The Silicosis Problem in the Swedish Iron and Steel Industry during the 20th Century

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Silicosis is an industrial disease that still takes its toll over the world.[1] In Sweden, new cases are rare today. From 1931, however, when silicosis was first acknowledged and registered as an occupational disease and up to 1979 over 4,600 established cases of silicosis were recorded in different trades. After that there have been comparatively few cases, around 220. Workers in the iron and steel industry were among those hardest struck by this illness.[2]

In many ways the handling of the silicosis problem reflects the development of the modern industrial safety policy and practice in Sweden. From the 1930s and up to the early 1960s, when silicosis was most prevalent in the iron and steel industry, the governmental regulation concerned primarily the prevention of occupational accidents, and thus the control of industrial dust in the plants was still comparatively weak. Therefore, the problem had to be handled mainly between the employers and workers at the company level. During these decades the so-called Swedish Model of co-operation in industrial relations was established. This model, which had developed during a long historical process, was a tripartite co-operation between the organised parties in the labour market and the state with the purpose of achieving economic growth, full employment and peaceful labour relations. Its political pre-condition was that reformist socialism was the leading ideology within the labour movement. Occupational health and safety was supposed to be an important field for co-operation within this model, which was codified in the first occupational health and safety agreement in 1942 between the Swedish Trade Union Confederation (*Landsorganisationen,* LO) and the Swedish Employers' Confederation (*Svenska Arbetsgivareföreningen,* SAF). This was a follow-up agreement to the main agreement settled in Saltsjöbaden in

[1] I want to thank Bernard Harris, Department of Sociology and Social Policy, University of Southampton and Anders Kjellberg, Work and Culture, National Institute for Working Life in Norrköping for valuable comments on the manuscript.

[2] Silicosis is a lung disease that is caused by the inhalation of dust from crystalline Silica (SiO_2), which mainly exists in quartz. Quartz is a mineral form found for example in granite and sand. Silica dust damages the tissues in the lungs and the resulting build-up of cartilaginous tissue successively reduces breathing capacity. Heart problems and tuberculosis often set in during an advanced stage of the disease. Quartz dust together with other industrial dust can produced mixed dust silicosis. See Ahlmark (1967) pp 21-28; few women have been afflicted with silicosis (around 20), most of them in the ceramic industry); concerning the statistics of the cases of silicosis (including mixed dust silicosis) recorded in Sweden, see Riksförsäkringsverket, silikosfall 1931-1979 and ISA, Arbetsskadestatistiken, Arbetsmiljöverket, silikosfall 1980-2000. There is no information concerning 1988,1989 and 2000.

1938, where the principles for self-regulation in the Swedish labour market were laid down. *Co-operation* in the way implied by the Swedish Model presupposed well-organised interests of labour and capital, negotiations and the settling of collective agreements between in principle equal parties. How the co-operation worked in practice depended however ultimately on the actual balance of power in the labour market. The work environment issue concerned primarily the sphere of production and not the distribution of the results of the production. Consequently, with regard to the work environment the employers had the ultimate responsibility and power.[3] As will be illustrated in this article, it was some time before this co-operation was extended to include the problem of industrial diseases such as silicosis. In addition, the historical prerequisites for the local parties to act as organised and independent parties could vary greatly.

From the early 1960s, the efforts of both the government and the central parties in the labour market to prevent industrial diseases increased considerably. This period was also a time of technical and scientific progress in the development of methods for measuring and analysing industrial dust and the elaboration of effective exhaust ventilation systems[4]. Furthermore, it was a time of rising professionalisation and bureaucratisation in the field of industrial safety, which was an international trend as well.[5]

The purpose of this article is to discuss how the state and the parties in the Swedish labour market handled the silicosis problem. How did the problem arise and how was it dealt with over time? How did it affect the social relations in the plants? Which were the main driving forces behind the development of the worker's protection against silicosis? The article focuses primarily on the silicosis problem in the iron and steel industry, in which the foundries were the most hazardous working sites. The local example referred to here has been taken from my book on this issue, *The Silicosis Problem in Österbybruk* (1993). Other than that there is not much research done on the development of the silicosis problem in Sweden.[6] The most interesting international study for my purposes is David Rosner's and Gerald Markowitz' book *Deadly Dust* (1991), which deals with the great silicosis crisis in the USA, especially during the 1930s, among other places in the foundries.

In my opinion, the historical development of industrial safety, as well as other questions in the labour market, can best be understood from a conflict perspective, where the power relations in production, in the labour market and in society

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[3] Self-regulation means that the main labour market parties should handle labour market issues without governmental interference; for a more detailed presentation of the Swedish Model, see Martin (1995), Kjellberg (1998) pp 74-84; for further discussion of the concept of *co-operation* in industrial relations, see Thörnquist (1994), (2001).

[4] Gerhardsson et al (1974).

[5] Ibid; Dwyer (1992); Thörnquist (1994) p 339.

[6] Thörnquist (1993); see also Berggren & Olsson (1988) pp 71-75; Wikander (1988); Eriksson (1991); Kavian (1999).

as a whole are taken into account. From this point of view, industrial safety is not an isolated and neutral question, which often has been maintained, but ultimately dependent on attitudes and interests. The conflict of economic interests, however, has often been more apparent in the matters of industrial diseases than concerning industrial accidents. The problems of diseases have normally required radical and expensive investments to solve, and the question of responsibility has often been more complicated.[7] The handling of the silicosis problem in the Swedish iron and steel industry is a good example of this.

The Recognition of Silicosis in Sweden

Silicosis is a disease that develops very slowly, normally not until 20–30 years after the beginning of the exposure to silica dust. Therefore, the roots of the international silicosis 'epidemic', which broke out during the 1930s within the iron and steel industry, were the mechanisation and rationalisation processes that had started several decades earlier. The mass-production of machines and vehicles caused a rising demand for castings, especially steel castings, which also worsened the silicosis risks in the foundries. The manufacturing of steel castings required a very high percentage of quartz in the furnace lining and in the moulding sand. In addition, steel needs higher temperatures than iron to melt, which burnt the sand and made it stick to the castings. When quartz is heated to high temperatures other forms of crystalline silica can develop as well, which are even more hazardous to inhale. With the use of sand blasting and other pneumatic tools for the cleaning of the castings, the occurrence of burnt and fine-grained quartz dust increased immensely. In extremely dusty settings, silicosis might develop after a comparatively short time.[8]

In the medical literature, silicosis was recognised as a special, non-infectious lung disease in the 1910s. However, it has probably been known since classical antiquity that stone dust causes lung lesions. In 17th century England, the grinding on sandstone wheels in metal manufacturing was connected with lung diseases. The famous Swedish scientist Carl von Linné observed in the 1730s that sandstone workers quarrying and manufacturing grindstones in the village of Orsa, situated in the province of Dalecarlia, generally died young of pulmonary diseases. As their wives and children were not afflicted, he assumed that it was work-related. In the early industrial society the workers in dusty trades called their lung diseases miners' phthisis, potters' phthisis, stone cutters' pthisis and so on, which implied that they were aware of the relationship between this illness and their work. However, accidents, diseases and all kinds of misfortunes were

[7] Thörnquist (1994); (2001).
[8] Rosner & Markowitz (1991; Thörnquist (1993), (1994) pp 340-343.

long regarded as God's punishment for sins, as they normally were in the pre-industrial society.[9]

After the tubercle germ had been discovered in the late 1880s and up to the 1920s, physicians all over the word generally diagnosed pulmonary disease as tuberculosis. Therefore, it was often considered as a problem originating from the worker's hereditary disposition, hygienic standards and living conditions. Consequently, it was also regarded as a matter of the worker's own responsibility. As Rosner and Markowitz have put it, "…the great plague of bacterial disease, tuberculosis, camouflaged industrial dust as a source of disease".[10]

