

table shows that this reduction in particle size eliminated the carcinogenic effect of these samples. It also greatly reduced their fibrogenic action.

TABLE 2. - Tests for carcinogenicity of six preparations of chrysotile in groups of 50 hamsters each

Chrysotile preparation	Mean fiber length		Mean fiber diameter		No. of mesotheliomas
	OM, micrometers	EM, micrometers	OM, micrometers	EM, micrometers	
Soft.....	32.5	6.9	2.2	0.18	8
Soft (heated).	-	-	-	-	10
Harsh.....	38.9	5.3	2.9	.2	9
Soft.....	-	.9	-	.03	0
Soft (heated).	-	-	-	-	0
Harsh.....	-	.4	-	.07	0

OM Optical microscope.

EM Electron microscope.

Now, we have tested a sample of tremolite talc for carcinogenicity in hamsters. Electron diffraction studies of this sample showed it to contain 50 percent fibrous tremolite and 35 percent talc (table 3). A majority of the talc particles were platy, but some were rolled or fibrous.

TABLE 3. - FD-14 (tremolite talc): Composition

	<u>Percent</u>
Selected area electron diffraction:	
Fibrous tremolite.....	50
Antigorite.....	10
Talc <sup>1</sup> .....	35
Chlorite.....	5

<sup>1</sup>Of this about 75 percent is platy and 25 percent is rolled or fibrous.

In this sample, the fibrous particles had an average length of 5.7 micrometers and an average diameter of 1.6 micrometers (table 4). They are therefore in a size range that might be carcinogenic in our experiments with chrysotile. However, this sample of tremolite talc induced no mesotheliomas after intrapleural injection into hamsters.

TABLE 4. - FD-14 (tremolite talc): Size measurement<sup>1</sup>

(Phase microscopy 10x ocular, 100x objective)

	Length, micrometers		Diameter, micrometers	
	Range	Average	Range	Average
Fibrous particles.....	2.5-16.5	5.7	1-5	1.6
Platy particles.....	-	-	1-10	2.0

<sup>1</sup>Ratio fibrous to platy particles: 3 to 1.

Table 5 gives detailed data on these tests which were conducted at our highest dose level (25 mg). In view of the long latent period before development of tumors, if we wish to compare relative carcinogenicity of different samples, validity of the comparisons depends on the number of animals surviving into the later periods of the tests. In table 5, the number of survivors in each group at each time period is shown as the denominator. The cumulative number of animals bearing mesotheliomas is shown as the numerator.

TABLE 5. - Yields of mesotheliomas in hamsters after intrapleural injection at 25-mg dose level<sup>1 2</sup>

Sample	151 days	340 days	372 days	450 days	500 days	550 days	600 days	650 days	700 days
Soft chrysotile.....	0/44	0/33	1/30	1/20	4/11	4/9	7/3	8/1	( <sup>3</sup> )
Harsh chrysotile.....	1/41	4/26	4/21	7/16	7/13	7/9	8/5	9/2	( <sup>3</sup> )
Heat-treated soft chrysotile.....	0/37	1/35	1/32	1/27	4/17	5/15	8/4	10/1	( <sup>3</sup> )
Tremolite talc.....	0/52	0/35	0/34	0/29	0/27	0/23	0/20	0/15	0/7

<sup>1</sup>Numerator: Cumulative number of hamsters with mesotheliomas.

<sup>2</sup>Denominator: Number of hamsters surviving on stated day.

<sup>3</sup>Survivors at 650 days in chrysotile groups were killed on that day. Pleural adhesions, but no tumors, were found in them.

We started with about 50 hamsters in each group. The first tumor was found at 151 days in an animal that had been treated with harsh chrysotile.

Now let us look at the situation as it was 500 days after start of tests. At that time, 4 mesotheliomas had occurred in the group treated with soft chrysotile and only 11 animals survived.

In the group treated with harsh chrysotile, 7 mesotheliomas had occurred and 13 hamsters were still living.

In the group given heat-treated soft chrysotile, there were 4 mesotheliomas and 17 survivors.

By comparison, no mesotheliomas had occurred in the group treated with tremolite talc, and there were 27 survivors.

The group on tremolite talc thus had many more animals at risk in the late stages of the tests, yet no mesotheliomas developed in them.

In the three groups on preparations of chrysotile, all of the animals had died or were killed to close out those groups by 650 days. At that time, the final yield of mesotheliomas in those groups was 8, 9, and 10, respectively.

By comparison, the group on tremolite talc had developed no mesotheliomas by 650 days, and there were still 15 animals living and at risk in that group at that time.