

Trading One Risk for Another: Consequences of the Unauthenticated Treatment and Prevention of Silicosis in Ontario Miners in the McIntyre Powder Aluminum Inhalation Program

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Abstract

From 1943 to 1979, miners and factory workers in more than two hundred work sites globally were subjected to mandatory medical treatments by their employers as an unproven, and ultimately ineffective, treatment to prevent the lung disease silicosis. The treatments involved inhaling finely ground aluminum dust known as McIntyre Powder, blown into miners' change rooms each shift using compressed air systems. Tens of thousands of industrial laborers were exposed to McIntyre Powder, yet their story is scarcely known, and the possible health impacts of their aluminum treatments were rarely studied. This paper integrates the history of the aluminum prophylaxis program and its control by the northern Ontario mining industry with the lived experience of one of the affected miners, whose daughter created a voluntary registry which documents health issues in exposed miners, and stimulated research that found a link to her father's Parkinson disease.

Keywords

aluminum, occupational disease, occupational hygiene, McIntyre Powder, Parkinson's, silicosis

Introduction

Jim Hobbs was thirty-seven years old the first time that he tasted aluminum dust. It was March 1978, and it was his first day going underground at Rio Algom's Quirke 2 uranium mine in Elliot Lake, Ontario, Canada. After changing from street clothes into his mining gear, Hobbs followed the other miners into a tunnel-like building that led to the cage that would transport them underground for their eight-hour shift of drilling, mucking, and blasting. The building—dubbed the 'gas chamber' by those who entered it—was lined with benches, and Hobbs followed the routine of the others, taking a seat and waiting for the cage call. Before that call came, and after the last man entered the building, the doors shut at both ends, the ventilation fans stopped, and the supervisor yelled what would become a familiar phrase in a surreal ritual that Hobbs would experience prior to every shift for the next year and a half: 'Breathe deep, boys!' The hiss of compressed air lines was quickly followed by a cloud of black dust filling the room, obscuring Hobbs' vision of all that surrounded him as he took

his first breaths of very finely ground aluminum powder swirling rapidly from punctured canisters attached to the air lines. His chest felt heavy, his exposed skin and clothes were blackened, a metallic taste formed in his mouth, and he soon joined the choir of coughing and gasping arising from the others. After ten minutes, the doors opened and Hobbs and his shift partners were herded into the cage. His first industrial medical treatment was over.

This is the story of a human health intervention in the form of an unproven, invasive, and dangerous treatment that was coerced, controlled, and disseminated worldwide by the northern Ontario mining industry in Canada for nearly forty years in the absence of workers' informed consent and under threat of job loss.^{1–13,a}

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The program was designed for the purpose of saving the industry compensation costs for the lung disease silicosis.¹⁵⁻¹⁷ The intervention involved inhalation of very fine aluminum powder as a prophylaxis (preventive measure) against the serious lung disease silicosis.¹⁸ Ultimately, it was given to tens of thousands of workers in at least two hundred workplaces worldwide (Canada, United States, Western Australia, Mexico, England, Belgian Congo, Chile) in mining and silica dust-producing industries.¹⁹⁻²²

However, this is also the story of the years-long mapping and mobilizing effort to document health outcomes in miners who were historically subjected to nonconsensual inhalation of finely-ground aluminum, known as McIntyre Powder (MP) after its manufacturer. That effort, known as the McIntyre Powder Project (MPP) and led by the daughter of Jim Hobbs more than three decades after the last aluminum dispersal, was driven by a deep-seated desire to know whether Hobbs' Parkinson diagnosis was connected to inhaling a neurotoxin in the form of MP and, more broadly, to combat the appalling lack of official long-term follow-up to monitor the health and well-being of all of the workers who were subjected to aluminum dust treatments.

The largest cohort of MP-exposed workers (over twenty-seven thousand) was found in the gold mining camps of northern Ontario, Canada (primarily Timmins, Kirkland Lake, and Red Lake), and the former uranium mines in Elliot Lake.²³ This is their story, as told through the impact on the life of one miner, woven into the history and legacy of industrial power and governmental acquiescence that is still unfolding today in the lives and deaths of thousands of Jim Hobbs' mining brothers.