Nevertheless, some Swedish company doctors were deeply concerned about the dust hazards in the plants and began to make systematic observations of its effects on workers' health. In the early 20th century, Karl Emanuel Hällsjö at the big steelworks Domnarvet in Dalecarlia, found a very high death rate in tuberculosis among the workers in the steel foundry. Therefore, he directed that the workers in the dustiest settings were to be given other tasks after one or two years.[11] Another physician, Nils Holmin, found in 1911 that the rate of tuberculosis was five times higher among grinders than among the other workers in the steel manufactures in Eskilstuna, which was something of a Swedish equivalent to Sheffield in England. It is reasonable to think that the workers suffered from silicosis, which in an advanced stage might well have been complicated by tuberculosis.[12]

In Sweden, as in most industrial countries, it was not until the 1930s that silicosis was more commonly recognised as an occupational disease. In 1929 the first Swedish insurance law concerning industrial diseases had been enacted. It included injuries caused by for example arsenic, lead, mercury and phosphorous and its compounds, but not silicosis. Then in 1930, a medical study undertaken in a quartz quarry works in West Sweden showed that almost all workers who had been in this setting for more than two years had contracted silicosis.[13] These alarming results forced an amendment to the act in 1931, which acknowledged silicosis as an occupational disease that entitled the sufferer to compensation. Sweden thus became the first country in the world, where silicosis was covered by the law of industrial insurance. Yet it was not easy for workers to get compensation. Silicosis could be difficult to diagnose, even with X-rays. In addition, the law only applied to cases that had been discovered in 1931 or later and where the worker had been exposed to silica dust within one year before the application

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[9] For a more detailed historical review see, Bruce (1942) pp 14-19; Dwyer (1991) pp 13-22.
[10] Rosner & Markowitz (1991) p 9.
[11] Hällsjö (1953).
[12] Holmin (1911).
[13] Mascher (1930).

was made. In 1937 this period was extended to 10 years because of the long latency of silicosis.[14]

Mapping Out the Spread of Silicosis

In 1930 the International Labour Bureau, an executive agency within the International Labour Organisation (ILO), arranged a silicosis conference in Johannesburg. It was not a coincidence that the conference was held in South Africa. In the Witwatersrand Goldfields in Transvaal, miners' phthisis had caused immense suffering and death among the workers, mainly Englishmen, since the establishment of the mining industry in the 1880s. The medical studies done in this area became of vital importance for the understanding of silicosis. This first silicosis conference initiated international co-operation in the research on silicosis and its prevalence, and in 1938 a new conference was held in Geneva.[15]

In Sweden, the government supported the idea of investigating the risks of silicosis, but gave no special grants for this purpose. Instead it was the National Association against Tuberculosis *(Nationalföreningen mot tuberkulos)* and the Employers' Mutual Accident Insurance Company *(Arbetsgivarnas Ömsesidiga Olycksfallsförsäkringsbolag)* that financed the first studies of the prevalence of silicosis in different trades. As the laws for industrial insurance covered silicosis, it was in the interests of the employers and the insurance companies to map out the spread of the disease. The physician Torsten Bruce conducted these investigations during the period 1934-1938 and became the central figure for the research on silicosis in Sweden. He also increased public awareness about the need for measures to prevent silicosis. The first project comprised 2,500 workers that were exposed to silica dust in different trades. Only a few of the workers studied were retired. The results were published in 1942 as Bruce's doctoral thesis. He showed that about 600, or 24 per cent, of the examined workers had silicosis. In the steel industry the amount was 20–40 per cent. Apart from this trade, the iron ore mines, the quartz quarrying and crushing industry and the pottery industry were the most hazardous work places. According to Bruce, silicosis had never been as prevalent in Sweden as it was in the 1930s.[16]

In the light of these results, a governmental decree was enacted in 1938 and came into force in the early 1940s. It provided for the medical examination of workers who worked in settings with extreme risks for silicosis, both when they signed on for jobs and thereafter periodically. In cases where silicosis were established or suspected, the workers should be transferred to dust free jobs. Workers who had some kind of illness or infirmity that could make them more

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[14] Ahlmark (1967) p 29-30; Ahlmark & Gerhardsson (1980) pp 45-49. The 1931 act also covered fibrosis of the lungs caused by silica mixed with other dust.
[15] ILO (1930), (1938); see also Katz (1995).
[16] Bruce 1942; during the 1930s the granite-industry was almost shut down SOU 1949:44.

predisposed to silicosis were not allowed to work in dusty settings at all. The employers had to organise and cover the expenses of these examinations. As the statute mainly applied to the hazardous workplaces known at that time, it covered most categories of workers in the steel foundries, but only sandblasters and quarts crushers in the iron foundries.[17]

After the investigations in the 1930s, it took about fifteen years until a large-scale silicosis study was done again. In the late 1950s, the around 2,220 cases of silicosis and mixed dust silicosis that had been reported to the authorities up to 1957 were followed up by a new medical project conducted by Torsten Bruce and two of his colleges, Axel Ahlmark and Åke Nyström. Over 50 per cent of these cases came from the steel industry. The report showed that silicosis was a growing problem in the iron foundries as well. However, as the development of silica dust was not so intense in this production process, it normally took between 30-50 years for workers to contract silicosis, and the disease progressed more slowly than among the workers in steel foundries.[18]

Hence, up to the 1960s, it was medical researchers, with Bruce in the lead, who mapped out the spread of silica dust hazard within the Swedish industries. The government responded to the alarming reports by imposing compulsory medical, but not technical, preventive measures against the dust in the plants. Indeed, the silicosis problem was also an urgent task for the parties in the labour market to take action against. To understand how the problem was handled between the parties, it is necessary to know a little about how industrial safety has been regulated historically in Sweden.

The Development of Industrial Safety

In Sweden, industrial safety has developed within a framework of legislation for worker's protection and compensation, but also to a large extent through self-regulation between the parties in the labour market.[19] As in most Western countries, a rudimentary labour legislation system for the reduction of working hours, factory inspection and industrial injury insurance developed around the turn of the 20th century. The first worker protection law, the Occupational Hazards Act *(Yrkesfarelagen)* concerning mainly factories, was enacted in 1889. In the same year the governmental Labour Inspectorate *(Yrkesinspektionen)* was established. About ten years later, the employers were obliged to compensate workers for the loss of income caused by accidents at work, which also made them more willing to insure the workers in the Employers' Mutual Accident Insurance Company that started at that time. The 1916 Accident Insurance Act

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[17] Ahlmark (1967) pp 143-163; Ahlmark & Gerhardsson (1980) p 45-46.

[18] This study also confirmed that silicosis progresses even after the exposure to silica dust has been discontinued. Ahlmark et al (1960).

[19] Unless stated otherwise, this part draws on Sellberg (1950) and Thörnquist (1994), (2001).

(Lagen om olycksfallsförsäkring) made insurance of the workers mandatory. In 1912 a more imperative Worker Protection Act (*Arbetarskyddslagen*) had been enacted and in 1919 the parliament *(Riksdagen)* decided to reduce the working day for industrial workers to eight hours. For a long period, however, the legislative system of workers' protection and compensation concerned mainly the problem of accidents. As mentioned above, it was only in 1929 that an insurance law was enacted that covered certain diseases.

Working conditions and working hours figured early in the local agreements in the labour market. As the trade union movement however was relatively weak in the first decades of the 20th century, it had limited resources to deal with issues other than wages. The old claim for a general reduction of working hours, for example, was therefore turned into a political question which, together with the question of suffrage, became one of the most important issues at that time. The institution of union safety representatives and joint safety committees had its breakthrough during the 1930s and 1940s. It was codified in the revisions of the Worker Protection Act in these decades, but it was first and foremost part of the development of the Swedish Model of self-regulation in the labour market. From 1942 up to the early 1990s the workers' protection acts were supplemented by central occupational health and safety agreements between the LO and the SAF.[20] At the same time as the first central agreement was settled, the Joint Industrial Safety Council *(Arbetarskyddsnämnden)* was established as a national body for co-operation between the organised parties in the labour market. Its main task was to spread information and propaganda and to support the establishment of work safety organisations at the company level.[21] The parties were in agreement that self-regulation gave better results than legislation, which especially the employers wanted to avoid. The 1949 Worker Protection Act reinforced both state control and the principle of self-regulation. In the same year a governmental body, the National Board for Occupational Safety and Health *(Arbetarskyddsstyrelsen),* was set up to control the implementation of the act. The parties in the labour market were represented both on this Board and on other governmental boards, as for example the board of the Labour Inspectorate at the central and regional levels. This arrangement, as well as the central agreements, were important elements of the Swedish model of tripartite co-operation.

