

# Workshop Presentation

## **9.3 ASBESTOS PROBLEMS IN KOREA: HISTORY AND CURRENT SITUATION**

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## **9 ASBESTOS PROBLEMS IN KOREA: HISTORY AND CURRENT SITUATION**

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### **The History of the Asbestos Industry**

Asbestos has been mined in Korea since the 1930's under Japanese control. At that time, asbestos was used mainly for the ship-building industry and the Japanese navy was the main consumer. Over two dozen mines were operating under the Japanese occupation which ended at 1945. One of them which was located at Kwang-Chun, Korea, was the largest chrysotile mine in Asia with more than 1000 miners. At that time, all men had to go into the army for World War II, but if they worked at the mine they were exempt from the conscription.

After the withdrawal of the Japanese from the Korean Peninsula, the production of asbestos dropped steeply (Table 1). Almost negligible amounts were mined. However, with the introduction of economic development plans in Korea since 1960's, asbestos consumption has increased again. Especially production of slate and other asbestos containing construction materials increased markedly following the nationwide renovation campaign of traditional houses in the countryside. With this as a signal, asbestos imports, as well as domestic mining, have increased steadily (Table 2).

**Table 1. Amount of asbestos mined in Korea by year (metric tons, MT)**

Year	Amount	Year	Amount	Year	Amount	Year	Amount	Year	Amount
1944	4,815	57	96	67	2,388	77	6,180	87	2,518
45	1,303	58	22	68	-	78	13,616	88	2,428
46-49	-	59	88	69	6,515	79	14,804	89	2,351
50	46	60	740	70	1,513	80	9,854	90	1,534
51	46	61	341	71	-	81	13,614	91	0
52	46	62	1,333	72	-	82	15,933	92	0
53	46	63	2,037	73	-	83	12,506	93	0
54	46	64	1,402	74	-	84	8,062	94	0
55	66	65	1,710	75	4,345	85	4,703		
56	54	66	687	76	4,762	86	2,983		
Total									145,533

- : unknown

**Sources:** Mineral year book (U.S.A., 1944-1992), Korean Mineral year book (1970-1993), Yearbook of Korean Corporation of Mine Development (1980-1993), Report of Energy and Resource Institute, Mining and Manufacturing Statistical Report, Ministry of Economic Planning, Bureau of Statistics, Census Report of Mining and Manufacturing Industries (1958), Year book of Korean Industry and Commerce Bank, Korean Geological Report, Japanese Colonial Office of Korea, Bureau of Geological Survey (1941), A study on Korean Mines (1944), Report on Korean Mines (1941-45), Japanese Colonial Office of Korea.

**Table 2. Amount of asbestos imported and exported by year**

Year	Amount (MT)		Year	Amount (MT)	
	Import	Export		Import	Export
1976	74,206	16	1986	68,017	0
1977	70,255	75	1987	77,598	41
1978	48,898	10	1988	87,470	0
1979	58,610	8	1989	77,475	0
1980	36,787	30	1990	74,549	0
1981	53,787	40	1991	88,753	157
1982	44,038	12	1992	95,476	23
1983	60,896	0	1993	82,854	18
1984	59,693	0	1994	83,276	0
1985	57,143	17	1995	88,722	0
Total				1,216,505	447

**Sources:** Korean Mineral year book, Yearbook of Korean Corporation of Mine Development, Statistics of Import and Export (1974-1993), Ministry of Economic Planning, Bureau of Statistics, Bureau of Statistics in Korea, Yearbook of Commerce Statistics (1974-1993), Bureau of Taxation

There have been three major uses of asbestos in Korea. Besides the manufacturing of construction materials, asbestos textiles and brake-lining production are the other two industries. These three industries have accounted for more than 95% of usage of raw asbestos fibers in Korea (Table 3).

**Table 3. Consumption of imported asbestos by type of industry (MT (%))**

Year	Construction <sup>1</sup>	Friction <sup>2</sup>	Textile <sup>3</sup>	Others <sup>4</sup>	Total
1976	71,312(96.1)	1,484( 2.0)	1,113(1.5)	297(0.4)	74,206
1981	48,032(89.3)	3,926( 7.3)	1,399(2.6)	430(0.8)	53,787
1985	49,143(86.0)	4,686( 8.2)	2,685(4.7)	629(1.1)	57,143
1990	61,354(82.3)	7,828(10.5)	4,100(5.5)	1,267(1.7)	74,549
1993	68,189(82.3)	8,700(10.5)	4,226(5.1)	1,740(2.1)	82,854

<sup>1</sup> Construction: asbestos slate, asbestos board, asbestos tile, asbestos papers, etc.

