in a Worker Using an Aluminium Powder," *British Journal of Industrial Medicine* 18, no. 1 (1961): 21–23.

44 C.G. Shaver and A.R. Riddell, "Lung Changes Associated with the Manufacture of Alumina Abrasives," *The Journal of Industrial Hygiene and Toxicology* 29, no. 3 (1947): 145–157.

45 Shaver is quoted in Tataryn, *Dying for a Living*, 209. Shaver's comments on aluminum therapy likely being safe due to the low doses involved is in "A Synopsis of Pulmonary changes Encountered in Employees Engaged in the Manufacture of Alumina Abrasives—Shaver's Disease," paper presented at the conference of the MRF, 24 and 25 January, 1949, container 7, series F 4170–4, AO.

rats dusted with a mixture of McIntyre Powder, coal, and silica dust died more quickly than those who inhaled just the coal and silica dust. Even those rats dusted with just aluminum died rapidly from lung disease, causing Ulmer to conclude that McIntyre Powder was not safe.⁴⁶ By the late 1940s, Ulmer and other researchers also suggested that animal and human experiments showed no measurable benefit from aluminum therapy with respect to the prevention of silicosis. In South Africa, the MRF did receive strong support from Dr. G.W.H. Schepers, but he was unable to convince South African politicians to approve aluminum therapy. Schepers attributed his failure to the entrenched conservatism among a political establishment that did not want to upset the existing compensation scheme and did not care about the health of black miners.⁴⁷ In 1968, South African professor Ian Webster buttressed the position of the naysayers with a controlled study of rhesus monkeys showing that both the aluminum and non-aluminum groups contracted silicosis. Only a slight delay in development of the disease could be attributed to aluminum therapy. In 1973, J.F. Paterson published a follow-up study of silicosis among Ontario's miners and concluded that, because other preventative measures had been adopted at the same time as aluminum therapy, "it is not now, and never will be possible to prove or disprove the value of aluminum prophylaxis in Ontario Miners." Furthermore, "because of a lack of knowledge about the value of aluminum prophylaxis, I can make no recommendation about its future use."⁴⁸

In the face of all this criticism, the MRF protected its reputation forcefully. In 1947 at the annual meeting of its technical committee, a confidential letter from Quebec's China Clay Mine was read aloud to foundation members. According to the letter, one of the mine's managers told his men that "by using Aluminum therapy, [they] were acting as guinea pigs, that there was as yet no proof of the good effects claimed for this method, and that in experimental animals it had activated tuberculosis. There had also been cases found wherein the inhalation of aluminum caused aluminum lung."⁴⁹ The foundation identified the manager and corrected what it labelled as misinformation with an educational campaign. In another example, anxious letters circulated among MRF members about negative results coming out of England's Fovor Tin Mine. "I am more worried than ever that they are going to come out with some adverse criticism," Robson wrote

46 W. Weller, E. Reif, and W.T. Ulmer, "Long-running Inhalation Experiments on Rats Related to the Silicosis Prophylaxis by McIntyre Aluminum Powder," *Internationales Archiv für Arbeitsmedizin* 22, no. 1 (1966): 77–94.

47 G.W.H. Schepers to William Dix, 28 October 1979, container 9 Series F 4170–7, AO. Schepers' work at the Miners Phthisis Medical Bureau in South Africa was marked by his willingness to challenge the inadequacy of the compensation system for industrial disease. See Jock McCulloch, "Dr. G.W.H. Schepers and the Politics of Silicosis in South Africa," *Journal of Southern African Studies* 35, no. 4 (2009): 835–848.

48 Reference to Webster's paper is found in Tataryn, *Dying for a Living*, p. 207. John F. Paterson, "Silicosis in Hardrock Miners in Ontario (A Further Study)," *Ontario Ministry of Natural Resources Bulletin* 173 (1 July 1973): 12, 14.

49 Minutes of a Meeting of the Advisory Technical Committee, 9–10 December 1947, file 1, container B244379, Series F 1352–3, AO.

to Irwin in the spring of 1950. In response, the MRF sent a representative to the United Kingdom to “endeavour to find out what the report will contain” so that their scientists would “be in a position to criticize it from first hand observations of the procedures they have adapted.”⁵⁰ Such reactions against perceived threats belied the foundation’s claims of neutrality on the issue of McIntyre Powder’s effectiveness.

