Please Note:

Only two copies of the pictures used in this Memorandum were made. If anyone wishes to see them, please call John Myers or K. S. Chopra.

TPN
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Technology Department
Mining and Metals Division - UCC
Niagara Falls, New York
September 17, 1973

J-4

M E M O R A N D U M

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FROM: K. S. Chopra

SUBJECT: Determination of Asbestos in Water

About 500 cc. each of water samples marked "effluent," "river-below," and "river-above" were received for analysis of asbestos content present in them, if any. The water sample marked "effluent" looked muddy, whereas the samples marked "river-above" and "river-below" looked relatively free of any finely distributed particles, but the color of the water in all the samples was yellow.

There are some techniques recommended in the literature about procedures to determine the approximate amounts of asbestos in liquids. The methods are very approximate in nature and too much faith is placed on the sampling procedure. It is assumed that a drop of the centrifuged sample concentrated from a large volume would disperse itself evenly on the holes of a microscope grid, and the final analysis as to number of fibers in the sample is based upon this assumption.

The water sample in all three cases was centrifuged and the weight of residue was checked in each case. In the case of the effluent sample, the following procedure was used to determine the asbestos content in the sample.

1.	Volume of the sample analyzed	235 cc.
2.	Weight of the residue collected after centrifuging and drying	.047 g.
3.	Weight of the above residue after treating overnight with 20% KOH at 48°C. to dissolve away organic materials and washing and drying	.034 g.
4.	Analyses of magnesium checked on 1/2 of the above residue sent for chemical analyses	.87%



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5. Assume the magnesium content in the residue is all tied up as asbestos (chrysotile, $Mg_2Si_2O_5(OH)_4$). In that case the total weight of chrysotile/l. is 6.8 mg.

If each fiber of chrysotile weighs 2×10^{-15} g. (assumed in literature), then the number of fibers/l. is

$$\frac{.0068 \text{ g.}}{2 \times 10^{-15} \text{ g./fibril}}$$

$$= 3.4 \times 10^{12} \text{ fibers/l.}$$

The residue from the "river-above" and "river-below" samples before treating with 20% KOH solution weighed .011 g. and .002 g., respectively, in the 250 cc. sample that was analyzed. Since the amount of residue collected in each case was very small, it was decided not to treat the residue with 20% KOH solution. A notable feature was that the amount of residue from the water sample collected from "river-above" weighs more than the residue collected from "river-below." It appears from this that the residue collected from the "river-above" sample contains more algae, diatoms, and other marine growths.

X-ray and electron diffraction work was done on a known chrysotile sample and was used as a standard. The X-ray diffraction pattern obtained from the effluent residue showed the presence of chrysotile in the sample. There are some electron micrographs showing the size, shape, and distribution of chrysotile fibers in the effluent attached to this memorandum.

Electron microscopy and X-ray diffraction work was performed on the samples from "river-below" and "river-above." The X-ray diffraction results from the "river-below" sample showed a trace of chrysotile present in the sample, whereas X-ray diffraction pattern "above-river" sample did not show the presence of chrysotile in the sample. Some of the electron micrographs and electron diffraction patterns of "river-above" and "river-below" samples are provided.

The optical microscopy work was done at lower magnifications on effluent "river-below" and "river-above" samples and shows the presence of glass fibers in all the samples. An example of the presence of cornstarch in the effluent is also shown.

A few basic conclusions can be drawn from the three samples analyzed. There is definite evidence of the presence of chrysotile in the effluent. There is trace evidence of chrysotile in the "river-below" sample and below limit of detection in the "river-above" sample. There is presence of glass fibers, some kind of marine life, paper fibers, and some other undetectable residue in all the samples. More faith was placed on X-ray diffraction work in checking the trace amounts of chrysotile than the electron diffraction technique. Shapes and size determinations are best determined by electron microscopy. Extrapolating from

the weight of residue in effluent as compared to weight of the residue in "river-below" sample, the number of chrysotile fibers in the effluent is 3.4×10^{12} as compared to 1.4×10^{11} or less in the "river-below" sample. These results can be very deceiving because the extrapolation is based upon the fact that the residue analyzed in effluents showed 0.87% magnesium and it was assumed that all the magnesium present is tied up as chrysotile. This assumption is not always true because magnesium could also be tied up as carbonate, etc.

K. S. Chopra

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Attach.

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