

Role of Legislation in Occupational Disease Prevention: A Case of Chronic Silicosis with Progressive Massive Fibrosis

Thammarath Thiamsuk¹; Supakorn Chansaengpetch²; Tirathat Virojskulchai³; Ekanut Jamsai¹; Sitthiphon Bunman⁴; Narongpon Dumavibhat⁵



Thammarath Thiamsuk

Abstract

Silicosis is a severe, irreversible occupational lung disease for which primary prevention remains the only effective intervention. Today, the principles of occupational medicine and the hierarchy of controls have evolved significantly. However, without a strong legal framework, implementing these preventive principles in actual workplaces is often challenging. This case report illustrates the contrast in occupational health management before and after the implementation of comprehensive legislation. We report a case of a male worker who developed symptomatic silicosis with progressive massive fibrosis at the age of 65 years during a 47-year career in a sanitary ware factory in Thailand. Throughout his employment, workplace hazard protection relied heavily on inadequate personal protective equipment, such as cloth masks. Notably, previous diagnoses of silicosis among his colleagues in 2007 and 2012 did not lead to the implementation of appropriate hazard control, probably due to health officials' lack of legal authority to intervene in private enterprises. The turning point occurred in 2019, coinciding with the enactment of the Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019). Empowered by this legislation, health officials mandated an investigation and obtained legal entry to conduct a factory walkthrough. This led to direct consultations with the employer and the immediate implementation of mandatory annual chest radiographs and other appropriate preventive measures.

Keywords: silicosis, progressive massive fibrosis, sentinel event, occupational legislation, hierarchy of controls, occupational disease

Silicosis remains one of the most debilitating occupational lung diseases caused by inhalation of respirable crystalline silica. Silicosis is often asymptomatic in its early stages, detected only via chest radiography, or may present with insidious progressive dyspnea.¹ Since there is no curative treatment, the management of silicosis relies entirely on primary prevention, eliminating or minimizing silica dust at the source or minimizing the exposure of the worker.^{2,3} The fundamental principle governing this is the hierarchy of controls.⁴

Implementing this concept in real-world industrial settings often proves difficult. A diagnosis of silicosis in a single worker should serve as a "sentinel event," signaling a hazardous environment and prompting an immediate workplace investigation.⁵ Historically, in Thailand, translating a sentinel event into workplace remediation faced structural challenges. Under previous frameworks, public health officials lacked the statutory authority to inspect private workplaces or enforce engineering controls. Due to this jurisdictional gap between health and labor authorities, clinical diagnoses did not automatically trigger mandatory environmental investigations, often leaving the remaining workforce vulnerable to ongoing exposure.

In 2019, the Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019) came into force.⁶ Under this law, health and safety officials gained the statutory power to compel disease reporting, access factory premises, and enforce preventive standards with legal

¹ Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

² Department of Preventive and Social Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

³ Department of Preventive and Social Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

⁴ Department of Community Medicine and Family Medicine, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand

⁵ Siriraj Tuberculosis Comprehensive Unit, Siriraj Hospital, Mahidol University, Bangkok, Thailand

* Address Correspondence to author:

Narongpon Dumavibhat, MD, PhD

Siriraj Tuberculosis Comprehensive Unit, Siriraj Hospital, Mahidol University, Bangkok, Thailand Wanglang Rd., Siriraj, Bangkoknoi, Bangkok 10700, Thailand

email: narongpon.dum@mahidol.ac.th

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penalties. In this report, we present a case of silicosis with progressive massive fibrosis in a worker with 47 years of exposure. This case starkly contrasts the systemic failures of the pre-law era, when sentinel events in the same factory were ignored, with the decisive, legally backed interventions made possible by the 2019 Act. It shows how legal empowerment is essential to translating the hierarchy of controls into practice.

Case Report

A Thai male, aged 65 years at the onset of symptoms, worked in the sanitary ware industry in Samut Sakhon for 47 years (1973–2020). His work schedule was consistently 8 hours per day, 6 days per week. He began his career as a casting worker and was promoted to casting supervisor in 1991. Despite his managerial title, his daily duties involved constant supervision on the production floor, particularly during mold preparation and ceramic casting.

A retrospective review of the factory's occupational injury reports revealed that two of his colleagues had previously been diagnosed with silicosis in 2007 and 2012. These prior cases should have served as critical sentinel events. Subsequently, in 2017, the company filed a similar occupational injury report for this patient after his annual health

surveillance chest radiograph showed abnormalities suggestive of silicosis. However, he was asymptomatic at that time. Despite this early detection and the documented historical cases within the same facility, he continued working until his retirement in 2020. Reportedly, respiratory protection was inadequate; he primarily used cloth or simple surgical masks. He was a lifetime non-smoker with no history of tuberculosis.