Up to the late 1960s, the well-organised and strong labour market parties, the stable Social Democratic government and the good state of the market were the

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[20] After the main agreement between the LO and the SAF in Saltsjöbaden in 1938, central agreements were also settled concerning vocational education (1944), works councils (1946), and time and motion studies (1948); see Johansson (1989).

[21] In 1978 the Federation of Salaried Employees in Industry and Services (*Privattjänstemannakartellen,* PTK) affiliated as the third part. Through a revision of the agreement in 1967, principles for occupational health service and education in work environmental issues were included as. Arbetarskyddsnämnden (1992) pp 29.

basic pre-requisites for a successful tripartite co-operation in occupational health and safety issues, though mainly concerning accidents. At the end of the 1960s, however, negotiating climate got tougher due to the social consequences of the rapid rationalisation and structural transformation of Swedish trade and industry. In the following years, labour unrest broke out within several trades. The wildcat strike in 1969/70 among the miners in the state-owned company LKAB in the north Swedish ore-fields concerned not least the work environment in these mines; among other things the fear of silicosis. During the first half of the 1970s a broad opinion for improvements of the work environment developed. This was not only a prioritised issue on the agendas of the unions and the labour parties. Many public and private professionals participated in the debate as well. It was also a topic much discussed in all kinds of media as well as in art, literature, films and theatres. In 1972 the government started up the Worker Protection Fund *(Arbetarskyddsfonden)*. Its purpose was to support and finance research and education in the field of industrial safety. The Joint Industrial Safety Council, for example, got big grants for the elaboration of educational programs and the industrial health service was reinforced. Regarded from an international perspective this sizeable state support was unique.[22]

In the radical revisions of the Worker Protection Act in 1973 and 1977, and in the renewal of the central occupational health and safety agreement in 1976, a wider definition of the area for workers' protection was laid down. In addition the *prevention* of accidents and diseases was emphasised. Occupational diseases, especially repetitive strain injuries and psychosocial matters, now received increasing attention in Sweden as well as in other industrial countries. In accordance with this, the law's name was changed to the Work Environment Act *(Arbetsmiljölagen)* and now the Worker Protection Fund was called *Arbetsmiljöfonden*. The reforms above were part of a general reinforcement of Swedish labour legislation in the 1970s, which also included co-determination, job security and gender equality in the labour market. The general background was the rising pressure on workers and the many conflicts in the labour market due to the escalated structural transformation and the rising number of close-downs of factories caused by the energy crises and increased international competition. Notwithstanding that the reforms of the 1970s strongly reinforced workers' rights to participate in the decision-making process in the firms, workers' commitment to industrial safety questions decreased during the following decades, as did union power on the whole. Among other things the reinforced labour legislation contributed to an increasing political and economic mobilisation of the SAF. In addition, the long era of stable Social Democratic governments, as well as a stable parliamentary situation in general, was over. The

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[22] Thörnquist (2001) pp 140-144; see also Isacson & Söderlund (1995) pp 50-53; Frick (1996); Johansson & Magnusson (1998) pp 159-167.

very stress on legislation seems also to have weakened the dialogue between the parties in the labour market, though the acts had to be completed by agreements. It broke the long tradition of strong self-regulation and many local union representatives soon became fed up with interpreting law texts. The rising unemployment rate in the 1990s, new principles for flexible ways of organising production and work (the Just-in-Time business concept) and the associated new forms for employment with short-term contracts, contributed to this development. Furthermore, Sweden followed a global trend towards more decentralised and individualised industrial relations. At the beginning of the 1990s the SAF cancelled the central agreements concerning both wages and the work environment definitely, including the principles for the industrial health services and education in health and safety issues. Parallel to this, the SAF withdrew its representatives from the governmental boards, for example the National Board for Occupational Safety and Health. Hence, big steps were taken away from the Swedish Model of co-operation in industrial safety matters and in other issues as well. The Joint Industrial Safety Council still exists, however, and there are agreements at the branch level.[23]

The Work EnvironmentalPolicy Concerning Silicosis

In the research reports published by Bruce and his colleges, they underlined the importance of not only medical silicosis prophylactics. They also emphasised very strongly the need for technical measures to prevent quartz dust in the plants.[24] Yet, up to the 1960s the National Board for Occupational Safety and Health did not give much concrete advice on this point. Nor was the wording of the law concerning the prevention of dust particularly clear and imperative. The Swedish public policy concerning the silicosis problem could therefore be characterised as *disposition prevention.* This means that workers' physical constitution and way of acting were regarded as the determining factors for injuries at work. Workers who were susceptible to pulmonary illness were, for example, excluded from dusty jobs. Rather than prescribing compelling measures for the prevention of the dangerous dust, the length of time for workers' exposure to the dust was to be limited. The opposite, *exposition prevention,* implies that the work environment should be adapted to workers' conditions and needs. The Swedish socio-

[23] During the first half of the 1990s the industrial health service system lost its governmental subsidies and the grants to the regional safety delegate institution was reduced. The latter institution supports working sites with weak health and safety organisation, which often are small companies. Thörnquist (2001), pp 140-146; Kjellberg (2001) pp 294-297; Thörnqvist (1999).

[24] Ahlmark et al (1960) pp 376-391.

logist Rolf Å Gustafsson has pointed out the longstanding dominance of *disposition prevention* in Swedish work environment policy.[25]

In my opinion, there are two interrelated causes behind this. First, for a long time there was a strong concentration on the accident problem. Since the mid-1920s the state and the parties in the labour market were in agreement that Swedish industry must rationalise to keep pace with the international competition. As both the international and Swedish experiences showed that the rationalisation process caused a rising number of industrial accidents, the work environment policy long focused on this problem. Secondly, this policy was influenced by the American Safety Movement, which dealt solely with accidents. The fundamental idea of the Safety Movement was that industrial safety should be an integrated part of Tayloristic management and labour policy. According to the Safety Movement, the main cause of the rising accident rate in the early 20th century was not technical defects, but the workers' carelessness. Therefore, occupational health and safety programmes should be integrated in the production plan. In its pure form the Safety Movement excluded union participation, and in this sense, it contradicted the very essence of the Swedish model for the handling of industrial safety problems. Despite this, the pedagogical and organisational ideas of the Safety Movement influenced not only Swedish employers, but also the governmental authorities and voluntary occupational health and safety organisations such as the Joint Industrial Safety Council.[26]

According to Gustafsson, the Swedish work environment policy changed towards exposition prevention with the labour reforms in the 1970s.[27] During the 1960s, however, a rising governmental interest in the prevention of silicosis must also be regarded as an important step in this direction. In 1963, the government started up a technical and medical investigation of 170 plants identified as dust-laden environments, among them about 50 iron foundries. The purpose was to identify the dust situation and to give proposals for a solution to the problems. At that time, approximately 25,000 workers in 1,000 working sites were exposed to silica dust. The project resulted in a considerable financial and personal reinforcement of the occupational health and safety authorities, which became even more striking in the 1970s. It was also the breakthrough for the use of scientific methods for measuring industrial dust. A dust-index was instituted, which among other thing made it easier to estimate and the compare the risks for silicosis and to lay down the general outlines of how to clean up dust. In addition, a central silicosis register was built up, where all kinds of data concerning the disease

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[25] This distinction was originally made by Didrichsen & Jahnlert (1981); Gustafsson (1994).

[26] Concerning the Swedish labour movement and the rationalisation process, see De Geer (1978) pp 359-369; for a more detailed presentation of the Safety Movement, see Sund (1993), (1994); Aldrich (1997).