<sup>2</sup> Friction: brake linings and pads etc.

<sup>3</sup> Textile: asbestos yarn, thread, ropes, cords, packing, clothing, etc.

<sup>4</sup> Others: gasket, paper, paint, etc.

Manufacturing of brake-lining and other friction materials had started in Korea around mid-1960's with the opening of automobile assembly plants. At first, used asbestos fabrics, especially those discarded

from ship-repairing processes, were used as the raw materials. Quite soon, the consumption of asbestos by this industry increased with the growth of automobile manufacturing industries until the early 1990's. As developed nations began to ban the use of asbestos brake linings for small automobiles from the early 1990's, the use of asbestos for brake lining in Korea also was cut back.

The third major asbestos industry in Korea, that is asbestos textile manufacturing, had started in the early 1970's. This was because of the tightening of safety and health regulations in developed countries, especially Japan and Germany. "Rex-Asbest", one of the largest asbestos textile companies from Germany started operations in Korea in the early 1970's and several Japanese textile companies moved over to the southern part of Korea just after the 1974 enactment of the Japanese Occupational Safety and Health Act. At that time no special precautions were exercised about asbestos in Korea. Even though a workers' health examination program had been instituted in 1963 in Korea, no specific screenings such as spirometry and full-size chest X-ray were employed. The first measurement of asbestos fiber in Korea was attempted only after the mid-1980's. The measurement results showed that overall the asbestos textile industry was the dustiest one in Korea (Table 4).

**Table 4. Airborne asbestos fiber concentrations by year and type of industry**

	GM (fibers/cc)								
	1984 <sup>1</sup>	1987 <sup>2</sup>	1988 <sup>3</sup>	1989 <sup>4</sup>	1991 <sup>5</sup>	1992 <sup>6</sup>	1993 <sup>7</sup>	1994	1996
Construction	0.40	0.27	0.23	0.53 ~ 0.15	0.52	0.08	0.17	-	0.14
Friction	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 bord	-	-	-	1.04	-	-	-	-	-
Repair auto	-	-	1.60	0.85	-	-	-	-	-
Gasket	-	-	-	0.05	-	-	-	-	-
Repair ship	-	-	2.45	-	-	-	-	-	-
Shipbuilding	-	-	-	-	-	-	-	0.02	-
Brakepads	-	-	0.35	-	-	-	-	-	-
Rectification	-	-	-	-	-	0.10	-	-	-

**Sources:** 1984<sup>1</sup>: Ministry of Labor, National Institute of Labor Science. 1987<sup>2</sup>: Dooyoung Park, Namwon Paik, Ministry of Labor, National Institute of Labor Science. 1988<sup>3</sup>: Namwon Paik, Yongchul Shin. 1989<sup>4</sup>: Namwon Paik, Korean Occupational Safety and Health Agency. 1991<sup>5</sup>: Namwon Paik, Youngwhan Lee. 1992<sup>6</sup>: Semin Oh, Dooyoung Paek, Yongchul Shin, Korean Occupational Safety and Health Agency. 1993<sup>7</sup>: Korean Institute for Industrial Health.

The asbestos industries have been shrinking since the early 1990's in Korea. This is mainly because of the worsening economic environment, and partly due to the stricter regulations following social worries about hidden problems. As mentioned above, automobile manufacturers had to use non-asbestos friction materials to export cars to developed nations, and this brought the cut-back of asbestos usage in friction material manufacturing industries. At the same time, cheaper asbestos textiles could be imported from other developing countries such as China and Indonesia, and this resulted in transferring asbestos textile plants to those developing countries. As a result of these changes, the amount of imported asbestos friction materials and asbestos textiles has increased more than that of exported ones since the mid-1990's in Korea (Table 5). Before those changes in Korea, raw asbestos fibers were imported, while more fabricated asbestos products were exported.