History

Silicosis, McIntyre Research Limited, and Animal Experiments

In the early 20th century, rapid industrialization, expansion of the mining industry in Ontario, as elsewhere, and technical changes in mining equipment led to higher silica-containing rock dust concentrations in the atmosphere of mines with increased exposure of miners underground.²⁴ Silicosis is a silica-dust disease of the lung characterized by irreversible scarring and compromised respiratory function that, as it progresses from the simple stage, interferes with breathing and air exchange. The disease has several forms and stages. In the advanced, chronic nodular stage, it can be disabling or fatal. Silicosis also predisposes to tuberculosis and other infections, which are still present globally among miners. There are other silica-related diseases, but these three forms of silicosis were the ones that were known at the time. They were becoming much more common and severe when they occurred.

In 1926, silicosis became a compensable industrial disease in Ontario under the Workmen's Compensation Act.²⁵ The highest silicosis rates at that time were found in the Porcupine mining camps in the Timmins area, prompting mine management at McIntyre Porcupine Mines to investigate a means of addressing the silicosis hazard.²⁶ In the 1930s, the mine's metallurgist (James J. Denny) and physician (Wilmot D. Robson), with laboratory support from the Banting Institute of the University of Toronto, conducted animal experiments with fifty guinea pigs and thirteen rabbits involving inhalation of quartz (pure silica) dust with or without the addition of aluminum dust.²⁷ The theory was that, by coating the surface of crystalline silica particles and reducing the surface properties that made them toxic, the aluminum dust would prevent fibrosis of the lung. Denny and Robson published their final results in 1939 and, with McIntyre Porcupine Mines, patented their aluminum therapy product known as MP on 2 May 1939 and formed the company McIntyre Research Limited on 22 November 1939.^{18,28,29} Uncontrolled clinical trials commenced soon after with Timmins-area miners.

McIntyre Research Foundation and Human Experiments

Jim Hobbs was born on the family farm in Massey, Ontario, in 1940, the same year that human aluminum dust inhalation trials began at the Porcupine Clinic for Silicosis Research (Porcupine Silicosis Clinic) at St. Mary's Hospital in Timmins, funded by Ontario Mining Association mines in the Porcupine mining camp.³⁰ With the assistance of the Ontario Workmen's Compensation Board, chest X-rays identifying silicotic and exposed but pre-silicotic miners were compiled to comprise a candidate pool of subjects for testing MP aluminum dust inhalation as both a medical treatment for established silicosis and a preventive medical intervention (prophylaxis) to protect miners.³¹ Two physicians, one from the Workmen's Compensation Board and one from Hollinger Mine, helped to select the treatment candidates, and between 1940 and 1943, clinical trials on forty-seven miners were conducted under the direction of Dr. D.W. Crombie of the Queen Alexandra Sanitorium in London, Ontario, and assisted by technicians and pathologist Dr. James Blaisdell.^{31,32}

On 22 July 1941, a contingent of industry and governmental leaders from the United States visited the Porcupine Silicosis Clinic for a tour and meetings with clinic staff and McIntyre Porcupine Mines executives to discuss the initial results of human MP experiments.³³ The U.S. contingent was comprised of the assistant medical director of Metropolitan Life (Dr. Anthony Lanza), the director of research from the Aluminum Company of

America (Dr. Francis Frary), a U.S. Bureau of Mines representative (Dr. Helmuth Herman Schrenk), the medical director of the Saranac Lake Sanatorium (Dr. Leroy Gardner), a representative from the U.S. Public Health Services (Dr. Neil), and a University of Colorado professor of medicine (Dr. D. Cummings), who previously assisted Dr. Gardner at the Saranac Lake Laboratory, which was a center of research on silicosis.³³ After studying the results of ten silicotic miners from the initial MP research trials during these meetings, two distinct patterns of silicotic nodules were found—"bee-bee shot" (now known as "simple silicosis" or "chronic nodular silicosis") and "snowflake" appearance (where the nodules coalesce on the X-ray, now known as "complicated silicosis" and often associated with large fibrotic masses). The conclusions and recommendations of this Canadian-American industrial-governmental meeting were summarized by Dr. Robson in a 29 July 1941 letter to Balmer Neilly, assistant to the president of McIntyre Porcupine Mines:

The conclusion was arrived at that by careful study of the X-ray films of each individual case it could be ascertained whether a particular man would respond to the treatment by aluminum therapy or not, i.e. it was felt that those cases showing a fuzzy snowflake appearance would respond much more rapidly than one with bee-bee shot appearance with clear-cut outline of the nodules.

... It was agreed that this clinic should carry on with the rigid selection of cases for treatment due to the fact that if one case went bad, whether it was due to aluminum treatment or not, the method would be discredited.