The MRF’s sensitivity to criticism also drove efforts to improve its image. In particular, its doctors wanted to ensure proper administration of their powder and, as years went on, to find alternative methods to the unpopular change-room dispersions. Generally, McIntyre Powder was administered via a high-pressure nozzle into miners’ dressing areas before they descended for underground shifts (see [Figure 2](#)). Windows and doors had to be tightly sealed, and miners were instructed to breathe deeply for ten minutes in order to inhale sufficient powder to protect them. This could be an unpleasant process, especially in hot summer months. In one-room change houses, miners’ personal clothing would get covered in aluminum powder. In the early years, foremen or mine managers with varying levels of training in its dispersion administered the powder. Some waited until miners were already in the room before releasing the powder, meaning that the men watched the black jet of aluminum as it emerged from the nozzle. Under the circumstances, it is unsurprising that miners often left windows and doors open or left the treatment chamber before their prescribed ten minutes had elapsed.⁵¹ The foundation tried a number of different tactics to make the process more palatable to miners, including one attempt to make a cleaner looking white powder, a newsletter series, and surprise inspections at the mines themselves. In the 1950s, doctors even proposed painting the change rooms grey so that the black powder would not show up so starkly on the interior walls.⁵² Despite these efforts, few miners warmed to McIntyre Powder and treatment procedures remained difficult to control. This was especially true outside of Canada, where the foundation was limited to occasional visits and educational campaigns.

Perhaps the most important means by which the MRF built a firewall against its critics was through the ongoing production of “in-house” scientific research. Through mostly internal publications, the MRF repeatedly asserted that decades of practical experience with aluminum powder meant that their product was safe and effective. The weight of scientific evidence, it insisted, was on their side. In 1949 the MRF held its first conference on silicosis prevention, an annual event that became the main staging ground for the renewal of faith in what had become the gospel of aluminum therapy. The conference featured a nearly endless stream of papers, many of which amounted to nothing more than cheerleading.

50 Robson to Irwin, 30 March 1950, file 4, container B244379, series F 1352–3, AO.

51 J.P. Bickell, “Inspections,” 22 March 1946, McIntyre Research Foundation, Third Annual Report for the Fiscal Year Ended December 31, 1945, Financial Statements, file 2, container B244379, series F 1352–3, AO; Report of Dr. Robson’s Visit to the Mines of Western Australia, 5 April – 21 April, 1956, file 9, container 244380, series F 1352–3, AO.

52 Minutes of the Meeting of the Technical Committee,” 15–16 April 1952, file 5, container 244379, series F1352–3, AO.

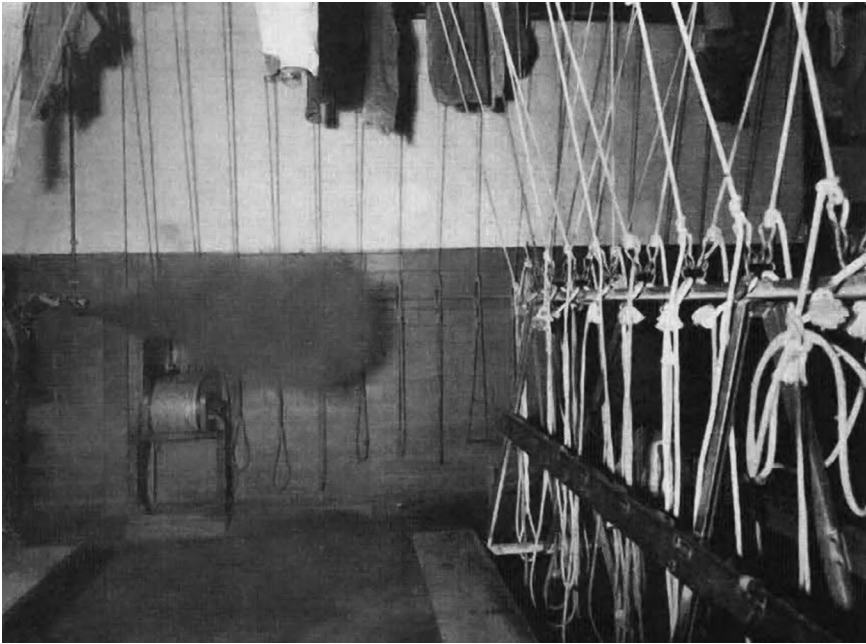


FIGURE 2 “Dispersal of McIntyre Powder in change room.” *Transactions*, Volume XLVII, 1944, pp. 185–202. Reprinted with permission of the Canadian Institute of Mining, Metallurgy and Petroleum

