

exposures in the Paterson plant. Dr. Corn responded:

I think the procedure is precisely what we're trying to do in industrial hygiene. And I would endorse trying to link similar plants where no measurements were available to other plants where measurements are available. There's no question about that.

I would classify Tyler as one of the most contaminated asbestos facilities I've ever been in. I think Tyler would be the high estimator. Port, I would consider typical of asbestos processing that I saw in those years. But Tyler was clearly a very bad facility. . . . So I don't know if averaging them, averaging might put you on the high side if you have measurements for both. I would pit you towards Tyler. . . . Tyler was a fairly startling facility [Tr. 7/3, p. 67].

Hence, given Dr. Corn's characterization of conditions in the two plants, to the extent that OSHA used data from the Tyler plant, the estimates of exposure would be *overestimated*, which would result in an *underestimate* of the potency factor, K_L .

Since the time of the OSHA proposals, the Seidman et al. study has been updated to include longer followup and an expansion of the findings in terms of the jobs of the workers and estimates of the fiber exposure accumulated by the workers during their work at the amosite asbestos factory. The updated study was presented at the hearings as Exhibit 261-A. The study extended the observation period through December 31, 1982, with a total of 593 deaths. Using the data from the Tyler Texas and Port Allegheny plants, Seidman and colleagues attempted to "assign plausible estimates of the exposures likely to have been associated with particular jobs in the Paterson plant" [Ex. 261-A, p. 6]. Seidman described the process as follows:

With the aid of the expertise of Dr. William Nicholson, I've gone back to the records that were accumulated on the Paterson workers, and in conjunction with fiber counts that were available for 1967 from Port Allegheny Plant and for 1967, 1970, and 1971 for the Tyler, Texas plant, the same kind of fiber was used, the same kind of equipment was used, the same processes were used to make the same kinds of products, we arrived at approximate—we estimated—looking at what the men themselves reported as to relative levels of dustiness in the jobs they worked at. We established levels of dustiness, dust index which at first was all I thought we could work with and I realized we had specific jobs that we could even modify this with, we assigned fiber counts per cc and then were able to then, with the aid of our historical data, to make an assignment which we applied to our Paterson plant. Then with the aid of the time that the men worked, we arrived at the total work time they worked at the plant, a total work experience dosage in terms of fibers [Tr. 7/12, p. 289, emphasis added].

As Mr. Seidman pointed out, when using the estimates of Tyler and Port Allegheny to determine exposures at the New Jersey plant, the estimates.

. . . may be somewhat on the high side to the extent that industrial hygienists tend to over-sample the dustier areas of factories. Also, there was a concerted effort to have the Paterson plant workers use respirator protectors which presumably might have reduced the exposure from inspired air while the protectors were being used. . . . It is important to realize that any overestimation there may be in the fiber counts we have assigned, will serve to underestimate the dose-response relationships associated with asbestos exposure at the Paterson plant [Ex. 216-A, p. 6].

Table 5 of Ex. 261-A shows the estimated exposures for over 30 job categories. During cross-examination, Mr. Seidman further explained:

Table 5 comes from two sources, one is internal and one is external. Internally, we had for about 40 percent of the men, a statement as to the dustiness of their job. We had—they said what their job was and how dusty it was; very dusty, somewhat dusty, or not dusty at all. . . . We had, for a number of jobs, what the counts—fiber counts—were for the jobs which, as I say, using the same kind of equipment, and same fiber and same kind of product, were in these plants of the same company. These were the general levels used to assign the jobs at UNARCO [Paterson, N.J.] and then modified them slightly depending on what the internal statement as to dustiness was [Tr. 7/12, p. 298-299].

Dr. Nicholson explained further:

The exposure-response data were generated by assigning each individual in the Paterson plant an exposure as calculated above for the period of time he would have been employed in a job with that given title. The total exposure in fiber-years/ml for each individual was then calculated summing over all jobs that the individual worked in [Ex. 303].

Table 1 gives cumulative observed and expected deaths for the workers in an amosite factory categorized by estimated fiber-year exposure. As noted in Ex. 84-392, it was believed that the average exposure for this population was approximately 35 f/ml, and this was the value used to calculate the original value of K_L for this cohort. However, in this updated analysis the average exposure was discovered to be closer to 50 f/ml [Tr. 7/12, p. 291]. Mr. Seidman indicated that the high number resulted when the estimates of fiber counts were "weighted by the kinds of jobs that the Paterson people had; [and] the number of people working at the jobs they had in the Paterson plant" [Tr. 7/12, p. 294]. Seidman went on to testify that "if you look at the historic data, there are ranges which go higher, but not

on the averages. There are ranges, there are samples that go into the 200's" [Tr. 7/12, p. 295]. He noted, however, that the estimate of 50 f/cc "seems pretty reasonable and plausible to me" [Tr. 7/12, p. 295].

As was pointed out by Mr. Hardy, representing the AIA/NA, during cross-examination, the dose-response curve appears to cross the y-axis at a level above zero. However, Mr. Seidman was clear that possible underestimation, errors in the measurements could not account for such differences. He commented—

To move them [the risk points at each dose level] far enough over so that the point on the straight line from this kind of material is going to come to zero [excess risk] on a straight line fit, they'd have such a cloud of dust, they wouldn't see each other at the next bench. . . . People couldn't work in such [conditions]—even the people who need a job desperately couldn't work in such an atmosphere [Tr. 7/12, p. 308].

TABLE 1.—CUMULATIVE OBSERVED AND EXPECTED DEATHS IN AN AMOSITE ASBESTOS FACTORY, 1941-45, BY ESTIMATED FIBER EXPOSURE—SEIDMAN, 1984¹

Cumulative exposure f-y/ ml	Midpoint	Lung cancer		
		Observed	Expected	SMR
<6	(3.0)	14	5.31	*264
6.0 to 11.9	(9.0)	12	2.89	*415
12.0 to 22.9	(18.5)	15	3.39	*442
23.0 to 49.9	(37.5)	12	2.78	*432
50.0 to 99.9	(75.0)	17	2.38	*714
100.0 to 149.9	(125.0)	9	1.49	*604
150 to 249.9	(200.0)	12	1.32	*909
250 plus	(250.0)	11	0.94	1,170
Total		102	20.51	49

¹ From Table 7, Seidman, 1984, Ex. 261-A.

* p < .001.

* p < .01.

In its original evaluation of this study, OSHA used overall averages (SMR=4.46, 35 f/cc, 1.46 years) to compute the K_L [0.068=(4.46-1)/(35×1.46)]. Substituting the overall values from the updated study gives a slightly smaller value of K_L [0.054=(4.97-1)/(50×1.46)]. In addition, the updated and expanded data base now provides enough data to perform a dose-response regression for the lung cancer data. The data are found in Table 1. As with other data sets, it may be speculated that there is greater uncertainty in the estimates at lower doses. This may be adjusted for by forcing the curve through the origin. Regressing excess SMR on the midpoints of dose gives an estimate of K_L of 0.045. Although this value of K_L is somewhat lower than the originally predicted value of 0.068, OSHA has greater confidence in it as an accurate