... The group were unanimous in the conclusion that the treatment of the ten cases presented had shown remarkable results and that it was only necessary to treat more cases before the treatment of silicotics by the inhalation of aluminum powder would be accepted without question.³³

Whether the men chosen for research trials of MP treatment accepted it understanding that it was experimental or even submitted voluntarily is unclear. McIntyre-Porcupine Mines officials clearly considered the possibility of harm being caused by MP treatments. They were concerned enough to decide against supplying each subject with a letter that, in draft, would have committed the company to assuming "all responsibility for any claims or injuries suffered or arising out of this aluminum powder treatment that are not compensable under the terms of the Compensation Act."³⁴ Concerned that such a letter was a written commitment that could result in the mines being "responsible for disability as long as the man lives," the general manager of McIntyre

Porcupine Mines instead gave the research subjects "my verbal assurance that they will be taken care of" in the event that the MP treatments caused harm not covered by Workmen's Compensation.³⁵

Given that Porcupine-area mines funded the original human trials of MP inhalation and that the adoption of MP prophylaxis would relieve the mines of this financial burden (and quite possibly relieve them of legal liability), there was no doubt some economic pressure and a vested interest to produce timely—and arguably favorable—results. Evidence of this is perhaps best summed up in a 1942 report from the Porcupine Silicosis Clinic to the Chairman of the Silicosis Research Committee (who was also the general manager of McIntyre-Porcupine Mines):

... the mining industry in the Porcupine Camp faces a very grave potential liability which hitherto has not been fully appreciated or recognized. It is in this large group of 250 cases that we believe aluminum will prove of greatest value and gives promise of saving the industry large sums of money that otherwise would be expended in compensation.¹⁵

This same sentiment was reiterated a few months later during a meeting of mining executives in Timmins, Ontario:

... aluminum therapy must be increased as it was the answer to the alarming increase in the number of silicotics and if the number was not drastically decreased the industry would be saddled with an almost impossible burden.¹⁶

It is worth noting that during the same time period that the Porcupine Silicosis Clinic was operating (early 1940s), similar experiments were being conducted in the United States by industry doctor J.W.G. (Guy) Hannon with ceramic and foundry workers.³⁶ Hannon later became the medical director of the McIntyre Research Foundation (MRF).²⁹ The foundation's original incarnation was the previously mentioned for-profit entity McIntyre Research Limited, formed by Denny and Robson to manage their proprietary interest in MP. In response to industry hesitancy to adopt the use of MP aluminum prophylaxis based on concerns over profit motives, McIntyre Research Limited dissolved in December 1946, and the nonprofit MRF was formed as the controlling body to oversee the development, distribution, promotion, and licensing of MP to industrial licensees for use as a medical prophylactic treatment with their workers.²⁹ From its inception and throughout its existence, the MRF was synonymous with the northern Ontario mining industry. Its original Board of Directors was comprised of the president, vice-president, general manager, and mine physician of

McIntyre-Porcupine Mines Ltd. (J.P. Bickell, Balmer Neilly, Richard J. Ennis, and W.D. Robson, respectively), pathologist Dr. Dudley Irwin from the Banting Institute (who later became the medical director of the Aluminum Company of America), and Dr. Hannon.^{29,30}

Controlling the directorship of the MRF enabled the northern Ontario mining industry to control the narrative on MP for decades. That narrative was insular and perpetually recycled in official MRF communications: MP aluminum prophylaxis is harmless and effective.^{6,21,30,37,38} Counternarratives presented by labor unions or contrary evidence presented by the scientific community were met with rigid defense of the official MRF stance.^{5,39,40} That pervasive control by the MRF, combined with a lack of governmental regulatory oversight, enabled the northern Ontario mining industry to subject its labor force to nonconsensual use of an unproven medical treatment for more than thirty-six years. External researchers who sought to conduct independent experiments using MP were contractually bound to have their research vetted and approved by the MRF prior to publication.⁴¹

Red Flags and Delayed Action

There were many checkpoints in the story of MP that ought to have thrown the handbrake to stop the uncritical dissemination of aluminum prophylaxis. In 1945, Dr. Robson presented a brief to the Premier of Ontario regarding the use of MP, seeking access to statistical information to enable analysis of the efficacy of ongoing aluminum prophylaxis in preventing silicosis.³⁰ That access was eventually granted, allowing the MRF to also control how silicosis statistics were presented and interpreted—which was generally accomplished by the MRF explaining away new cases of silicosis found in Ontario miners as being unrelated to Ontario mine dust exposure.⁴² In 1946, the American Medical Association published a statement recommending “that the general application of aluminum therapy in industry be delayed until adequately and impartially controlled clinical observation demonstrates its effectiveness in preventing or alleviating silicosis in man.”⁴³ In 1948, Berry provided the first aluminum inhalation study to use a control group, which confirmed the placebo effect.⁴⁴ At the Third International Conference of Experts on Pneumonokoniosis [sic] in 1950, no conclusive evidence was found that aluminum prophylaxis prevented silicosis, and some concern was noted for the possibility of harm.⁴⁵ In 1956, the British Medical Research Council recommended against the use of aluminum powder in the treatment and prevention of silicosis.⁴⁶