Often penned by company managers or executives, these papers relied mostly on the anecdotes about the spectacular knock-down effects of aluminum powder on once-rampant silicosis in individual mines and factories. Some work presented at the conference was more substantive. At the 1958 conference, for instance, Dr. Schepers responded to ongoing safety concerns with a paper arguing that aluminum hydrate might cause tissue damage in the lung, but other forms of aluminum, particularly the aluminum oxide that formed McIntyre Powder, remained safe.⁵³ Another internal paper, Angus Campbell’s major statistical study published in 1962 (one that Irwin declared a “landmark” in the foreword), purportedly proved that the sharp drop in silicosis among Ontario miners after 1944 was largely due to the introduction of aluminum therapy.⁵⁴ Although much of this work was conducted by industry insiders with direct ties to the foundation (Campbell, for instance, was an engineer at McIntyre Mine) and thus did not pass through the rigours of independent peer review, it did allow the MRF to claim it had done its due diligence on the issue of aluminum’s safety and effectiveness despite the persistent criticisms of the program.

53 G.H. Schepers, “The Antidotal Capacity of Aluminum against the Histotoxic Action of Quartz,” 9th conference of the McIntyre Research Foundation, 27–29 January 1958, container 5, series F 4170–3, AO.

54 Angus Campbell, “Trends in the Development of Silicosis in Ontario Miners and Aluminum as a Factor in Prevention,” presentation to the Chairman and Directors of the MRF, December 1961, file 10, container B244380, series F-1352–3, AO.

If the MRF's stubborn rejection of critics could be attributed to a legitimate debate among scientists, its overt rejection of working people's objections to aluminum therapy more clearly reflected a clear political alliance with the interests of industrial managers. The first records of union objections to aluminum therapy in North America date to 1954, when the United Steelworkers of America (USWA) at the Jessop Steel Company in Pennsylvania and the International Union of Mine, Mill and Smelter Workers (IUMMSW) at the Anaconda Mine in Butte, Montana, raised opposition to the program. The USWA raised similar complaints in Canada in the same year when its representative in the Porcupine Mine, Mr. Behie, "violently objected" to aluminum therapy. Angus Campbell dismissed the criticism as a ploy by the unions to obtain grants from the Ontario Compensation Board to promote safety and to maximize compensation claims for silicosis from miners who had other lung conditions.⁵⁵ Faced with such indifference, the labour movement nevertheless continued to fight aluminum therapy. In 1958 the Canadian Labour Congress called for the elimination of aluminum therapy at its annual convention, arguing that the key to controlling silicosis in Canadian gold mines was to improve the insufficient ventilation and dust control programs.⁵⁶ The president of the MRF, William Dix, responded with the claim that the USWA, in particular, was using aluminum therapy as a "wedge issue" to press other demands, and that "we should feed proper and authoritative material ... so that criticism against aluminum therapy can be promptly dealt with."⁵⁷

The MRF occasionally went beyond mere rhetorical responses to its critics in the labour movement. In 1966, the MRF lent its full support to the management of the Molybdenite Corporation of Canada at the Val d'Or, Quebec mine, providing expert witnesses for an arbitration proceeding with the USWA over the issue of aluminum powder. The union eventually dropped its grievance, but management also refused to renew its licence for aluminum powder based on S. Grassmuck's survey of recent medical literature on aluminum exposure. The MRF produced a vigorous rebuttal to Grassmuck's report, continued with its dismissive attitude to union concerns, and considered hiring a public relations firm to deal with similar incidents.⁵⁸ In 1968 the MRF worked closely with management

55 A. Campbell to Officers of the Technical Committee, McIntyre Research Foundation, 27 July 1955, file 8, container B244380, series F 1352-3, AO.

