Asbestos Problems Yet to Explode in Korea

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Although asbestos mining and manufacture has occurred in Korea since the 1920s, it was not until the 1980s that the broader social democratic movement heightened public awareness of the health problems associated with exposure to asbestos. The first systematic national survey of asbestos-related diseases was conducted in 1993. In that year, the first case of asbestos-related disease was compensated by the government. This long-delayed recognition of asbestos-related disease took place in a country that already had more than 100 asbestos factories. About 40 to 50 mesothelioma cases are reported annually through the Korean Cancer Registry. Nonetheless, only six mesothelioma cases have ever been referred to the government for workers' compensation. Lung cancer is the fastest growing cancer in Korea. Over the last 15 years, mortality from lung cancer has more than tripled. Among all these lung cancer cases, only 12 have been recognized as occupational in origin and compensated accordingly. *Key words*: asbestos; Korea; mesothelioma; workers' compensation.

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Asbestos was mined in Korea, mainly under the Japanese occupation, before 1945. At the end of World War II, the mining stopped almost completely, but it resumed in the 1960s with the growth of the asbestos cement industry. In the mid-1980s, asbestos mining again stopped because the domestic production could not compete with cheap imports. The asbestos textile and brake lining industries started up in the 1970s, resulting in the import of raw asbestos that peaked at more than 90 thousand tons in 1992. Since that time, the activities of these industries have dwindled because of the economic situation in Korea. After the economic crisis in 1997, the importation of raw asbestos fell to less than a third of the previous peak level.

The first case of asbestos-related disease was reported in 1993, when a former asbestos textile worker was found to have malignant mesothelioma at the age of 46. She had been working at the same asbestos company for 19 years, and had had to stop working because of thoracic pain. She was initially treated for tuberculosis, but soon thereafter malignant mesothelioma was diagnosed and the causal relationship with asbestos recognized. Since that time, asbestosis and lung cancer due to asbestos exposure have also been recognized and compensated. The compensated cases were, however, mainly those of workers exposed to asbestos products, not from the asbestos manufacturing sectors.

The first systematic national survey of asbestos-related diseases among asbestos manufacturing workers was organized in 1993 by the author.[1] By that time, we had become aware of the potential for exposures to asbestos during the manufacturing of asbestos products. In Korea, the asbestos manufacturing sectors have been the target of occupational health and safety programs such as medical screening and workplace exposure measurements and controls. Most asbestos-related diseases occur in workers exposed to asbestos products, such as mechanics, welders, and maintenance workers. Shipbuilding, automobile manufacture, and automobile repair are high-risk sectors where we expect to find asbestos-related diseases.

ASBESTOS VICTIMS

Asbestos mining and manufacture had taken place in Korea for more than 30 years before the first case of asbestos-related disease was identified. Even though asbestos mines were in operation since 1920s, no case of asbestos-related disease with mining history has yet been identified and compensated by the government. Before 1945, conscripts for military duty were sent to mines of strategic value by the Japanese regime. Health and safety concerns could not be raised during the Japanese occupation. After 1945, the asbestos mining industry all but disappeared, for economic reasons. The government had paid no attention to the conditions in the asbestos mines, and health and safety problems among asbestos miners were largely ignored. We have no record of the numbers or whereabouts of miners from the early asbestos mining period.

Exposed Workers and Others

Only since the start of the asbestos cement industry in the 1960s have we been able to identify the numbers of workplaces and employees possibly exposed to

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TABLE 1. Numbers of Registered Asbestos-exposed Workers in Korea, 1993–2003

Year	The Number Registered
1993	4
1994	16
1995	7
1996	9
1997	98
1998	13
1999	21
2000	162
2001	77
2002	38
2003	4
TOTAL	449

asbestos. During the 1960s there was only one asbestos cement factory, with about 200 employees. By 1993, there were 118 workplaces with 1,476 workers in the asbestos manufacturing industry.[2] The mean tenure for asbestos cement and friction material workers was 6.7 years, and it was 4.8 years for textile workers. Based on the mean tenures and years of operation, the total number of workers exposed in these workplaces was estimated to be more than 7,000, with about 8% of them having been exposed for more than 20 years. These numbers were limited to those who had worked in asbestos manufacturing industries. Since 1993, those who have been exposed in asbestos manufacturing plants for more than three years have been able to register for a follow-up medical screening program and maintain a health record. To date, 449 workers have been registered in this program (Table 1).