[27] Gustafsson (1994) p. 266; other authors have used other terms for describing the same transformation; see for example Lund & Gunnarsson (1987); Tucker (1994).

were collected. As a result of the investigation, the public factory inspector began to follow up and give practical advice for the prevention of dust in the plants. The outcome was reported to the National Board for Occupational Safety and Health. Hence, the governmental control of the technical measures to prevent dust in the plants increased. Furthermore, a joint committee representing the state and the central parties in the labour market was established to plan further projects to solve the silicosis problem.[28] Thus, eventually the problem became an important subject of the Swedish model of tripartite co-operation.

A new governmental silicosis project started up in 1968 within the National Institute for Occupational Medicine *(Arbetsmedicinska institutet)*. From now on reports were made to the parties in the labour market continuously. A nation-wide study was undertaken which comprised over 1,000 work sites. It showed that in most of the investigated industries the recommended limit for silica dust in the air (0,2 mg/m^3) was exceeded for more than half of the work force. In particular, the situation was serious in the iron foundries and the stone industry, where the silicosis risks had been identified comparatively late. As a result of this investigation the National Board for Occupational Safety and Health issued general regulations regarding technical measures to prevent dust as well as annual dust measurements in dusty trades.[29] Despite this, silica dust, gas and smoke still caused problems in many trades. Therefore, a follow-up study of the dust situation was carried out in the period 1974–1980. The purpose was also to inform about and give suggestions for technical preventive measures in the plants and to control that these measures really were taken. Through the revisions of the Worker Protection Act in 1977, which came into force 1978, the National Board for Occupational Safety and Health was authorised to issue compelling directives as well. The general conclusion reached by the study was that considerable improvements in the work environment were achieved during the 1970s.[30]

Measuring dust is however a problematic method for estimating changes in environmental risks factors, which Peter Westerholm, researcher on occupational medicine, pointed out. The amount of dangerous dust in the air can vary greatly from time to time in the workplaces due to for example changes in the climatic conditions and variations in the work processes. Therefore, in his view the results of the silicosis projects were of limited usefulness. According to Westerholm, the

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[28] This silicosis investigation was carried out during the period 1964-1966 at the National Institute for Public Health *(Statens Institut för Folkhälsan)*, the National Board for Occupational Safety and Health and, from 1966, the National Institute for Occupational Medicine *(Arbetsmedicinska Institutet)*. Otto Westling, Arbetarskyddsstyrelsen (Arbetsgruppen för silikosfrågor) till Järnbruksförbundet 22 oktober 1969. Forskningsverksamheten, Arbetarskyddskommittén, korrespondens 1969, Järnbruksförbundets arkiv FBB 3, Stockholm; see also the final report, Ahlmark (1967).

[29] Gerhardsson et al. (1974).

[30] Arbetarskyddsstyrelsen (1983); Nordfors (1985) p 151, 184.

results from for example the iron foundries did not indicate any improvements[31]. As the reported number of annual cases of silicosis did not decline – although they appeared after a longer time and in an earlier stage – some researchers feared that the problem would remain unsolved during the rest of the century or even longer.[32] However, as mentioned above, the number of reported cases of silicosis decreased notably in 1980s and 1990s, due to not only stricter dust control and better dust prevention, but also because of the structural transformation, which had reduced the number of work places in dusty trades considerably.

The state's increasing commitment to the question of silicosis prevention in the 1960s was, as will be seen below, in the first place a result of longstanding political pressure from the trade union movement, which also referred to Bruce's and other physicians' research results and recommendations. In a broader context it was also part of the rising public opinion on environmental and work environmental issues. In the 1960s chemical hazards and air pollution in the work environment and in the external environment had begun to receive increased public attention in Sweden as well as in many other countries. During and after the miners' conflict in 1969/70 the silicosis problem often figured in the radical and widespread debate on work environmental issues.[33]

In the early 1970s the asbestos hazard gained great public attention in Sweden. The big alarm came in 1975, when physician Anders Englund, a researcher at the National Institute for Occupational Medicine, showed a clear connection between exposure to asbestos and a special form of lung cancer, mesoteliom. In this situation, the government transferred experts from the then current silicosis project to carry out research on the asbestos problem on the basis of their special experience. In 1976 the National Board for Occupational Safety and Health issued a directive that prohibited any new installation of products with asbestos cement. In other words, the state destroyed the market for the companies that produced these products. This was a new, controversial feature of the governmental prevention policy that caused great debate in Sweden as well as internationally.[34]

A Labour-ManagementProblem

As the silicosis risks were most prevalent in the iron and steel industry before the governmental silicosis projects started up and the control of industrial dust increased, the problem was primarily a labour-management issue. However, as the employers' interests in occupational health and safety issues mainly concerned

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[31] Westerholm (1980) pp 52-53, 57; Interview with Professor Peter Westerholm, December 19, 2000.
[32] Ahlmark & Gerhardsson (1981) pp 48- 49.
[33] Yrkesskadestatistiken, Riksförsäkringsverket, silikosfall 1931-1979; ISA, Arbetsskadestatistiken, Arbetsmiljöverket, silikosfall 1979-2000.
[34] Arbetarskyddsstyrelsen (1999) pp 99-104.

accidents, the silicosis problem was not put on the agenda as a matter of course. In addition, many small companies lacked a working industrial health and safety organisation. Hence, the problem was also highly dependent on local union power. Since the late 1920s, the central parties in the labour market and the state had discussed the idea that occupational health and safety ought to be handled in peaceful co-operation between the parties. But the economic crisis and wide-spread labour unrest made it hard to realise these intentions. During a time of longstanding mass-unemployment, it was not easy for unions to demand costly improvements in the work environment. It is reasonable to think that the Joint Industrial Safety Council, which in practice started to work in 1945, would have given the local parties technical and practical advice on how to deal with the silicosis problem. However, during the first decade of its existence, the Joint Industrial Safety Council was mainly concentrated on the accident problem.[35]

Indeed, the silicosis problem implied many bones of contention between the local parties. First and foremost there was the question of what to do about the hazardous dust. Should the problem be tackled mainly by expensive investments in the buildings and ventilation systems, and perhaps also by automation of dangerous work operations, or should it be up to the workers to shelter themselves from the dust through for example protective masks and by changing their way of acting? Another problem, which often caused conflicts between the parties, was how mechanisation and rationalisation, for example the introduction of mechanical grids to knock the castings from their moulds, affected the dust situation, and the social situation, in the plants. Furthermore, who was really afflicted with the disease? Generally, it was the company doctor's mandate to make the first difficult assessments of the suspected silicosis cases. The unions, on their part, often had their own opinion of whether a worker had silicosis and was entitled to compensation or not. Unions often regarded the company doctors as loyal to the employers and to the insurance companies, though many doctors actually supported the workers' interests. Especially in the old, paternalistic Swedish iron and steel works, the deep social gap between the workers and the salaried employees could be a real obstacle for a fruitful co-operation between the physicians and the unions in the struggle against silicosis, which will be exemplified below. Furthermore, the local parties had to deal with the severe social consequences of silicosis, for example the fear of the dangerous dust and the problem of transferring workers with silicosis in its early stages to dust free jobs, which often also were less well paid.[36]

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[35] Arbetarskyddsnämndens styrelses protokoll samt årsberättelser 1942-1955. Arbetarskyddsnämndens arkiv Stockholm; Arbetarskyddsnämnden (1992).

[36] Thörnquist (1993).