56 Memo from W. Geldard, 14 May 1958, file 9, container B244380, series F 1352-3, AO.

57 Dix to Hannon, 16 May 1958, file 9, container B244380, series F 1352-3, AO.

58 For the rebuttal, see MRF President's Report for 1966, container 8, series F 4170-5, AO, and Dudley Irwin, "Comments on the Grassmuck Report," no date, container 7, series F 4170-4, AO. For the original reports, see S. Grassmuck "McIntyre Powder Prophylactics: A Report on Recent Medical Findings to the Occupational Health Committee of the Quebec Metal Mines Accident Prevention Association" at the meeting on 14 December, 1966 at the Chateau Champlain, Quebec City, container 6, series F 4170-3, AO. On refusal to renew licences see J. Bonneville, Manager, East Sullivan Mine, to Roger Bédard, USWA, 29 July 1965, container 6, series F 4170-6, AO. The discussion of hiring a public relations firm occurred at the Director's Meeting for the McIntyre Research Foundation, 31 May 1967, container 13, series F 4170-10, AO.

at the Pamour Mine in Timmins, distributing literature to counter union objections to the use of aluminum powder.⁵⁹ In every case where organized labour raised concerns about the use of aluminum powder, the MRF adopted the paternalistic stance that an education blitz, rather than serious engagement with the workers' concerns, would quash the supposedly ignorant perspective of the unions. In part, the MRF's hostility towards organized labour can be explained by the fact its executive was dominated by management perspectives, but as the Molybdenite Corporation case suggests, unions represented a more direct threat to aluminum therapy programs because, unlike dissenting scientists, they had the power to remove treatments from the workplace through the grievance and collective bargaining processes.

Perhaps the most overt way the MRF furthered management's interests was to frame aluminum therapy as a means to avoid stricter dust control standards and entrench voluntary company measures as the primary approach to silicosis prevention.⁶⁰ The issue is complicated, because the MRF consistently emphasized that aluminum therapy was not meant as a substitute for suitable medical screening and effective dust control measures. The MRF went so far as to use its patent on aluminum powder as a means to prevent the manufacture of knock-off therapies, and then used its monopoly position to insist that appropriate dust control measures be in place before approving shipments of aluminum powder. However, the MRF never defined an acceptable air quality standard for silica dust. As long as companies made some kind of effort to control dust, the MRF allowed them to use aluminum powder as an extra layer of protection against whatever level of silica particle remained in the workplace environment. In 1955, the USWA in the Porcupine region went so far as to declare that management used aluminum therapy as a direct substitute for adequate dust control and ventilation. The MRF countered that it would not distribute its powder to "dust control laggards" and that the unions were raising the issue just to get grant money for safety and to increase compensation claims. Yet, the MRF never developed a precise definition of a "laggard" company or a means to enforce standards for adequate air quality in the workplace.⁶¹ Indeed, the MRF later revealed its true colours when it actively opposed the introduction of a threshold limit value for silica dust in Ontario, part of the package of reforms the Ontario government had introduced in its proposed Act Respecting the Occupational Health and Occupational Safety of Workers in 1977. The foundation argued that "enforceable standards involve decisions of acceptable risk and are limited by available knowledge and economic benefits. It is to be hoped that until a proper basis is established for regulatory standards threshold exposure limits be continued as guidelines or

59 T. Newkirk, Technical Advisor, MRF, to D.A. Irwin, President, MRF, 5 September 1968, container 8, series F4170-6, AO.

60 See Hogaboam, "Silicosis on the Ontario Hardrock Mining Industry, 1921-1975," and Penrose, "So Now They Have Some Human Guinea Pigs."

61 The USWA objections and the response are recorded in a letter from A.J. Campbell to the MRF's Technical Committee, file 8, container B244380, Series F 1352-3, AO.

objectives.”⁶² For the mining executives at the helm of the MRF, companies only had to do the best they could to control dust rather than achieve a basic standard for dust-free air. Aluminum powder could take care of whatever residual hazardous material remained.