If any of the many checkpoints in the MP treatment program had been heeded and acted upon by the Ontario or Canadian governments, Jim Hobbs would

never have known the taste of aluminum dust. He would never have been exposed. He may have lived in better health for many years. Hobbs began mining in the nickel and copper mines in Sudbury, Ontario, in 1959 at the age of 19, having already been working for three years to support his parents and siblings. His father had been disabled in an industrial accident in 1955, and Jim was the eldest boy in a family that eventually grew to eleven children. Hobbs left mining for less dangerous employment the year his first child was born in 1962. He worked for twelve years as a foreman in a local dairy, before returning to mining at Crean Hill Mine in Sudbury in 1974. By then, he and his wife Elaine had four children, and he was determined that each of them would receive the education that he did not have the opportunity to complete; mining wages enabled him to do so. When uranium mining was booming and Rio Algom Quirke 2 was hiring en masse in 1978, Hobbs traded in nickel mining for the Elliot Lake uranium mines.

Between 1962 and 1973, the MRF documented seventy-three cases of silicosis found among Elliot Lake uranium miners, representing an alarming trend of increasing disease prevalence in the dusty and dangerous working conditions of early uranium mining in the Elliot Lake mining camps.^{42,47,48} In protest against these conditions, a wildcat strike by United Steelworkers members in April 1974 led to the formation of a *Royal Commission on the Health and Safety of Workers in Mines*, which resulted in Ontario's *Occupational Health and Safety Act*.⁴⁹ The MRF presented a brief to the commission regarding MP, and in the meantime, the practice continued unabated.⁶ It was only after the United Steelworkers engaged national media attention on the matter in a feature *Toronto Star* newspaper article and Canadian Broadcasting Corporation The Fifth Estate television broadcast in September 1979 that the Ontario Ministry of Labour (MOL) intervened, commissioning a scientific review that shut down the use of MP in Ontario mines in the ensuing months.^{50–52}

The MOL intervention was initially challenged by the mines—a 1980 letter from the President of Pamour Porcupine Mines to the Ontario Minister of Labour defiantly asserted that “The industry does not need, and does not seek ‘the statutory authority for compulsory use of prophylactic agents’,” which implied that the industry did not want authorization to use MP because this would bring the practice under regulation and such authorization could be withdrawn at any time in the future.⁵³ However, the MOL persisted and its scientific task force recommended the discontinuation of involuntary exposure to MP treatments. Not surprisingly, the practice did not survive the transition to voluntary exposure.

The role and standing in the industry of the MRF were vastly diminished following the discontinuation of MP inhalation in the mining industry in Ontario.

The MRF continued to operate until 1992, closing shortly after the release in *The Lancet* of a study by Rifat et al.⁵⁴ that found a statistically significant decline in cognitive functioning in Ontario miners who had been exposed to MP compared to MP-unexposed miners. The MOL commissioned a follow-up study which was actively campaigned against by the mining industry.^{55–57} In a letter penned to the MOL by Bruce Campbell of the Ontario Mining Association, the industry's motivation against further study of MP health effects is laid bare:

Of course we are concerned that some people can look on the study as an opportunity to qualify for workers' compensation benefits, the equivalent for a disabled person to winning the lottery.⁵⁷

When the MRF folded in 1992, they donated their records to the Archives of Ontario but placed a fifteen-year ban on public access to the records save for permission from Bruce Campbell.⁵⁸

Assessing the Impacts of MP Aluminum Prophylaxis

Initial Efforts and Roadblocks

For forty years following the discontinuation of MP prophylaxis, the Rifat studies represented the only Canadian effort to scientifically investigate the health outcomes of MP-exposed northern Ontario miners. A 2013 study by Peters et al. of Western Australian miners subjected to MP treatments found that MP exposure did not protect miners against developing silicosis and that it “may possibly increase the risk of cardiovascular disease and dementia of the Alzheimer's type.”⁵⁹ Compounding the absence of scientific research regarding MP and its potential health effects, a significant barrier to identifying possible MP-related neurological effects was erected in 1997 by the Ontario Workplace Safety and Insurance Board (WSIB—then known as the Workers' Compensation Board), in the form of a blanket policy that denied compensation claims for neurological disorders associated with occupational aluminum exposure.⁶⁰ The policy was developed by the WSIB in direct response to the successful appeal of an electrical worker's claim for cognitive impairment associated with occupational aluminum exposure.^{61,62} In the WSIB's 107-year history, this was its only negative or exclusionary entitlement policy.