**Table 5. Asbestos-containing materials imported/exported by year and type of industry (tons)**

Year	Construction <sup>1</sup>		Friction <sup>2</sup>		Textile <sup>3</sup>	
	Import	Export	Import	Export	Import	Export
1964	0.4	0	0	0	0	0
1965	0.4	0	0	0	0	0
1966	0.7	0	0	0	0	0
1967	0.4	0	0	0	0.3	0
1968	0.3	0	0	0	0.3	0
1969	430.2	0	17.6	0	658.3	0
1970	108.6	0	11.2	0	713	32.3
1971	64.5	23.5	35.4	0	990.1	101.4
1972	507.4	94.2	17.6	162	6,583	387.4
1973	630	5,619	7.8	8.8	32.6	0
1974	715.2	1,722	5.7	50.2	85.5	0
1975	1,146.1	11,722	9	38	109	0
1976	1,221	12,042	16.4	33	51	0
1977	1,511.8	6,634	169	16	253.9	659
1978	2,239	26,682	26.9	8.9	168.3	714
1979	1,930	6,759	34	8.6	44	1,374
1980	2,437	3,598	21	123	10.6	1,375
1981	5,943	38,952	19.6	149.2	86	12,260
1982	3,879	480	34	191	21.9	1,266
1983	4,943	870	48	160.3	34.5	633
1984	2,148	1,748	41	32.4	33.8	1,462.8
1985	3,929	1,310	53	56	30.1	1,766.8
1986	1,758.6	2,831	91	351	153.1	1,746.7
1987	2,562.1	2,385	273	892	17	1,893
1988	718	1,286.3	439	755	838.1	2,952
1989	2,996.5	1,214.8	466	692	918.3	2,364
1990	3,896.8	710.1	302	331	3,016	1,676
1991	4,086.3	1,395	317	259	2,089.1	1,528
1992	4,095.6	732.7	360	480	2,664	1,201
1993	4,133.5	1,099	580	319	1,636.7	996
Total	58,032.3	129,959.5	3,395.2	5,116.4	21,238.7	36,388.4

<sup>1</sup> Construction: asbestos slate, asbestos board, asbestos tile, asbestos papers, etc.

<sup>2</sup> Friction: brake linings and pads etc.

<sup>3</sup> Textile: asbestos yarn, thread, ropes, cords, packing, clothing etc

**Sources:** Statistics of Import and Export (1964-1993), Bureau of Statistics in Korea, Yearbook of Industrial Production (1975-1993), Bureau of Statistics in Korea.

## Health Problems Associated with Asbestos Use

The first asbestos victim in Korea was identified in 1993, when a former asbestos textile female worker was diagnosed with mesothelioma at the age of 46. She gave up working at the asbestos textile factory a year before the final diagnosis due to the worsening pain. Because she had been working at only one company for 19 years, and mesothelioma was a rare cancer, job exposure was rather easily suspected as a cause of her disease after the final diagnosis. Since then, five more mesothelioma cases were referred

for workmen's compensation. However, their exposures to asbestos involved work at ship-building, boiler and mechanics, serpentine mines, or construction sites, and none of these five cases worked in primary asbestos industries, such as manufacturing of construction materials, brake linings or asbestos textiles.

In Korea, about 40 to 50 mesothelioma cases are reported annually through the cancer registry (Table 6). Considering the fact that not all cancer cases are diagnosed or reported at major participating hospitals, the annual incidence of mesothelioma among the general population in Korea stays around 1-2 cases per million. The sex distribution is almost even with equal numbers of mesothelioma cases among men and women.

**Table 6. Mesothelioma cases among Cancer Registry cases by year**

Year	Total No of Cancer Registry Cases (A)	Mesothelioma Cases (B)	B/A (%)
1983	23771	12	0.05
1984	21381	18	0.08
1985	28679	18	0.06
1986	36175	28	0.08
1987	32449	27	0.08
1988	42135	36	0.09
1990	50078	44	0.09
1991	51730	23	0.04
1993	59150	57	0.10
1994	60911	37	0.06
1995	64761	40	0.06
1996	72323	44	0.06
1997	78797	58	0.07
1998	76868	48	0.06

Lung cancer is the fastest growing cancer in Korea, and over the last 15 years the mortality has increased more than 3 times (Table 7). Nowadays, it has become the third most common cancer among Koreans, just next to stomach and liver cancers.

Among these lung cancers, 4 cases were referred for workmen's compensation up to now. Their work history included exposures as underground facility keepers, foundry workers, auto mechanics and maintenance workers. Similar to the cases with mesothelioma, none of the lung cancer cases worked in primary asbestos industries. This number is far too short of potential asbestos cases in Korea, considering the fact that up to a 1:4 ratio can be expected between mesothelioma and lung cancer cases due to asbestos exposures.

When the occupations of lung cancer victims among men were analyzed over the years, professionals, service and sales workers, plant and machine operators, and laborers were the groups with fast increasing numbers, while senior officials, technicians, craft and related trade workers, and house workers showed little or no increase over the period (Table 8).

As for the women, service and sales workers were one of the fast increasing groups (Table 9). These analyses suggest that occupational activities are linked with the increase in lung cancer, especially for men, and asbestos exposures among plant and machine operators and laborers should deserve further attention in the near future in Korea.