The patient reported that his symptoms began in 2019 with chronic dry cough and progressive dyspnea on exertion. He first sought medical evaluation in 2020. Physical examination was unremarkable, with normal breath sounds and no digital clubbing.

The chest radiograph obtained in 2017 was retrospectively classified by a NIOSH-certified B Reader using the 2022 International Labour Organization (ILO) International Classification of Radiographs of Pneumoconioses. The reading revealed diffuse small opacities q/q with a profusion of 2/1. Additionally, a large opacity category B was observed in the upper lung zones, suggestive of silicosis with progressive massive fibrosis (Figure 1A). The patient was asymptomatic and continued working in the same work environment. His chest radiograph in 2019 demonstrated a denser large opacity (Figure 1B).

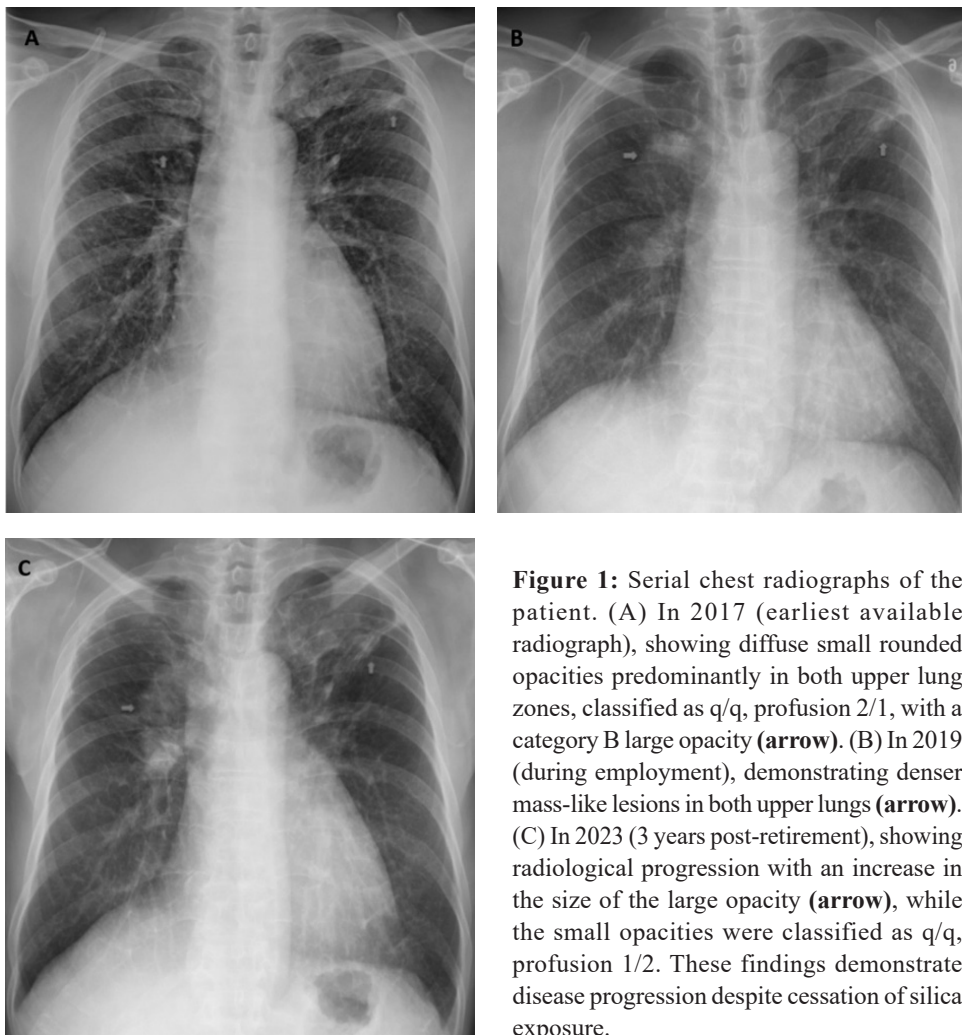


Figure 1: Serial chest radiographs of the patient. (A) In 2017 (earliest available radiograph), showing diffuse small rounded opacities predominantly in both upper lung zones, classified as q/q, profusion 2/1, with a category B large opacity (**arrow**). (B) In 2019 (during employment), demonstrating denser mass-like lesions in both upper lungs (**arrow**). (C) In 2023 (3 years post-retirement), showing radiological progression with an increase in the size of the large opacity (**arrow**), while the small opacities were classified as q/q, profusion 1/2. These findings demonstrate disease progression despite cessation of silica exposure.

Spirometry performed in 2020 demonstrated a moderate obstructive ventilatory defect (FEV1/FVC, 52.4%; FEV1, 64.1% predicted), with preserved forced vital capacity (FVC, 97.3% predicted). Given his lifelong non-smoking status and prolonged occupational dust exposure, the obstructive ventilatory defect was considered potentially related to his occupational lung disease.