MP Project

In 1990, Rio Algom closed Quirke 2 Mine and Jim Hobbs transitioned from mining to seasonal municipal and residential construction work. Late in the summer of 2000, he began experiencing resting tremors in his hand

and arm. Balance problems followed along with increased difficulty in doing familiar tasks and fine motor movements. By October, he could no longer work and applied for employment insurance benefits. He was referred to a neurologist specializing in movement disorders and in February 2001 was diagnosed with Parkinson disease at the age of 60. Hobbs had no family history of neurological issues or movement disorders and though the diagnosis was unexpected, he accepted it and initially responded well to medication to control his primary symptom of marked tremoring, which had progressed to both arms and legs. Being a proud man, he was very self-conscious of his tremoring and avoided public outings for fear that others would mistake his shaking and imbalance for that of a ‘drunk’.

In 2011, as a result of a casual conversation about his mining exposures, Hobbs disclosed to his family for the first time that he had been subjected to aluminum dust inhalation. He knew the term MP, but not much else about the reason why he had been given a medical treatment at work, other than he was told it would protect his lungs. Under the heading “Ventilation Procedures” in a Rio Algom Mines Limited *Underground Safety Rules* booklet that Hobbs had been issued upon hire, the first point reads:

Alluminum [sic] Prophylaxis Treatment: Men working underground and in the surface crushing plant should receive 3 to 4 minutes of aluminum [sic] therapy in the treatment rooms each shift.⁶³

No further explanation was offered or asked—like most miners, Hobbs was conditioned to accept what the company told him.

After ten years of dealing with Parkinson's, however, Hobbs was ready to question what the aluminum dust may have done to him, and in September 2011, he made a claim to the Ontario WSIB for Parkinson's related to MP exposure. His claim was denied, appealed, and denied again. The barrier posed by the WSIB's neurological disorders and occupational aluminum exposure policy was insurmountable for an individual claim to succeed. Hobbs consequently withdrew his claim in 2014, but at the request of his youngest daughter, he agreed to allow her to tell his story publicly in order to pursue justice, expose the history of MP usage, and seek answers on the potential health impacts on the workers who were subjected to MP treatments.

Following a year of research into MRF archival records and associated governmental and Ontario Mining Association records, the MPP was founded by Hobbs' daughter in 2015 to document health issues in MP-exposed miners and advocate for formal scientific research into potential links to neurological disorders or other health effects.⁶⁴

Using a self-reported voluntary registry, the MPP compiles information on miners who were exposed to MP inhalation. Affected miners registering with MPP, or their surviving next-of-kin, provide basic demographic information (name, gender, contact information, date of birth/death), mining work history, and health symptoms/diagnoses. Information is also gathered regarding workers' memories and experiences with MP inhalation and general working conditions, using semistructured interviews. Registration for the MPP voluntary registry is made in person, via email, phone, or online. Follow-up is conducted to verify aluminum dust exposure using historical MRF documents and individual mining work records. A variety of ongoing outreach efforts was commenced by the MPP in 2015 to inform and engage affected workers, mining families, advocates, and the general public regarding the history of MP prophylaxis and the work of the MPP in mapping the types of health issues found in MP-exposed workers.

MPP Voluntary Registry

The MPP voluntary registry is a grassroots mapping exercise to gather initial information about the types of health issues being reported among MP-exposed workers, with the objective of stimulating formal scientific research into the health effects of MP exposure, and secure compensation for workers where warranted by the weight of evidence. The registry is ongoing and dynamic, in that it remains open for new registrants and the information of existing registrants is updated

as workers or Estates provide information on new health diagnoses or deaths. Deaths are also verified using obituary notices. The summary that follows is a snapshot in time of the available registry information as of 28 April 2021, representing six years of data since the registry was established.