The Employers' Policy

How then did the employers' associations react to the alarming reports of the spread of silicosis in the iron and steel industry? The Swedish Employers' Confederation (SAF) seems not to have discussed work environment problems and industrial safety very much during the 1930s. Up to the late 1940s, silicosis or other industrial diseases figured very seldom in its journal *Industria*. When the government prescribed medical silicosis prophylactic in 1938, the SAF agreed that it was needed; however, as the examinations were expensive for the employers, the state ought to discuss the problem with the SAF before issuing further ordinances. In addition, the SAF strongly emphasised that the effects of legislation in general in this field were limited. According to SAF, the parties should create safe work places voluntarily, and in accordance with the Safety Movement ideas. Ultimately, SAF claimed, it all depended on the workers' readiness to act carefully. Nor, in the 1930s, did the Iron Works Association *(Järnbruksförbundet)*, which was the counterpart of the organised steelworkers, pay much attention to the widespread silicosis problem. In the 1940s, however, its interest in the problem began to increase due to both the pressures from the unions and the general development in the labour market.[37]

After the Second World War, there was a great shortage of labour in industry, especially in heavy industry. In the foundries the problem of getting skilled workers appeared even before the war. Workers preferred the engineering industry, which provided both better working conditions and higher wages. In the iron works communities it was not only the hazardous work environment, but also the work in three shifts and, not least, the low housing standards that contributed to this development. The housing of workers was part of the paternalistic welfare system and many of the initiatives to improve the housing standards were deadlocked by this system, as the dynamics of the free market did not exist. In 1948 the government started up a special iron works investigation to study the social standards in this milieu and to find out how they could be improved and thereby become more attractive for workers.[38] The labour shortage became the turning point for management's interest in occupational health and safety issues other than accidents. In the late 1940s, the Iron Works Association established an industrial safety committee within its research department, which among other things dealt with the silicosis problem. A concrete question discussed in this committee was the possibility of replacing quartz sand by olivine sand, which did not cause silicosis. This issue was studied in a project in the mid-1950s at the research department of the Swedish Iron Masters' Association *(Jernkontoret),* which was a trade organisation for the iron and steel works. According to the

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[37] *Industria* 1938 no 5:141-144; Thörnquist (1993) p 59, p 83.
[38] Thörnquist (1993) pp 20-23, (1994) p 320; SOU: 1950:15.

report, however, olivine could not be generally recommended. Experiences from Norway and from a couple of foundries in Sweden showed that olivine was not suitable for all types of quality steel.[39]

The Ironworks Associations' rising interest in work environment issues was evident also from its reaction to two nation-wide investigations of working conditions in the foundries, carried out by the Swedish Moulder Union *(Svenska Gjutareförbundet)* in 1929 and in 1956 respectively. The Association did not pay much attention to the alarming results of the first study, which stated that the hygienic standard was deficient in most foundries and that the risk of severe accidents and diseases, such as rheumatism, were extremely high. The latter report, which maintained that not much in the way of improvements had been achieved since 1929 and which pointed out silicosis as the major health problem, got a lot more attention. This time the Iron Works Association was obviously concerned about the situation, which also implied rising insurance costs and great problems to recruit workers. The central board discussed the report closely with the members, both to check whether the work environment really was as bad as had been stated in the union report and to find solutions to the problem. In the following decade, the governmental silicosis investigations and the successively increased state control gave the employers further motivation to voluntarily take action against the dust.[40]

It is also interesting to follow the opinion of the foundrymen and the foremen, who had the immediate responsibility for the machinery and the organisation of work in the foundries. In a comment on the 1929 union investigation, the Association of Swedish Foundrymen – Society for Foundry Technique *(Sveriges Gjutmästareförbund – Gjuteriteknisk Förening)* stated in its journal, *Gjuteriet,* (The Foundry), that the Moulders' Union had strongly overestimated the work environment problems, at least in the case of modern foundries. In addition, the expensive improvements required in the report must be related to the fact that the real wage rate had increased by 35 per cent during the recent two decades. According to *Gjuteriet*, the major problem was the unwillingness among the foundry workers to change their habits and to follow safety instructions, but it also emphasised that the foremen had an important role in this context. The journal often referred to the ideas of the Safety Movement as well.[41] During the 1940s, on the other hand, the connection between the increasing shortage of labour in the iron and steel industry and the hard working conditions was often discussed in *Gjuteriet.* The problem with silica dust in the foundries, as well as

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[39] Hult & Beckius (1959).

[40] Järnbruksförbundet till de företag inom förbundet som ingick i Gjutareförbundets utredning om arbetsförhållandena i gjuterierna, 28 augusti 1957. Arbetarskyddskommittén, korrespondens 1957-1958. Järnbruksförbundets arkiv FBB 3, Stockholm.

[41] *Gjuteriet* 1930 n 12, 1932 no 7.

various suggestions for its technical solution, now got a lot of space in the journal.[42]

Of course, the employers' efforts to do something about the silicosis risk varied strongly from plant to plant, due to not only power relations between the parties, but also to their awareness of the problem, technical know-how, economic resources and company cultures. Furthermore, the production structure varied from foundry to foundry, which meant that the plants often required specific solutions for cleaning up dust. In general, small companies had the worst work environment. After the war many new, small foundries were established, which both the Iron Works Association and the foundrymen regarded as the main obstacle for improvements of the work environment, as well as for a rational development of the trade in general. In several big companies, such as the Domnarvet Steelworks, which had great problems with silicosis, the company doctors, Karl Emanuel Hällsjö and his successors, especially the legendary Johan Pontén, worked actively to improve the work environment in the foundry. The company was one of the first firms in Sweden to replace quartz sand with olivine, and it had a leading position in the Iron Works Association's occupational health and safety committee.[43]

The employers rising interest in the silicosis problem, which also can be described as a reorientation towards a policy of exposition prevention, meant better preconditions for co-operation between the parties in the labour market on this problem. In the 1960s, the Industrial Safety Council took up the silicosis problem as well, mainly in the stone industry.[44] The 1950s and 1960s were the heydays of the Swedish Model of tripartite co-operation and the building up of the welfare state, the so-called People's Home. Successively the silicosis problem was subjected to this co-operation. However, the Swedish welfare system rested to a large extent also on experts. The field of occupational health and safety was no exception to this, which as we will see, in the long run had effects on the dialogue between local parties regarding the silicosis issue.

The Union Commitment

In international as well as in Swedish research it has been maintained that unions gave low priority to industrial safety questions, especially during the inter-war period. The New Zeeland sociologist Tom Dwyer claims that from about 1920, when a legislative system for workers' prevention and compensation had been established in most industrialised countries, unions generally lost their interests

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[42] *Gjuteriet* 1942 no 6-7, 1944 no 10-12, 1946 no 4-6, 1947 no1, 1947 no 6.

[43] Ibid; Ponten (1953); Ahlmark & Nyström (1960) pp 376-377; Thörnquist (1993); concerning the work environmental problems in general at the Domnarvet Ironworks, see Maths Isacson's chapter in this book.

[44] Arbetarskyddsnämndens styrelses årsberättelser 1965 och 1966.

in struggling for better working conditions. The institutionalisation of industrial safety in the companies, through for example the establishment of safety committees and the increasing bureaucratisation of the trade union movement contributed to this development as well. Thus, up to the 1960s, there was a "social peace" concerning occupational health and safety issues in most countries. Among others Dwyer mentions the USA, Australia and Sweden. Then, in the late 1960s, the radical political movement aroused a broad interest for work environmental problems within the trade union movement and in society as a whole.[45] However, he only discusses how the problem of industrial accidents was handled, and industrial safety cannot be reduced only to that problem. Furthermore, he does not take into account the various industrial relations systems in the countries mentioned and hence not the various socio-economic, political and cultural prerequisites for union commitment. The system of industrial relations refers to the character of the labour market parties and the institutionalised relations between them at micro and macro levels.[46]

As will be exemplified below, my research findings present another picture of the development of unions' commitment in industrial safety questions and contradict the perception of "social peace" during the period 1920 up to the late 1960s. In the iron and steel industry, which represented a big and important sector of Swedish industry, unions worked actively for safer working conditions, especially at the local level. They also took action against changes in the work processes that they suspected would increase the dust hazard as well as decrease workers' professional status. Furthermore the unions were committed to matters concerning workers' compensation and the transfer of workers to dust-free jobs. Their claims were not only addressed to the employers, but to the government as well. The central union representatives generally supported the local initiatives. They also carried out investigations on the spread of silicosis and organised a broader front against the silicosis problem within the labour movement. In addition, union claims in the iron and steel industry also concerned the great accident risks, although the employers paid more attention to this problem.