FOUNDATIONAL COLLAPSE: THE END OF ALUMINUM THERAPY

Despite the MRF's firm defence of its activities, by the 1970s the wheels had begun to fall off the aluminum therapy program. In 1969, silicosis statistics from the uranium mines at Elliot Lake provided the first serious blow to the aluminum orthodoxy. Operating with minimal health and safety standards since the uranium boom of the 1950s, silicosis rates remained high at Elliot Lake irrespective of the existing aluminum therapy program (though MRF president W.B. Dix argued that most of the cases had resulted from exposure in coal and gold mines prior to work in the Elliot Lake's mines).⁶³ While MRF officials argued for increased applications of aluminum, silicosis rates only dropped as the Elliot Lake mining companies, Rio Algom and Denison, took steps to mitigate underground dust beginning in 1969.⁶⁴ A second blow came in 1971 when the United States Food and Drug Administration revoked approval for aluminum therapy based on lack of evidence of its effectiveness. As a result, mining companies from around the world began to cancel their licences for McIntyre Powder.⁶⁵ It was probably clear to all but the most dedicated MRF insiders that the glory days of the aluminum powder program had come to an end.

In 1979, a mix of negative media attention and regulatory changes drove the final nails into aluminum powder's coffin. On 17 September, Paul Falkowski, coordinator of occupational health and safety for the USWA – already a public figure due to his activism on the problems in the Elliot Lake mines – wrote to the Ontario minister of labour, Robert Elgie, asking him to put a stop to aluminum therapy in Ontario mines.⁶⁶ The next day, the Canadian Broadcasting

62 McIntyre Research Foundation Annual Report for 1977, container 8, series F 4170–6, AO. The lobbying effort continued into 1978 as the MRF “cautioned against setting a legislative standard” for silica dust. McIntyre Research Foundation Annual Report for 1978, container 8, series F 4170–6, AO.

63 W.B. Dix, “Silicosis Cases in the Ontario Uranium Industry to December 31, 1969, With Particular Reference to the use of Aluminum Prophylaxis,” November 1970, container 7, series F 4170–4, AO. The annual report for 1970 states that eighty percent of cases at Elliot Lake had received fifty percent of their exposure without aluminum therapy, and that the “few” cases that developed at the mines using aluminum suggested the therapy was still valuable. McIntyre Research Foundation Annual Report, 1970, container 8, series F 4170–6, AO.

64 Tataryn, *Dying for a Living*. For an overview, see Laurel Sefton MacDowell, “The Elliot Lake Uranium Miners’ Battle to Gain Occupational Health and Safety Improvements, 1950–80,” *Labour/Le Travail* 69 (Spring 2012): 91–118.

65 MRF, Minutes, Directors Meeting, 17 June 1971, file 12.2, container B244381 series F 1352–3, AO.

66 Falkowski to Elgie, 17 September 1979. AO, container 10, series F 4170–8, AO.

Corporation's flagship investigative journalism show, the *Fifth Estate*, aired a program that was highly critical of aluminum therapy. President W.B. Dix knew that his interview with reporters for the program would not bode well for McIntyre Powder. "While the facts were stressed," he wrote to foundation members, "these taped and 'put-together' shows usually air ... only those parts which ... benefit their objective."⁶⁷ On the same day the *Fifth Estate* episode aired, the *Toronto Star* newspaper ran a feature article by industrial health crusader Lloyd Tataryn (also a writer for the *Fifth Estate*) entitled "Some Miners are Dying for a Living."⁶⁸

As the media storm mounted, the Ontario Ministry of Labour suspended the use of aluminum powder pending several investigations. In October 1979, Dr. Murray Finkelstein produced a review for the ministry concluding that, even if aluminum appeared not to have "marked lung toxicity ... there are not rigorously performed studies of aluminum prophylaxis, and so we have no knowledge of its benefit in human prophylaxis." Finkelstein also raised the possibility that aluminum might be a neurotoxin, citing evidence of a "dialysis dementia" that had developed among kidney patients exposed to high levels of aluminum in their dialysis fluid (this is now known to be a different disease). Although Finkelstein argued that aluminum powder levels in industrial settings were too low to have a neurotoxicological effect, he suggested that workers be given an informed choice about whether to submit to the treatment. He further called for brain tissue to be collected during autopsies of aluminum prophylaxis recipients, as "this would shed light on the question of aluminum kinetics and allow a re-analysis of the benefit-harm equation."⁶⁹ In January 1980, a scientific task force that the minister of labour had assigned to examine aluminum prophylaxis similarly concluded that "there is as yet no acceptable evidence of physical benefit for aluminum powder as a therapeutic agent in humans." Even though the task force dismissed the long list of scientific studies suggesting the possibility of harm associated with aluminum therapy (including the possibility of neurological disorders, a possibility the task force dismissed as speculative), it concluded that there was no scientific basis to recommend continuing with aluminum treatment in Ontario industries. The task force did not, however, rule out the possibility of reviving aluminum if further epidemiological studies demonstrated its value as a prophylactic.⁷⁰ Finally, in January 1980 Ontario's Advisory Council on Occupational Health and Occupational Safety concluded