The exposure levels for asbestos cement, friction materials, and textile industries were less than 0.5, 1–2, and more than 5 fibers/cc, respectively, during mid-1980s.[2] The exposure levels soon came down thereafter, but previous exposures had undoubtedly been much higher for all industries (Table 2).

We have no data on how many Korean citizens used asbestos products or worked and lived near asbestos mines and manufacturing facilities.[3] Neither do we know about the exposure levels of these people. One way to guess the exposure levels is to calculate the use of raw asbestos per capita per annum. Asbestos usage peaked at 2.2 kg/person/year in 1992 in Korea. It had come down to 0.5 kg/person/year by 2001, a figure still higher than those for most other developing countries.

Diseased and Compensated Workers

The first cases of asbestosis were found in 1993 with the first national survey of asbestos manufacturing facilities.[1] Among those examined, about 3% had chest x-ray findings compatible with asbestosis, and half of them also had restrictive lung function changes. There was a clear dose–response relationship when the groups were divided according to tenure. No worker with less than ten years of tenure had abnormal chest findings, while 8% of those with 20 or more years of work had abnormal findings (Table 3).

Lung cancer is the fastest growing cancer in Korea. Over the last 15 years, mortality from lung cancer has increased more than threefold (Table 4). It is now the second most common cancer among Koreans, slightly behind stomach cancer.[4]

To date, among all these lung cancer cases, only 12 have been recognized as occupational in origin and compensated accordingly. Work histories of the affected workers included exposures as underground facility keeper, foundry worker, plumbers, auto mechanic, maintenance workers, welder, and boilermaker. Only two of these cases occurred in workers who had worked with raw asbestos. The number of compensated lung cancer cases is very small in Korea, considering the emergence of mesothelioma cases among asbestos-exposed workers.

When the occupations of men who died of lung cancer deaths were analyzed, professionals, service and sales workers, plant and machine operators, and laborers were the groups with increasing numbers, while senior officials, technicians, craft and related trade workers, and house workers showed little or no

Table 2. Airborne Asbestos Fiber Concentrations by Year and Type of Industry

	Geometric Mean (Fibers/cc)								
	1984	1987	1988	1989	1991	1992	1993	1994	1996
Construction	0.40	0.27	0.23	0.53~0.15	0.52	0.08	0.17	—	0.14
Friction production	1.70	—	—	0.42	0.68	0.19	0.10	0.67	0.55
Textile	6.70	4.4~5.9	2.57	0.49~2.0	3.93	2.09	1.22	1.21	1.87
Asbestos board	—	—	—	1.04	—	—	—	—	—
Auto repair	—	—	1.60	0.85	—	—	—	—	—
Gasket	—	—	—	0.05	—	—	—	—	—
Ship repair	—	—	2.45	—	—	—	—	—	—
Shipbuilding	—	—	—	—	—	—	—	0.02	—
Brakepads	—	—	0.35	—	—	—	—	—	—
Rectification	—	—	—	—	—	0.10	—	—	—

TABLE 3. Prevalence of Asbestosis by Tenure among Asbestos Workers

Tenure	Asbestosis Cases*	Probable Asbestosis†	Possible Asbestosis‡
0–9 years	0% (0/82)	0% (0/82)	0% (0/82)
10–14 years	0% (0/15)	7% (1/15)	7% (1/15)
15–19 years	6% (1/16)	6% (1/15)	13% (2/16)
≥ 20 years	4% (1/26)	8% (2/26)	23% (6/26)
TOTAL	1.4% (2/139)	2.9% (4/139)	6.5% (9/139)

*Over 1/0 profusion according to ILO classification with compatible lung function tests.
†Over 1/0 profusion according to ILO classification without compatible lung function tests.
‡0/1 profusion according to ILO classification or other compatible pleural findings.

increase (Table 5). As for the women, service and sales workers showed an increase (Table 6). These findings suggest that some occupations are linked with increases in lung cancer, particularly for men, and that asbestos exposures among plant and machine operators and laborers deserves immediate further investigation in Korea.