However, on the whole, the Swedish trade union movement had a weak position in the labour market during the inter-war period, and it often had to give priority to the questions of mass unemployment and wages. In the latter part of the 1930s, the prerequisites for union claims improved due to better trade conditions, the legal reinforcement of the position of the union safety representatives and the Social Democratic government's social reform policy in general. Hence, during this period, legislation seems not to have made the Swedish union passive, but provided them with the courage to act. During the 1940s and 1950s, the

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[45] Dwyer (1991) pp 72–80; see also Kelman (1981); what concerns the Swedish inter-war period, see Sund (1993), (1994).

[46] Thörnquist (2001); for a discussion of the concept of *industrial relations system* see Kjellberg (2001) pp 337-341.

Swedish model of co-operation in industrial safety was established, which of course implied a strong union commitment.[47]

Several American researchers have emphasised that the trade unions in the USA, which were on the rise and politically powerful in the 1930s and 1940s, were truly engaged in the silicosis problem as well. According to Rosner and Markowitz, for example, the issue was put on the national agenda in the 1930s in the first place due to "the activities of labourers struggling to control the conditions of work in a rapidly changing industry".[48]

Union commitment to the silicosis problem was also dependent on the workers' position in the production process. Ladle-men, moulders and other craftsmen had a more powerful position in the labour market than did the other foundry workers. The craftsmen had much more control over the work process and they could not be easily replaced. As they could organise their work comparatively independently, they also had better prerequisites to take measures to shelter themselves from both the stone dust and other hazards in the work environment. With the continuing mechanisation and rationalisation process though, the craftsmen lost much of their professional status, as their special competence was needed less often. However, this process progressed more rapidly and was more apparent in foundries where the rationalisation process had led to serial production. Many Swedish steel foundries produced highly differentiated and exclusive steel castings, which could not be manufactured without the traditional professional skills of ladle-men, core-makers and moulders. Hence, many craftsmen could retain a comparatively high degree of control over the work process. On the other hand, many dangerous work operations still persisted in these foundries because they could not be automated as they could in foundries with a more standardised production.[49]

Due to their position in the production process and their professional skills, Swedish foundry workers were also affiliated to two different, strong unions, which had different policies. Craftsmen such as ladle-men, moulders and core makers were organised in the Swedish Moulder Union. Those who worked with the sand preparation, the knocking-out of the castings and the cleaning of the castings, which also were those who were the most exposed to the dangerous silica dust, were generally organised in the Swedish Metal Worker Union *(Svenska Metallindustriarbetareförbundet)*. In 1962 the Swedish Moulder Union joined the latter. The Moulder Union was a craft union that restricted and controlled access to the trade. It had a decentralised organisation, with no national collective agreements. Wage differences were supposed to preserve workers'

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[47] Thörnquist (1993); (1994); (2001). Union struggle for better working conditions during this period is documented in other Swedish studies as well; see for example Olsson (1986); Lund & Gunnarsson (1987); Berggren & Olsson (1988).

[48] Rosner & Markowitz (1990) p 73; see also Rosenberg & Levenstein (1999) 206-209.

[49] Thörnquist (1993) pp 48-49; Thörnquist (1994) pp 340-343.

professionalism. Both wages and working conditions could vary greatly from plant to plant. The Metal Worker Union, on the other hand, was a centralised organisation with a broad social basis and it pursued a "trade-unionist" policy.[50]

In 1929, as noted above, the central board of the Moulder Union had made a nation wide investigation of the work environment in the foundries. Although the report showed that smoke, gas and dust were common problems in the foundries, silica dust or silicosis was not mentioned. When Bruce carried out his first study, the central board discussed the silicosis risks, but it did not give much information to the unions at the plant level on how to deal with the problem. Probably the foundry workers did not know about silicosis until someone at the workplace received this diagnosis.[51]

During the depression in the early 1930s the local branches of the Moulder Union at different iron and steel works had started to co-operate informally in the matter of wages for the purpose of avoiding competition from underbidding. When they became aware of the silicosis hazard, this turned into another natural question to rally around. Hence unions arranged annual conferences to keep themselves informed of the spread of silicosis, to co-ordinate their claims and, not least, to discuss what they could do on their own to minimise the dust. Their main union demand was that the collective agreements should include guarantees for technical preventive measures against silicosis in the plants. The most urgent measure to be taken by the employers was to move the dustiest parts of the work process, the knocking-out and the cleaning of the castings, to a special shop. Of course, this mainly benefited the craftsmen. Therefore, preventive measures against silicosis could reinforce the social segregation in the foundries between skilled and unskilled workers that had started earlier with the mechanisation and rationalisation processes. I will return to this below.

However, unions did not manage to get any guarantees for technical measures to protect the workers against dust in the collective agreements. Instead they turned this claim into a political question. The Metal Worker Union had long advocated this course, because their members generally had limited possibilities to change their own work process. Together with other unions concerned with the problem of silica dust and the LO, the Moulder Union and the Metal Worker Union requested legislation that would make technical measures to prevent dust mandatory and guarantee injured workers better compensation. However, when the Worker Protection Act eventually was revised in 1949, it was a disappointment for the unions. It would take another decade before the state started to act on the unions' demands.[52]

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[50] Thörnquist (1993) p 49.
[51] Ibid pp 51-52.
[52] Ibid pp 52-60.

The problems of recruiting workers to the foundries and, in the long run, the reproduction of skilled workers were also a union concern. In 1956 the central board of the Moulder Union carried out a new investigation of working conditions, an investigation that comprised about 230 foundries within both the iron and steel works and the engineering industry, for example the shipyards. Except for the 28 largest foundries, which at that time employed more than half of the about 10,000 foundry workers, the hygienic standard was still reported to be miserable. Many workplaces lacked for example both dressing rooms and dining rooms. The accident risks were still very high as well. The overwhelming problem, however**,** was still silicosis. As ventilation was a technically complicated matter to deal with locally, the board found it necessary to require special public factory inspectors for the foundries. The board also meant that radical improvements might not be carried out unless the whole trade underwent a structural transformation. Furthermore, the board presented a detailed suggestion for a governmental investigation of the dust situation in the foundries, which was supported by other unions representing those afflicted by silicosis and the LO. This led to a bill being put to the parliament in 1961, which was the prelude to the governmental silicosis projects in the 1960s and 1970s. Another union demand in order to reduce the number of disputes in insurance cases concerning silicosis was realised as well. A central committee to judge injuries caused by industrial dust, made up of both medical and technical experts, was established in the early 1970s. However, there were never any special factory inspectors appointed for the foundries, as there were for example for the forestry, the ships and the industry that produced explosives.[53]

Hence, from the 1930s and up to the early 1960s, the Swedish trade union movement, together with physicians such as Bruce and his colleges and several company doctors, were the main agents for the development of workers' protection against silicosis in the iron and steel industry. The handling of the silicosis problem also reflected very clearly the conflicting interests between the parties in industrial safety matters. Although management in the 1940s and 1950s began to see strong economic motives for investments in the work environment, there was indeed no "social peace" in this field.

In the international debate, Vincente Navarro has emphasised the importance of the strong trade union movement and the longstanding Social Democratic government for the successful development of the Swedish occupational health and safety policy. His main point is that the development of industrial safety in a country is ultimately determined by class interests.[54] I do agree with this conception. However, in studies on the concrete development, the role of the Social Democratic Party needs to be more analysed and discussed. In comparison with

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[53] Svenska Gjutareförbundet (1957); *Gjutaren* 1956, no 2, 1957 no 7.
[54] Navarro (1983).

the trade unions, the Social Democratic government advocated long a more liberal attitude towards the employers what concerned the regulation of technical preventive measures against industrial dust in the plants.