**Table 7. Lung cancer mortality in Korea by sex**

Year	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	2140	5.8	1517	8.2	623	3.4
1984	2329	6.0	1720	8.9	609	3.2
1985	2888	8.3	2147	12.0	741	4.4
1986	3259	9.6	2416	13.8	843	5.2
1987	3561	10.4	2684	15.3	877	5.3
1988	4098	11.8	3054	17.1	1044	6.2
1989	4590	13.2	3470	19.3	1120	6.7
1990	5028	14.4	3761	20.8	1267	7.7
1991	5532	15.2	4225	22.0	1307	7.7
1992	6671	16.9	4980	24.4	1691	9.0
1993	7325	17.4	5456	25.4	1869	9.1
1994	8196	18.8	6137	28.0	2059	9.5
1995	8546	18.9	6377	28.1	2169	9.6
1996	8890	19.4	6613	28.7	2277	10.0
1997	9566	20.8	7070	30.5	2496	10.9

**Table 8. Lung cancer cases among males by occupation**

1983-1997 (Year)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Male Total	1049	1126	1430	1556	1697	1875	2055	2169	2409	2711	2815	3076	2985	3102	3147
1 Senior Officials	29	42	30	30	36	42	33	53	45	64	17	21	11	10	25
2 Professionals	0	0	0	5	4	3	8	9	14	13	55	67	56	67	88
3 Technicians	81	97	109	126	141	153	158	165	205	192	66	34	58	25	88
4 Clerk	131	113	149	156	196	184	196	210	206	245	144	167	219	252	231
5 Service and Sales	7	7	10	12	21	24	34	35	40	79	311	343	344	403	366
6 Agriculture/Fishery	351	372	490	504	490	588	640	652	760	842	905	1011	959	925	950
7 Craft/ Related Trade	107	110	143	154	178	216	231	255	293	426	289	343	268	281	258
8 Plant/Machine Op	0	0	0	0	0	0	0	0	0	0	86	89	187	101	95
9 Laborers	0	0	0	0	0	0	0	0	0	0	126	168	199	187	174
10 House Workers	340	391	496	561	594	658	747	781	811	820	773	820	726	815	855
11. Soldiers	3	4	3	6	4	4	3	5	6	5	11	8	14	1	6
12. Unknown	0	0	0	1	33	3	5	4	29	25	32	9	44	35	11

**Table 9. Lung cancer cases among females by occupation**

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

Asbestosis screening was attempted in 1993 among asbestos textile workers in Korea. Among those who had been screened, about 3% showed compatible chest x-ray findings 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 workers with less than 10 years of tenure showed abnormal chest findings, while 8% of those with 20 or more years of work showed abnormal chest x-ray findings (Table 10).

**Table 10. Prevalence of asbestosis according to exposure duration among asbestos workers**

Tenure	Asbestosis Cases <sup>1</sup>	Probable Asbestosis <sup>2</sup>	Possible Asbestosis <sup>3</sup>
0 - 9	0% (0/82)	0% (0/82)	0% (0/82)
10 - 14	0% (0/15)	7% (1/15)	7% (1/15)
15 - 19	6% (1/16)	6% (1/15)	13% (2/16)
20 -	4% (1/26)	8% (2/26)	23% (6/26)
Total	1.4% (2/139)	2.9% (4/139)	6.5% (9/139)

1. Asbestosis: over 1/0 profusion according to ILO classification with compatible lung function tests
2. Probable Asbestosis: over 1/0 profusion according to ILO classification without compatible lung function tests
3. Possible Asbestosis: 0/1 profusion according to ILO classification or other compatible pleural findings

## Current Regulations and Potential Problems

At present, crocidolite and amosite are banned and only chrysotile is allowed for use in the manufacturing of asbestos products. Employers are required by the Industrial Health and Safety Act of Korea to provide health and safety measures for employees when they make asbestos products directly with raw asbestos fibers.

However, those industries which use, install, or remove asbestos products, such as construction, insulation, mechanics or maintenance works are exempt from providing specific health and safety measures for asbestos. Even though most of the compensated mesothelioma and lung cancer cases up to now in Korea have worked in these industries, we have no idea about the numbers exposed or level of exposures among these workers.

Asbestos products are currently sold at hardware stores in Korea without any particular warning or material safety and data sheets. No one single specific provision such as a campaign or educational program has been made to protect employees at hardware stores and their customers who buy and use asbestos products.

The other pitfall of current regulation is that only current employees at the covered worksite can be reached by the health and safety programs. Once they leave the workplace, it is hard to follow them or keep registers updated. Neither employers nor employees are interested in providing or receiving health and safety programs because of entangled economic and other privacy issues.