A total of 552 workers registered with the MPP between April 2015 and April 2021. Five are excluded from this summary; three due to no MP exposure further to follow-up verification and two due to not being a miner or mine worker (one U.S. factory worker, and one mine supply contractor). The remaining 547 workers are all male; 301 are alive and 246 are deceased, 47 of whom were alive at the time of registration and subsequently died. Year of birth is known for 527 registrants (96%) and year of death is known for 233 of the deceased registrants (95%). Year of birth ranges from 1876 to 1963. Year of death ranges from 1943 to 2021. It should be noted that the registrant who died in 1943 received his MP exposure in the original Porcupine Silicosis Clinic trials, as he was afflicted with silicosis. The next closest year of death among participants is 1952. Age at death ranges from forty-two to ninety-four years.

Reported health conditions among the registrants are broadly broken down in Tables 1 and 2 by category: respiratory, neurological, cancers, and cardiovascular. Workers often reported multiple symptoms and/or diagnoses such that one worker could have comorbid conditions within the same category (e.g. Parkinson's and dementia; chronic obstructive pulmonary disease and

Table 1. Workers With Reported Diagnosed Conditions or Symptoms ($n = 547$).

Health condition category	Workers with diagnoses (% of n)	Workers with symptoms (% of n)	Total (% of n)
Respiratory	174 (32%)	142 (26%)	316 (58%)
Neurological	110 (20%)	62 ^a (11%)	172 (31%)
Cancer	146 (27%)	N/A—not captured	146 (27%)
Cardiovascular	141 (26%)	N/A—not captured	141 (26%)

^aMemory loss was noted by 57 of the 62 workers reporting undiagnosed neurological symptoms.

Table 2. Types of Diagnosed Conditions Reported for Workers.

Respiratory		Neurological		Cancer	
COPD	91	Parkinson disease	54	Lung	65
Silicosis ^a	71	Alzheimer/dementia	54	Digestive system	28
Asthma	16	ALS	8	Prostate	23
Sarcoidosis ^a	10	Lewy body dementia	4	Bladder	10
Pulmonary fibrosis	5	Multiple sclerosis	2	Blood	10
		Progressive supranuclear palsy	1	Kidney	5
				Pancreatic	3
				Other	34

Note. COPD = chronic obstructive pulmonary disease; ALS = amyotrophic lateral sclerosis.

^aTwo workers were given provisional diagnoses of silicosis or sarcoidosis and are excluded from either category.

silicosis). Table 1 captures the number of workers with reported respiratory, neurological, cancerous, or cardiovascular conditions such that each worker is counted only once per category, irrespective of how many types of specific health conditions within that category the worker may have. Table 2 tallies the number of workers with specific diagnoses under respiratory, cancer, and neurological health categories such that every diagnosis is counted once for every worker diagnosed with it. Only primary cancers were counted in the breakdown of cancer by type.

Well over half (58%) of MPP voluntary registrants reported respiratory conditions or symptoms, but nearly half (45%) of those in the respiratory category did not have an established diagnosis. Similarly, one-third (33%) of registrants within the neurological category reported experiencing varying degrees of memory loss but had not yet pursued and/or been given an official diagnosis. Chronic obstructive pulmonary disease (ninety-one registrants) and silicosis (seventy-one registrants) comprised the bulk of diagnosed respiratory conditions, while Parkinson's and Alzheimer's disease or dementia (fifty-four registrants each) accounted for the vast majority of diagnosed neurological conditions. Notably, eight cases of amyotrophic lateral sclerosis were found among the 547 workers on the MPP registry. One-quarter of the registrants (27%) reported at least one primary cancer diagnosis, and one-quarter (26%) were diagnosed with cardiovascular conditions; twelve of those were high blood pressure only.

Research and Compensation

The efforts of the MPP and the story of Jim Hobbs and other affected miners were documented by The Fifth Estate on 29 January 2016 as a decades-later follow-up to their 1979 *Powder Keg* episode.⁶⁵ As a result of the questions raised in the broadcast and increased public scrutiny, the Ontario WSIB commissioned a review of the scientific literature surrounding aluminum and health.⁶⁶ The literature review report, conducted by Intrinsic and released in 2017, was inconclusive about the potential harm of occupational aluminum exposure but was widely interpreted (including by the WSIB) as ruling out an association.^{67,68} A gaps analysis and critical review of the Intrinsic report, conducted by Tee Guidotti and completed in 2019, narrowed its focus to three MP exposure-specific studies and concluded that the original 1990 Rifat study “strongly suggests a neurological effect consistent with dementia” and that the study had statistical power and should be given weight.⁶⁹