- 67 Dix to members of the MRF, 11 September 1979, container 10, series F 4170–8, AO. The original *Fifth Estate* report can be viewed at: <https://youtu.be/R1-fsm3GAK0>.
- 68 Tataryn, "Some Miners are Dying for a Living," *Toronto Star*, 18 September 1979, A10. See also Ross Howard, "Miners Dosed with 'Danger Dust' for 30 Years," *Toronto Star*, 18 September 1979, A10.
- 69 Murray Finkelstein, "A Review of Aluminum Prophylaxis for Silicosis," 18 October 1979, container 11, series F 4170–9, AO.
- 70 M. Gent, C. Gray, and D. Hewitt, "Report on Findings Concerning the Effects of Aluminum Prophylaxis," 11 January 1980, container 11, series F 4170–9, AO.

that aluminum powder should be regulated as a drug and, given the known and unknown risks involved, it should not be administered without the informed consent of workers. If the latter report was somewhat weak in its recommendations, the combined effect of the three reports signalled the death knell of aluminum therapy in Ontario and the other few remaining holdout mines and factories in North America.⁷¹

Dix continued to rebut aspects of the three reports and accentuate the task force's conclusions on the harmlessness of aluminum throughout the 1980s.⁷² Both of the other participants in the debate continued to press their objections, with Falkowski writing a long letter to Minister of Labour Robert Elgie criticizing the task force for omitting a large body of research on the harmful effects of aluminum powder.⁷³ Regardless, Elgie concluded that, given the possibility that aluminum powder might be considered a drug, the entire matter should be punted up to the federal Department of Health and Welfare for regulation under the Food and Drug Act. It is not entirely clear from the archival record what happened to this request, but some summaries of correspondence suggest the Department of Health simply let the issue die because no one made a formal application for approval of aluminum as a drug.⁷⁴

Around this time, somebody within the MRF began to deposit newspaper articles dealing with developments in the field of Alzheimer's research into its filing system, suggesting that the organization had begun to worry about the impacts of McIntyre Powder on the brain.⁷⁵ By 1985, the issue of aluminum powder's possible connection to Alzheimer's was front and centre in Ontario's legislature, with New Democratic Party member Elie Martel challenging the labour minister, Jim Gordon, to commission a study on the health impacts and effectiveness of aluminum powder. Gordon inquired about the issue with Jan Muller, who was then conducting research on the second part of his comprehensive study of the causes of death among Ontario miners. Muller replied that he could not comment on the issue of efficacy because the historical data contained no suitable control groups, and because mines had adopted aluminum simultaneously with dust mitigation measures.⁷⁶ In 1990, however, medical researcher Sandra Rifat's study of Ontario miners who had been subjected to McIntyre powder revealed no significant occurrence of neurological disorders

71 The report is sympathetic to the MRF, noting that "the practice [of aluminum therapy] was introduced at the time by reasonable men acting on the best information available in an attempt to prevent a disease perceived to be a scourge of the mining industry." Advisory Council on Occupational Health and Occupational Safety, "Policy and Principles for Using Prophylactic Agents in the Workplace and in Particular Aluminum Inhalation Therapy in the Ontario Mining Industry," 15 January 1980, container 10, series F 4170-8, AO.