A Local Example

In the following I will give an example of how the silicosis problem was dealt with in the old ironworks community in Österbybruk, situated in North Uppland, in the former steel district in central Sweden. The main purpose is to show that co-operation in industrial safety in the sense of the Swedish Model, presupposed specific historical conditions to become established and to work successfully. The aim is also to show the complex social consequences of the silicosis problem at the local level, and to further discuss the driving forces behind the development of industrial safety. In the old paternalistic Swedish iron works communities, where workers were strongly dependent on the local industry and where families traditionally had lived for generations, the silicosis problem could turn into a real social trauma.[55] As the economic recession in the 1930s became longstanding within many trades, there was not much chance to get a job elsewhere either. In addition there was a longstanding housing shortage in the iron works communities that made workers less willing to leave the paternalistic welfare system, which, as mentioned above normally included workmen's dwellings. Consequently, fathers went on working and their sons followed into dusty shops with great fear for their health and lives.

This old Walloon ironworks had a traditional production structure, which included almost all stages in the iron processing industry. Thus, there were melting works, a forge, a rolling mill, a foundry, a mechanical workshop and a factory for the manufacturing of industrial knives. The raw material came from the famous Dannemora iron ore fields situated nearby. Traditionally the high-quality iron and steel produced here had been exported to for example Sheffield for the manufacturing of knives and other tools. In 1926, the old ironworks merged with a modern combine of ironworks in the region called the Fagersta Combine *(Fagerstakoncernen),* with *Fagersta Bruks AB* at their head. Österbybruk became a centre within this combine for the production of castings made of stainless steel and special alloyed steel for tools and machine parts that had to resist extreme strain of heat, acid and weight. The products were used mainly in the shipbuilding industry and in the pulp and steel processing industries. The castings differed greatly in size and shape and there was seldom any serial production. The manufacturing of such complicated products presupposed a permanent staff of skilled craftsmen, and therefore much of the traditional, paternalistic social organisation of work was kept almost intact up to the late 1940s.

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[55] Unless stated otherwise, the following pages draw on (Thörnquist 1993).

Österbybruk provides a good example of the silicosis problem in the iron and steel industry in many senses. Most of the hazardous shops were represented in this plant. There was a quartz crushing shop, furnaces that were lined with quartz, a steel foundry and a knife factory where workers ground the knife blades on dry sandstone wheels. There was even a shop for the manufacturing of grindstones. In the long run, the new steel foundry, which was established in 1931, became the most hazardous workplace. As the foundry was too small from the very beginning and, among other things, the ceiling was too low, the ventilation was not sufficient. From the late 1930s on, management set up increasingly advanced exhaust ventilation systems and the dustiest parts of the work process were moved to a separate room in the foundry, but the dust problem still remained. The production of strongly diversified and often very large castings made the rationalisation of dangerous work operations, such as the cleaning process, extremely difficult.

The example of Österbybruk also shows very clearly how the silicosis problem arose and how it affected the social relations in the steel foundry. In the old iron foundry that had existed since the late 19th century, the whole work process had been done in the same shop by moulders who did all kinds of work operations. In conjunction with the mechanisation process, there was however a job splitting, which caused a social segregation among the workers. The moulders and the ladle-men were the most well-paid craftsmen with the highest status, while those who worked with the sand preparation, the knocking-out and the heavy cleaning of the castings were both less paid and much more exposed to the dangerous silica dust. Furthermore, the work process gave the craftsmen better opportunities of sheltering themselves from the dust. They made their own practical arrangements to reduce the dust, often without asking the management for permission. Those who worked with pneumatic machines on the other hand could not do very much to change their own work process. Yet they had the most dusty and dangerous work operations. Consequently, the silicosis problem deepened the social gap between the skilled and the unskilled workers.

The first two cases of silicosis, which affected a quartz crusher and a sandblaster, were reported in the early 1930s. They had contracted silicosis after a short time, only 3 and 6 years respectively, in very dusty shops. The disease was in both cases further complicated by tuberculosis, and it progressed very fast. After a couple of years both men were dead. In the beginning of the 1950s over 50 workers had been afflicted with silicosis. Some of them had died and others had to change to new, often less qualified and less well-paid jobs. For craftsmen, such as ladle-men and moulders, who had great professional pride, this was a tragedy in itself.

A related problem was that the need for jobs to be set aside for the disabled was great during the decade after the Second World War, when the traditional order of organising the production and work finally began to be dismantled in

this old iron work community. Now, for example, the company engaged external entrepreneurs for many tasks within the maintenance sector, which traditionally had been big at the iron works communities. Thus many work tasks that had earlier been assigned to the old and handicapped disappeared at the same time as those who were afflicted by silicosis increased.

Furthermore, the development of the silicosis problem in Österbybruk shows that the paternalistic social order, which was based on individual and hierarchical labour-management relations, was an obstacle for co-operation in industrial safety matters in the sense implied by the Swedish Model. It should be emphasised that the development of this form for co-operation depended on special economic, social and cultural conditions. The establishment of trade unions was generally delayed in this sheltered labour market, where workers long were employed for life and where labour relations were characterised by strong personal interdependence and social control. It has been claimed that the social organisation of the paternalistic iron manufacturing community was the origin of the Swedish welfare system.[56] I do not agree with this conception however. In contrast to the paternalistic system, the Swedish welfare system, which the Swedish model was part of, presupposed developed capitalistic labour relations with organised and independent parties, collective bargaining and, not least, a developed representative democratic system.

In Österbybruk, workers started to unionise as late as 1919, and then they became strongly left wing. Consequently they regarded the reformist idea of co-operation between labour and capital with great scepticism. In the revision of the Worker Protection Act in 1931, workers' participation in work safety was recommended. Shortly thereafter, the central board in Fagersta initiated joint safety committees at the iron works in Österbybruk and at other works within the combine. In spite of this, the economic crisis and the increasing problem with silicosis deepened the antagonism between the workers and the company. Up to the late 1930s the committee did not deal very much with the dust problem. Nor did the Labour Inspectorate take much action. The main driving force for the development of the prevention of silicosis was the unions. The unions acted however mainly outside the safety committee, which they regarded only as a means of delaying any fundamental changes. Hence, the existence of a joint safety committee in a plant must not be regarded as proof of a working co-operation between the parties in the labour market.

In all essentials the company doctor, Ola Oredsson, supported the workers' interests. He inspected the dusty workshops and gave concrete suggestions as how to prevent dust development. He also made assessments of the effects on workers' health of the continuous, but comparatively moderate, mechanisation and rationalisation processes in the shops. By virtue of his medical authority, he

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[56] Enzensberger (1982); Isacson (1991).

tried to convince the company of the need to make investments to diminish the dust problem. Throughout the years he also tried to convince the management of the necessity to shut down the quartz crushing shop and to stop the manual sand-blasting, which in his view were the most dangerous work operations. Nonetheless, the unions often mistrusted Oredsson. He did not diagnose all suspected silicosis cases the way the unions expected and his personal appearance often provoked them. The fundamental problem, however, seems to have been the deep class distinctions in this old paternalistic milieu. Unfortunately, the workers regarded the company doctor per definition as the company's man.

During the 1940s, the silicosis issue gained increasing attention within management and safety engineers were engaged in the problem at both the company level and at the central level within the combine. In the late 1940s a major rationalisation project started up, which also included radical steps against the dust problem. In the first place it meant a major rebuilding of the steel foundry. The silicosis problem had caused the company great insurance costs and serious disruptions of the production. However, as in many other companies, the then most important motive for management to take action against the silicosis problem was the shortage of labour, which caused great problems for the company after the war. In addition, a new, liberal managing director and the beginning of a change in the trade union policy towards reformism, also resulted in a better basis for dialogue between the parties.

The complex development of modern labour relations in the field of industrial safety at the ironworks in Österbybruk was not unique in the Swedish iron and steel industry. Many companies had long paternalistic traditions and when the silicosis problem appeared in the 1930s, this hierarchical and personal system of labour-capital relations made it difficult for employers and the employees to co-operate as organised, free and equal parties in accordance with the Swedish Model. In addition, the balance of power in the labour market as a whole to the employers' advantage created few opportunities for peaceful co-operation between the parties.