Guidotti's critical review was commissioned by the Occupational Health Clinics for Ontario Workers, Inc. (OHCOW), a nonprofit system of clinics that provides occupational health expertise services and supports to

workers in Ontario, Canada, including investigating the work-relatedness of injuries and diseases.⁷⁰ In 2016, OHCOW and the United Steelworkers District 6 held intake clinics in Timmins and Sudbury, Ontario, for MP-exposed workers or their Estates to register for inclusion in the MP cohort at OHCOW.⁷¹ The OHCOW MP cohort is largely drawn from the MPP voluntary registry, with an approximate two-thirds overlap in registrants. OHCOW provides individual medical and industrial hygiene reviews for workers in the MP cohort and investigates clusters of diseases found within the cohort; recent focus has been on a cluster of sarcoidosis cases and an ongoing investigation into cardiovascular issues, the latter prompted by published analyses of MP composition that found its particle size to be in the fine and ultrafine particulate range.^{72,73}

In October, 2017, the WSIB began including MP cumulative exposure estimates in its adjudication of chronic obstructive pulmonary disease workers' compensation claims, in recognition of the harmful contribution made by this additional dust burden in the lung.⁷⁴ However, the WSIB considers MP exposure on a time-weighted average over an eight-hour work shift, which belies its actual manner of distribution as an acute, high-intensity airborne exposure accomplished through puncturing canisters of MP attached to compressed airlines in miners' change rooms while miners change from street to work clothes each shift.² (Note: Rio Algom Quirke 2 Mine specially built a chamber for distribution of MP inhalation, such as Hobbs had experienced, but most other northern Ontario mines used their miners' change rooms for MP treatments). Figure 1 shows canisters of MP, labeled as a treatment for silicosis and cautioning “For use only under doctors [sic] direction.” (In practice, of course, there was no individualized supervision.)

On 24 May 2017, Jim Hobbs died alone on the floor of a nursing home. He had been hospitalized with lung issues the month prior and since then had lost his ability to support his own weight with his legs. For months prior to his death, he was up multiple times each night and needed twenty-four-hour care. His family had rallied around to support him and his wife, who had been his primary caregiver as Hobbs' Parkinson disease progressed to end stage. However, without the practical and financial supports available through WSIB, it quickly became unsustainable to safely keep Hobbs at home with informal supports. His one wish was to die in the home he had built and lived in since 1973, and his family was unable to give that to him. He spent a total of nine days in a nursing home before he died. An autopsy confirmed end-stage Parkinson's, the beginning of Alzheimer's, and chronic obstructive pulmonary disease.

In August 2017, the WSIB made two major public announcements regarding MP.⁷⁵ The first was that it



Figure 1. Canisters of McIntyre Powder.

had declared its blanket policy on occupational aluminum exposure to be obsolete effective 16 June 2017—three weeks after Hobbs died—although there was no retroactivity, meaning that claims filed prior to that date would still be subject to the negative entitlement policy. The second announcement was that the WSIB had contracted with the Occupational Cancer Research Centre to conduct an epidemiological data linkage study to investigate possible associations between MP exposure and neurological health conditions. The Occupational Cancer Research Centre study linked Mining Master File data on 36,826 Ontario miners with a provincial health records database that commenced in 1992. The study compared neurological disease rates in miners who had MP exposure, miners who had no MP exposure, and the general population of Ontario. The Occupational Cancer Research Centre study was completed in March 2020, and its results were released by WSIB on 8 May 2020.^{23,b} The study found elevated rates of Alzheimer's and motor neuron disease in miners overall compared to the general population of Ontario, but not specifically linked to MP exposure. Importantly, however, the study did find a statistically significantly elevated risk for Parkinson disease and Parkinsonian symptoms in MP-exposed miners compared to unexposed miners or the Ontario population. As a result, the WSIB is now allowing workers' compensation claims for Parkinson-related conditions in MP-exposed miners, where both the diagnosis and MP exposure are confirmed, and the MP exposure preceded the Parkinson diagnosis.⁷⁷ Unfortunately, access to this delayed justice is impossible for many families who are unable to prove their deceased miner's Parkinson diagnosis. Under 1990 legislation in Ontario, medical records are generally retained for ten

years past the healthcare practitioner's last contact with adult patients.⁷⁸

On 28 October 2020, the Estate of Jim Hobbs received a letter from the Ontario WSIB, accepting Hobbs' claim of Parkinson disease on the basis of his exposure to MP. Included in the entitlement is loss of earnings benefits, a noneconomic loss award, and healthcare benefits related to his Parkinson disease—three years too late.