72 Dix to Ministry of Labour, 21 January 1982, container 11, series F 4170-9, AO.

73 Falkowski to Elgie, 2 May 1980, container 11, series F 4170-9, AO.

74 Based on summary of correspondence 3 July 1981, box 817693, RG 7-190, AO.

75 See container 1, series F 4170-1 and container 11, series F4170-9, AO.

76 Based on summary of correspondence 6 February 1986, Box 817693, RG 7-190, AO.

among the test group, but significant impairment on cognitive tests “consistent with putative neurotoxicity of chronic aluminum exposure.”⁷⁷ That same year, Dix dismissed concerns about the impacts of aluminum on the neurological health of workers, writing to Ontario’s Industrial Disease Standards Panel with the suspect claim that “if ... the administration of McIntyre aluminum powder had in any way caused any detrimental tissue reaction of a neurological nature ... I would have heard about it.”⁷⁸ Nonetheless, the panel released a report in 1992 on the potential workplace dangers of aluminum, which suggested a possible link to neurological disorders such as Alzheimer’s, with a recommendation for more research.⁷⁹ Amid ongoing criticism, and as the Ontario government’s suspension of new orders for McIntyre Powder reached its twelfth year, the foundation, bereft of its *raison d’être*, voted to disband.⁸⁰

The precise health impacts of the half-century campaign to eradicate silicosis with aluminum powder remain unknown. The Ontario Workplace Safety and Insurance Board (formerly the Workmen’s Compensation Board) has never revised its 1993 position that there is no proven causal link between aluminum exposure and neurological disease. The issue might have faded into obscurity had it not been for the tireless efforts of Janice Martell, daughter of former uranium miner Jim Hobbs. After Hobbs was diagnosed with Parkinson’s disease in 2001, Martell began to research the historical record on aluminum prophylaxis and the possible links to neurotoxic health effects. In 2015 she started an organization, the McIntyre Powder Project, which is both an advocacy group and an online community that collects research material, and organized a registry of those exposed to aluminum powder. After the *Fifth Estate* followed up on the story in 2016, Martell was inundated with contacts from former miners.⁸¹ By November 2018, her voluntary registry had collected information from 500 former miners, of whom 317 had respiratory conditions or symptoms, fifty-eight had symptoms of neurological conditions, and ninety-nine had confirmed diagnoses of a neurological disease (forty-four with Parkinson’s, thirty-one with Alzheimer’s, seventeen with dementia, and seven with amyotrophic lateral sclerosis (ALS) also known as Lou Gehrig’s disease). These numbers are shocking, because normally Parkinson’s would only affect one percent of people

77 S. Rifat et al., “Effect of Exposure of Miners to Aluminum Powder,” *The Lancet* 336, no. 8724 (November 1990): 1162–1165. On the connections between aluminum and the brain, see Kilburn Kaye, “Does Exposure to Aluminum Affect the Brain,” *The Lancet* 374, no. 9190 (November 1999): 1575–1577, and Lucija Tomljenovic, “Aluminum and Alzheimer’s Disease: After a Century of Controversy, Is There a Plausible Link?” *Journal of Alzheimer’s Disease* 23, no. 4 (2011): 567–598.

78 Dix to Heller, Executive Administrator, Industrial Disease Standards Panel, 12 November 1990, container 9, series F 4170–7, AO.

79 Industrial Disease Standards Panel, Interim Report to the Workers’ Compensation Board on Aluminum, May 1992. <http://www.canoshweb.org/odp/html/may1992.htm>.

80 McIntyre Research Foundation Director’s Meeting, 18 July 1991, container 11, series F 4170–9, AO.

81 For the video, see https://youtu.be/pv2rrwf_wx8.

over sixty; and ALS only two out of every 100,000 people in the general population (Alzheimer's rates are much higher, impacting one in ten people over sixty-five).⁸² Martell's work on the registry has inspired further medical research on the links between aluminum powder and neurological disease at McMaster University. On 29 March 2019, she helped to organize the submission of ninety-two claims for compensation to the Ontario Workplace Safety and Insurance Board, with a promise of "more claims to come."⁸³

LESSONS FOR INDUSTRIAL HEALTH AND ENVIRONMENTAL HISTORY

It is clear that controversy, accusations of wrongdoing, and collapse were not among the outcomes the founders of the MRF had envisioned. One could, perhaps, find some sympathy for key figures such as Dix and Irwin as they witnessed a good portion of their life's work unravel by the late 1970s. Yet the history of the MRF suggests that its progenitors did not merely make an honest scientific mistake with aluminum powder. Rather, the MRF's attachment to industry, its need for demonstrable successes, and its defensiveness functioned to silence legitimate criticisms and prevent independent research. The paternalism of the MRF forced mine workers to breathe in a foreign substance on a daily basis with little evidence as to its harmlessness or efficacy.⁸⁴ The irony of using a dust to retard the pathological effects of another dust remained lost on the MRF; the unknown risk was a price worth paying to reduce the human and financial costs associated with silicosis. Convinced of the infallibility of their own position, the foundation wrapped McIntyre Powder in an edifice of what seemed from the inside to be unassailable scientific truth. To the extent they did establish proof of harmlessness (a feature of the program that remained in doubt almost the whole time it operated), McIntyre's researchers focused