In Korea, about 40 to 50 mesothelioma cases are reported annually through the Cancer Registry[5] (Table 7). In view of the fact that not all cancer cases are diagnosed by the participating hospitals, the annual incidence of mesothelioma among the general population in Korea is estimated to be around 1–2 cases per million. The sex distribution of reported cases is almost even.

Six mesothelioma cases have been referred to the government for workers' compensation. Their exposures to asbestos included work at shipbuilding, as a boiler operator and a mechanic, at the serpentine rock mines, and at the construction site. Only one of the six affected workers had worked in asbestos manufacture. This worker had been employed in a textile factory.

Victims' Organization

In Korea, there is not as yet any specific organization for asbestos victims. Only the pneumoconiosis victims' organization has been active, but it is mainly for coal miners. The Pneumoconiosis Act in Korea covers only miners, omitting those workers from the manufacturing sector. Because of the small number, geographic locations, and lack of legal representation, the voice of asbestosis victims has been weak.

NATIONAL SCHEMES OF COMPENSATION, TREATMENT, AND PREVENTION

Compensation Criteria

The compensation criteria for asbestos-related diseases are stipulated by the Workmen's Accident Compensation Insurance Law in Korea. Asbestosis, lung cancer, and mesothelioma are compensable diseases, and evidence of ten or more years of significant exposures at work is required for work-relatedness. The presence of asbestosis is not required for the compensation of victims of lung cancer or mesothelioma. Instead, the presence of hyaline plaques or calcified pleural plaques on chest x-ray, asbestos bodies in sputum, or significant numbers of asbestos fibers in biopsy tissues can be used as evidence of significant exposures. Because of the low level of awareness of asbestos-related problems among workers and their physicians, few of them raise the question of work relatedness. Moreover, because the work records are not available to support claims, the exposure history is often hard to substantiate for already deceased workers with fatal diseases such as mesothelioma or lung cancer. This is particularly true for those who have only used but not manufactured asbestos products. Accordingly, we are in the process of accumulating a knowledge base for acceptable expo-

TABLE 4. Lung Cancer Mortality in Korea by Sex

	Total		Male		Female	
	Lung Cancer Death (No)	Mortality (/100,000)	Lung Cancer Death (No)	Mortality (/100,000)	Lung Cancer Death (No)	Mortality (/100,000)
1983	2,140	5.8	1,517	8.2	623	3.4
1984	2,329	6.0	1,720	8.9	609	3.2
1985	2,888	8.3	2,147	12.0	741	4.4
1986	3,259	9.6	2,416	13.8	843	5.2
1987	3,561	10.4	2,684	15.3	877	5.3
1988	4,098	11.8	3,054	17.1	1,044	6.2
1989	4,590	13.2	3,470	19.3	1,120	6.7
1990	5,028	14.4	3,761	20.8	1,267	7.7
1991	5,532	15.2	4,225	22.0	1,307	7.7
1992	6,671	16.9	4,980	24.4	1,691	9.0
1993	7,325	17.4	5,456	25.4	1,869	9.1
1994	8,196	18.8	6,137	28.0	2,059	9.5
1995	8,546	18.9	6,377	28.1	2,169	9.6
1996	8,890	19.4	6,613	28.7	2,277	10.0
1997	9,566	20.8	7,070	30.5	2,496	10.9