Commentary

Workers are often exposed to toxic hazards in the workplace; silica dust, diesel engine exhaust, radon, and arsenic among others are typical in mining processes. MP, on the other hand, was intentionally dispersed into the mine environment. It was introduced into miners' bodies by mining executives as a nonconsensual, nonoptional faux-experimental medical treatment on the unproven, and ultimately erroneous, theory that it would prevent silicosis. It was a cheap solution to a long-standing industrial disease, developed by the northern Ontario mining industry to mitigate their financial and legal risk once silicosis became recognized as a compensable industrial disease in Ontario. The more expensive—but proven effective—option was for the mines to supply adequate ventilation and improved dust control to reduce miners' exposure to the cause of silicosis, namely respirable crystalline silica created from drilling, blasting and crushing rock during mining activities. Instead, the mining industry shifted its compensation liability risk onto its work force by instituting a decades-long industrial human health intervention in the guise of an experiment in prophylaxis.

The power differential between employer and employee, the economic dependence of workers on their

employment for survival, and the potential cost savings to mining companies by instituting MP inhalation instead of effective occupational hygiene improvements constituted a cheap but ineffective fix to the silicosis hazard. It also raises significant human rights concerns because workers were given no choice but to participate, in the absence of their informed consent and at risk of their livelihoods if they refused. Even minimal standards of care and research would have dictated that there be external regulatory oversight, independent medical assessments, education of risks, and benefits to workers prior to MP inhalation, and provision for workers to opt out of MP treatments. None of that happened.

Of equal and perhaps greater concern is the indefensible absence of long-term follow-up to monitor the health and well-being of the miners and other workers who were subjected to MP experimentation. The need for longitudinal studies was certainly raised, as reflected in a 1972 report by mining engineer John Beattie:

It appears that a complete assessment of the preventative value of aluminum prophylaxis still lies in the future in the life histories of those who entered dust occupations from 1944.⁷⁹

The responsibility for actually monitoring those life histories, however, was abandoned—by the northern Ontario mining industry who introduced and controlled MP inhalation, and by the government entities that stood by while it happened.

The mapping and mobilizing efforts of a layperson through the MPP to document the numbers and types of health issues experienced by northern Ontario MP-exposed miners demonstrates that it is not only possible to do this work but that it is both valuable and necessary to do so. The recently established link between MP exposure and Parkinson disease risk was discovered because the concerning numbers of MP-exposed miners with Parkinson disease and amyotrophic lateral sclerosis documented among the MPP voluntary registrants led to formal scientific research into possible links to neurological disorders. Occupational diseases often develop over many years and may not appear for decades, long after workers have retired and industries shuttered. Scientific research is stimulated by curiosity about observable phenomena, but the lack of visibility inherent in industrial disease development means that if we are truly to identify and prevent the health impacts of toxic workplace exposures, we must become actively curious and observant about the long-term health of exposed workers. The men of the MP faux-experiment stand as testament to that, and failing to apply the lessons from their experiences is one indignity that we can spare them.

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The authors, first and foremost, gratefully acknowledge the miners and mining families who came forward with their stories and documented their experiences with McIntyre Powder inhalation. Over and over, you asked us to make the workplace safe for your grandchildren and to “help the next guy.” Your courage has exposed an unconscionable wrongdoing, and it has also provided a pathway to change. In telling your story, we deeply hope that those who are in positions to implement that change will be moved to do so.

Special thanks to Jim and Elaine Hobbs for allowing your story to be told in order to help others and to seek justice, despite your personal pain and vulnerability in doing so.

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Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Janice Martell is the founder of the McIntyre Powder Project. She is employed by the Occupational Health Clinics for Ontario Workers, Inc. (OHCOW) and is the daughter of a McIntyre Powder-exposed miner. Dr. Tee L. Guidotti completed previous independent consultation work for OHCOW as described in this paper.

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Notes

- a. For a detailed historical review of silicosis and aluminum therapy, see Jorgenson and Sandlos.¹⁴
- b. This work has since been published in the *Scandinavian Journal of Work, Environment & Health*.⁷⁶

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Tee L. Guidotti is a retired professor of occupational and environmental medicine who remains active in teaching and research and as a consultant to the Occupational Health Clinics for Ontario Workers, Inc. (OHCOW). He has held senior positions at several universities, including the University of Alberta and the George Washington University in Washington, DC. He has published a number of books, including *Global Occupational Health, Health and Sustainability*, and most recently, *Handbook of Occupational and Environmental Medicine*. He is best known for his work on the occupational health of firefighters and energy workers.