82 See McIntyre Powder Project at <http://www.mcintyrepowderproject.com/>.

83 See the 1 April 2019 post on the McIntyre Powder Project Facebook page <https://www.facebook.com/mcintyrepowderproject/>. Some preliminary work on the particle size of McIntyre Powder (inspired by Martell's group) has indicated it is possible that aluminum was transported to the brain of treated miners. See Andrew Zarnke, Pat E. Rasmussen, Marie-Odile David, Housam Eidi, Konnor Kennedy, Kevin Hedges, Todd Irick, Christopher Thome, Jake Pirkkanen, and Douglas Boreham, "Physical and Chemical Characterization of McIntyre Powder: An Aluminum Dust Inhaled by Miners to Combat Silicosis," *Journal of Occupational and Environmental Hygiene* 16, no. 11 (2019): 745–756.

84 More recent research suggests aluminum has little effect on silicosis. See Susan Peters, Alison Reid, Lin Fritzsche et al., "Long-term Effects of Aluminum Dust Inhalation," *Occupational and Environmental Medicine* 70, no. 12 (December 2013): 864–868. A study of the impact of aluminum aerosols on sheep exposed to silica suggested no therapeutic effect after three years of exposure (with caveats related to the timing of the treatment). Raymond Bégin, Serge Massé, and André Dufresne, "Further Information on Aluminum Inhalation and Silicosis," *Occupational and Environmental Medicine* 52, no. 11 (1995): 778–80.



FIGURE 3 “Opened Canister of McIntyre Powder,” Timmins Museum.
Photograph courtesy of Janice Martell.

narrowly on possible lung impacts, even after the evidence of aluminum’s neurotoxicity began to appear in the medical literature. Although the scientific authority ascribed to aluminum powder diminished over time, the MRF’s disregard for the health impacts of aluminum on workers’ bodies suggests a story of wilful industrial pollution rather than benevolent public health. Just as industrialists and governments minimized the danger to workers of substances such as asbestos, arsenic, cadmium, and uranium dust, so too were they willing to expose the bodies of workers to aluminum without adequate consideration of the health risks.⁸⁵ The fact that aluminum was intended as a cure for the health impacts of another dust may add a layer of irony to the story, but does not diminish the fact that industrial hygienists inflicted on workers a slow-acting health hazard, all

85 For environmental histories of these workplace exposures to health hazards, see Van Horssen, *A Town Called Asbestos*; Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade* (Cambridge: MIT Press, 2012); Brett Walker, *Toxic Archipelago: A History of Industrial Disease in Japan* (Seattle: University of Washington Press, 2010), and John Sandlos and Arn Keeling, “Toxic Legacies, Slow Violence and Environmental Injustice at Giant Mine, Northwest Territories,” *The Northern Review* 42 (2016): 7–21.

the while displaying contempt for the environmental and health concerns workers raised about the aluminum dust entering their bodies on a daily basis.

The deepest irony of the McIntyre powder program is that efforts to control dust in industrial environments had more than likely established an effective check on silicosis, rendering the effort to control workers' bodies unnecessary. In workplaces where dusty conditions persisted, more investment in ventilation and dust control methods would have provided a much more certain method of controlling silicosis than aluminum powder. Coincident with its adoption of aluminum powder as a preventative treatment for silicosis, the Canadian mining industry, working under the auspices of the MRF, reinforced its power over workers, denying them the right to informed consent as they exposed them to a form of industrial pollution that carried dire consequences for their future. McIntyre Powder's endurance in the face of shaky scientific evidence speaks to the mining companies' assumption of control over workers' bodies, exposing them to a counterfeit cure without considering the risk of a new airborne hazard in the workplace environment.

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