TABLE 5. Lung Cancer Cases among Males by Occupation, 1983–1997

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total	1,049	1,126	1,430	1,556	1,697	1,875	2,055	2,169	2,409	2,711	2,815	3,076	2,985	3,102	3,147
Senior officials	29	42	30	30	36	42	33	53	45	64	17	21	11	10	25
Professionals	0	0	0	5	4	3	8	9	14	13	55	67	56	67	88
Technicians	81	97	109	126	141	153	158	165	205	192	66	34	58	25	88
Clerk	131	113	149	156	196	184	196	210	206	245	144	167	219	252	231
Service and sales	7	7	10	12	21	24	34	35	40	79	311	343	344	403	366
Agriculture/ fishery	351	372	490	504	490	588	640	652	760	842	905	1,011	959	925	950
Craft/related trade	107	110	143	154	178	216	231	255	293	426	289	343	268	281	258
Plant/ machine operator	0	0	0	0	0	0	0	0	0	0	86	89	187	101	95
Laborers	0	0	0	0	0	0	0	0	0	0	126	168	199	187	174
House workers	340	391	496	561	594	658	747	781	811	820	773	820	726	815	855
Soldiers	3	4	3	6	4	4	3	5	6	5	11	8	14	1	6
Unknown	0	0	0	1	33	3	5	4	29	25	32	9	44	35	11

sure criteria among end-user groups of asbestos products for the purpose of obtaining workers' compensation for victims.

Access to Treatment

Even though Korea has pneumoconiosis hospitals, it has not provided much in the way of medical treatment for asbestos victims. The reason behind a great deal of the hospitalization is to obtain wage replacement during the hospital stay. Most hospitalization is directed at acute terminal care. Rehabilitation and active secondary prevention of complications have been largely neglected. Moreover, except for providing scholarships for the education of children of victims, family support programs have had low priority.

Awareness Campaigns

Public campaigns about asbestos dangers have been staged by labor unions and nongovernmental organizations (NGOs) such as Green Alliance. In 2000, the Subway Workers Union had asked through public advertisements that former workers who had worked with asbestos during the construction of the subway identify themselves, because unsuspected asbestos installations had been found during renovations of the subway.

TABLE 6. Lung Cancer Cases among Females by Occupation, 1983–1997

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total	398	391	452	496	508	571	591	654	633	803	795	867	811	828	933
Senior officials	1	1	3	2	2	5	4	2	7	4	0	0	0	0	0
Professionals	0	0	0	0	0	0	0	0	0	1	6	9	9	7	9
Technicians	5	4	3	6	8	3	16	6	7	11	4	2	1	2	9
Clerk	8	9	13	14	10	15	9	28	17	26	5	6	6	10	12
Service and sales	0	1	1	4	2	0	4	7	3	8	45	40	27	40	50
Agriculture/ fishery	70	77	72	73	73	94	84	104	88	131	140	134	159	141	133
Craft/related trade	3	6	1	8	3	9	7	8	6	12	7	11	6	13	9
Plant/ machine operator	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Laborers	0	0	0	0	0	0	0	0	0	0	4	6	9	5	13
House workers	311	293	358	389	393	442	464	497	499	607	576	656	576	594	692
Soldiers	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	17	3	3	2	6	3	7	3	17	15	6

Table 7. Mesothelioma Cases in the Cancer Registry, by Year

	A	B	B/A (%)
1983	23,771	12	0.05
1984	21,381	18	0.08
1985	28,679	18	0.06
1986	36,175	28	0.08
1987	32,449	27	0.08
1988	42,135	36	0.09
1990	50,078	44	0.09
1991	51,730	23	0.04
1993	59,150	57	0.10
1994	60,911	37	0.06
1995	64,761	40	0.06
1996	72,323	44	0.06
1997	78,797	58	0.07
1998	76,868	48	0.06
1999	82,320	39	0.05
2000	83,846	45	0.05

*A = total number of cancer cases registered; B = mesothelioma cases.

Lawyer groups in Korea and environmental NGOs have jointly conducted a campaign for the compensation of asbestos-related diseases through the public media. However, this was not successful in bringing forth many new cases. The results of this campaign indicate the need for more targeted and specific campaigns directed at highly exposed groups of former workers.