The patient retired in 2020, ceasing all occupational exposure. However, his condition continued to deteriorate. In 2023, he reported worsening dyspnea and sought compensation from the Workmen's Compensation Fund. His chest radiographs in 2023 showed radiological progression with enlargement of the PMF masses (Figure 1C). Currently, the patient is receiving supportive care and long-acting bronchodilators to manage his respiratory symptoms.

Discussion

Silicosis is a progressive, irreversible fibrotic lung disease caused by inhalation of respirable crystalline silica. Chronic silicosis, the most common form, typically develops after a latency period of a decade or more following exposure to low-to-moderate dust levels.⁷ Crucially, silicosis can progress even after removal from silica exposure.⁸ Because there is currently no effective medical cure, disease management relies entirely on primary prevention governed by the hierarchy of hazard controls. Under this framework, eliminating or substituting silica at its source remains the ultimate goal. When elimination is not feasible, engineering controls (such as local exhaust ventilation, enclosed systems, and wet methods) serve as the most critical interventions. Conversely, relying solely on PPE is considered the last and least effective line of defense according to the hierarchy of controls.⁴

Despite these established principles, translating them into workplace practice has historically been challenging. In this workplace, the diagnoses of silicosis among the patient's colleagues in 2007 and 2012 should have served as critical "sentinel events," signaling a severe occupational hazard. However, under the previous legal framework, particularly the Occupational Safety, Health and Environment Act B.E. 2554 (2011)⁹, the system was likely to be fragmented. Medical professionals diagnosing the disease in hospitals lacked the statutory authority to cross into private industrial sectors to inspect conditions or enforce engineering controls. Consequently, workplace improvements relied heavily on the employer's voluntary compliance, which may not have always been consistently implemented. This systemic gap appears to have been a contributing factor that left the current patient and his peers to rely on grossly inadequate PPE, such as standard cloth masks, for decades, potentially playing a role in his progression to symptomatic silicosis.

The paradigm shifted dramatically with the enactment of the Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019), further strengthened by the Ministerial Regulation on the Standard of Health Check-ups for Employees Working with Risk Factors B.E. 2563 (2020).¹⁰ These legislative measures served as a crucial bridge between clinical diagnosis and workplace remediation. Empowered by these

laws, health officials were granted explicit statutory authority to enter the factory, conduct comprehensive disease investigations, and formulate prevention strategies through direct consultation with the employer. In this context, a formal disease investigation serves more than confirming occupational exposure for a single patient; it is a vital public health intervention designed to break the cycle of hazard and prevent similar cases among the remaining workforce.⁵ Under the new regulations, when an occupational disease is identified, the employer is legally compelled to provide immediate medical care and submit a preventive and corrective action plan to safety inspectors within a 30-day timeframe.^{6,10}

However, an important observation regarding this legal framework is that while it mandates a timely response, it does not explicitly specify which level of the hierarchy of controls (e.g., elimination, administrative, or PPE) must be adopted. The adequacy of the proposed hazard controls is instead evaluated collaboratively by health officials and safety officers. In extreme cases where hazards pose widespread or life-threatening risks, officials may also be granted emergency authority to declare specific hazard control zones.⁶ Furthermore, the legislation enforces strict secondary prevention protocols, mandating both initial health examinations within 30 days of employment and consistent, risk-based periodic screenings for exposed workers.¹⁰

This case demonstrates that while medical knowledge can identify a workplace hazard, strict enforcement of comprehensive legislation ultimately prevents employers from reverting to inadequate PPE and transforms ignored sentinel events into actionable, lifesaving preventive measures. By shifting the focus from individual treatment to systemic prevention, the Act B.E. 2562 (2019) aims to ensure that a diagnosis is no longer a disregarded outcome but an actionable measure to protect the collective health of all workers.

Conclusion

In conclusion, this case of a male worker who developed symptomatic silicosis with progressive massive fibrosis at the age of 65 years during a 47-year career involving silica exposure demonstrates the vulnerabilities created by past legal gaps and inadequate PPE. His diagnosis, despite documented sentinel events at the same factory in 2007 and 2012, could illustrate these structural limitations, in which medical warnings lacked the statutory power to compel environmental change. However, the enforcement of the Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019) offers a crucial legal mechanism to address such systemic flaws. By providing the necessary legal authority, the legislation is designed to bridge the critical gap between future clinical diagnosis and concrete workplace remediation. Ultimately, while this case highlights the potential consequences of fragmented law enforcement, it also emphasizes the critical need for robust legal frameworks. Moving forward, the effective implementation of this Act, and in turn, enforcement will be essential to transform individual medical diagnosis into systemic protection, aiming to enforce the hierarchy of controls and safeguard the collective health of the workforce.

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