At the beginning of the 1950s, the dustiest parts of the work process, the knocking out operation and the heavy cleaning, were moved outdoors as they were in many other steel foundries with the same type of production of large and complicated castings, which had to be cleaned manually. The dangerous dust was supposed to blow away in the open air. This step did however not solve the problem. Rather it generated new, serious work environmental problems since those who had to do the heavy cleaning had to work out-doors. The new working site was cold and windy and there were great risks for accidents. In the 1950s the company also began to use modern thermal cleaning processes that caused hazardous smoke and gas. In addition it was difficult to get rid of the quartz dust even outdoors. Those who took this kind of job were, significantly enough, mainly Finnish immigrants, who had been recruited to the Swedish iron and steel

industry during and after the second World War.[57] Therefore, the place was called the "Karelia" and it became an isolated working site in both a spatial and social sense. Generally the workers at Karelia were not unionised, and the unions on their hand, did not pay much attention to the bad work environment there either. The problem became more a dispute between different groups of workers at the working site and thus few claims were directed to the employers. Consequently the problems remained unsolved. The "solution" of the silicosis problem hence caused a new social segregation in the foundry. The resulting increase in competition between the workers further weakened union power on the whole.

As shown above, the organisation of industrial safety was increasingly bureaucratised at all levels in society during the post-war period. The role of the private and public professionals was strongly reinforced and the staff of safety professionals grew strikingly. This meant that advanced technical and organisational measures could be taken to solve the silicosis problem. But, in many plants it also meant that the dialogue between the parties was more or less discontinued. In Österbybruk the "solution" of the silicosis problem was mainly discussed over the heads of the workers. Although the solutions did not benefit all workers in the foundry and even generated new work environment problems for those who had the heaviest work operations, the silicosis issue disappeared from the agendas of the joint safety committees in many companies.[58] The silence worried the Moulder Union, not least in the light of the increasing number of registered silicosis cases in the iron foundries. The union investigation of the work environment in the foundries in 1956 should be regarded in this context.

From the 1950s on, many steel foundries replaced quartz sand in the moulds with olivine sand. Dust measurement and exhaust ventilation improved, and state control was reinforced. In addition, many foundries were shut down, which as mentioned was an important factor for the declining number of reported silicosis cases. Some foundries continued to use quartz; the one in Österbybruk, for example, up to 1992. During the international crisis within the steel industry in the early 1980s, the ironworks in Österbybruk was shut down and parts of it were sold out. In 1983, the employees bought the foundry and the mechanical workshop for a symbolic sum; otherwise these parts would probably have been shut down as well. Today the company, *Österby Gjuteri AB,* employs 100 workers and the company is one of the leading steel foundries in Sweden. It still specialises in exclusive castings of stainless steel and special alloyed steel of various kinds. For the company, high quality has always been the most important competitive advantage in the increasingly tough international market. According to both

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[57] Compare Rosner & Marcowitz pp 60-62.
[58] Rosner & Marcowitz have pointed out the same trend in the USA.

the management and the workers, this was the reason why quartz sand was used as long as up to the early 1990s.[59]

However, many other problems at the "Karelia" still existed in the mid-1990s. It is true that the foundry inherited them from the old company, but according to the Labour Inspectorate and the central union representatives, it was also a question of prioritising employment over safety. Yet even they could sometimes feel a divided loyalty in this matter. In the 1990s, North Uppland suffered from mass unemployment, as did the whole steel region in Central Sweden and everybody was interested in *the existence* of the employee owned foundry.[60] During the 1990s the company has taken measures to solve the problems at the "Karelia", for example, by improving the exhaust ventilation system, by practising job rotation and by elaborating new production methods. Today, this part of the facility is under construction and will be transformed to an in-door site.[61] Eventually, the main driving force for radically changing the work environment at the "Karelia" seems to have been business interests themselves, namely the increasing international claims for standardisation and certification of quality and of the protection of the external environment. Today, the work environment tends to be another important field for competition in the international market.

Finally, one can raise the question whether the motivation for investments in the work environment decreases when labour and capital become joined in the same hands. Is perhaps the dialectic relationship between labour and capital a dynamic force for the development of industrial welfare? Various kinds of co-ownership between labour and capital, which make the fundamental conflict between them less visible, are used in modern management strategies. These are however in the first place not meant to support the interests of the employees.

Concluding Remarks

The silicosis problem that emerged in the Swedish iron and steel industry in the 1930s, and which caused great suffering among workers during several decades thereafter, was an international phenomenon as well. The silica dust hazard came about mainly as a consequence of the increased production of steel castings and the mechanisation and rationalisation of the work process that had begun around the turn of the 20th century. Its social implication was not only a hazardous work environment, but also job splitting, a successive deskilling of craft-work and an increasing gap between skilled and unskilled workers. However, there was not a

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[59] *Gjuteriet* 2000, no 6; in august 2001, 63 employees are full owners according to the original principle "one man one wote", which is less than during the 1980s and 1990s.

[60] Interview with Rolf Ählberg, former central representative in work environment issues at the Swedish Metal Worker Union, Stockholm, September 20 1995.

[61] Interview with Hans Andersson, managing director at Österby Gjuteri AB, Österbybruk, July 6 2001.

simple relationship between rationalisation and silicosis. The efforts at solving the silicosis problem meant in turn that further technical and organisational measures of rationalisation were taken in the plants, which also could result in the establishment of new dangerous working sites and a new social segregation in the foundries. Hence, the silicosis problem was not only a conflicting labour-management issue in the plants. The dust problem – as well as its solution – also caused tension between different groups of workers, which of course also implied risks for a weakening of union power.

The work environment was supposed to be a central area for the Swedish Model of co-operation at all levels in society. Up to the 1960s, however, this co-operation mainly concerned the problem of occupational accidents. Thus the Joint Industrial Safety Council, for example, meant less for the solution of the silicosis problem in the iron and steel industry, which had its greatest problems during the period 1930–1960. Besides, the public policy of prevention long implied that the determinant factor for safety at work was the workers' own ability and willingness to avoid hazards. The solution of the silicosis problem depended more on the employers' ability and willingness to make expensive investments in the work environment. In the 1930s, however, the balance of power in the labour market made it difficult for unions to demand for costly improvements, and hence the silicosis problem was a highly conflicting issue between the parties. In addition, it would take two decades before the Social Democratic government started to support the unions' demands on stricter state control of the dust situation in the plants. In the traditional iron works communities, a common obstacle for co-operation in the way implied by the Swedish Model was the lingering paternalistic social and cultural structures. A matter of vital importance for the employers' readiness to voluntarily make radical and expensive investments to clean up the dusty shops was the great shortage of labour in the 1940s and 1950s. Hence, this also meant better preconditions for co-operation between the parties in the labour market.

A successful tripartite co-operation on the silicosis problem, in the first place at the national level, developed in the 1960s with the starting up of nation-wide silicosis investigations. Thus after hard pressure from the trade union movement the silicosis problem was eventually put on the national agenda and the state's control of industrial dust was reinforced. This development however also meant that the experts gained more and more influence on the solution of the silicosis problem, which seems to have weakened the dialogue between the parties at the local level.

The main agents and driving forces behind the development of workers' prevention of silicosis in the iron and steel industry were the trade unions and some devoted physicians. From the 1930s the unions within this important trade, as well as in other trades concerned with the silicosis problem, were increasingly committed to industrial safety matters in general. Hence, my results contradict

the conception that unions gave low priority to occupational health and safety during the inter-war period and up to the late 1960s. It is however important to consider the socio-economic, political and cultural prerequisites for union commitment over time. In addition, to understand the development of industrial safety and all the actors' commitment to these matters, as well as co-operation between them in this area, it is necessary to study not only how the problem of occupational accidents was dealt with, but also how the problem of industrial diseases was handled.

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Interviews

Interview with Rolf Ählberg, former central representative in work environment issues (centralt arbetsmiljöombud) at the Swedish Metal Worker Union, Stockholm, September 20 1996.
Interview with Professor Peter Westerholm, Arbetslivsinstitutet, Stockholm, December 13 2000.
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The introduction of female cooks in the forest broke the old division of labour between the sexes. Source: Skogsindustriarbetarens arkiv, Stockholm.