National Asbestos Regulations

The Industrial Health and Safety Law requires employers to obtain permission for the use of raw asbestos in manufacturing processes.[6] Crocidolite and amosite were banned in Korea in 1997, leaving only the chrysotile as the currently used form of asbestos. The occupational exposure limit for chrysotile was established in 1986 at 2 fibers/mL, and it was lowered in 2001 to 0.1 fiber/mL, which will be in effect from 2003. Those who have worked at an asbestos manufacturing site for more than three years can maintain a health record and become eligible for follow-up medical screenings even after leaving the site. However, one of the failings of the regulation is that only current employees are covered by the health and safety programs. Once they leave the workplace, it is extremely difficult to maintain the health record. Neither employers nor employees are interested in providing or receiving health and safety benefits because of complicating economic and privacy issues.

Industries using asbestos products, such as construction and shipbuilding, are largely untouched by the regulation, and some high-risk groups such as mechanics have not been targeted by any prevention efforts of the government. As a result of the efforts of the Subway Workers Union, workers who are involved in the removal and abatement of asbestos have been covered by the regulatory protection since 2001.

LESSONS LEARNED

Asbestos became a social concern in Korea as a part of the social democratization following the massive people's demonstrations in 1987. As in other countries, health and safety measures were recognized when joined with human rights issues in general.

The asbestos industries have been in decline since the early 1990s in Korea, mainly as a result of a worsening economic environment, but also partly due to the stricter regulations to prevent health problems. In the early 1990s, automobile manufacturers were required to use non-asbestos friction materials when exporting cars to developed countries. At the same time, asbestos textiles imported from other developing countries such as China and Indonesia had become much cheaper. This resulted in transferring asbestos textile plants to those developing countries. As a result, since the mid-1990s in Korea, imports of asbestos friction materials and textiles increased far more than exports.[7]

In addition to the economic pressures, the efforts of unions, NGOs, and lawyers have contributed to raising public awareness and to demands for attention to asbestos-related problems. Even though it was easily recognized that asbestos victims have economic problems as well as medical problems, a neglected fact was that they have social problems too. For some of them, it was not easy to bring up the problem voluntarily because of the stigma attached to "troublemakers" or "dissidents." Because of this we feel that one of the missing links in the problem-solving process is the social worker. For many of those victims who still have to support their families and want to have an active role in society, compensation cannot be the sole solution.

The other problem in the process is the inflexibility of the workers' compensation system. In Korea, the compensation and monitoring scheme is geared mainly to coal workers' pneumoconiosis, and no specifically tailored program exists for asbestos victims. The differences in lung function test results and x-ray findings between asbestosis and coal workers' pneumoconiosis are often ignored in the screening and compensation process, with negative effect on their prognoses.

FUTURE TASKS

The asbestos problem in Korea is yet to arise. The incidence of mesothelioma in Korea is still low, around the pre-epidemic level of other countries. However, the major use of asbestos occurred only after the 1960s, and we are now beginning to observe asbestos-related health problems. We do not know the past occupational exposure patterns and environmental burdens, but most of asbestos-related health problems to date

have been found among workers exposed to asbestos products rather than miners. For almost all of these workers, we do not know the levels of past exposures.

Since 2001, workers who are involved in removing asbestos products and in asbestos abatement have been protected by regulation. However, asbestos products are currently sold at hardware stores in Korea without any public warning or Material Safety Data Sheet. No campaign or educational program has been conducted to benefit workers exposed to asbestos products. Even though the regulation is there to be implemented, it is not always practical to expect it will happen. We need much heightened safety and health cultures in Korea.

To raise social awareness and to target the potential problem areas, we need to have systematic and effective surveillance programs, not just medical screening and workplace exposure measurements. One useful approach would be a mesothelioma registry. And of primary importance, we need to advocate the total ban of all forms of asbestos in Korea.

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