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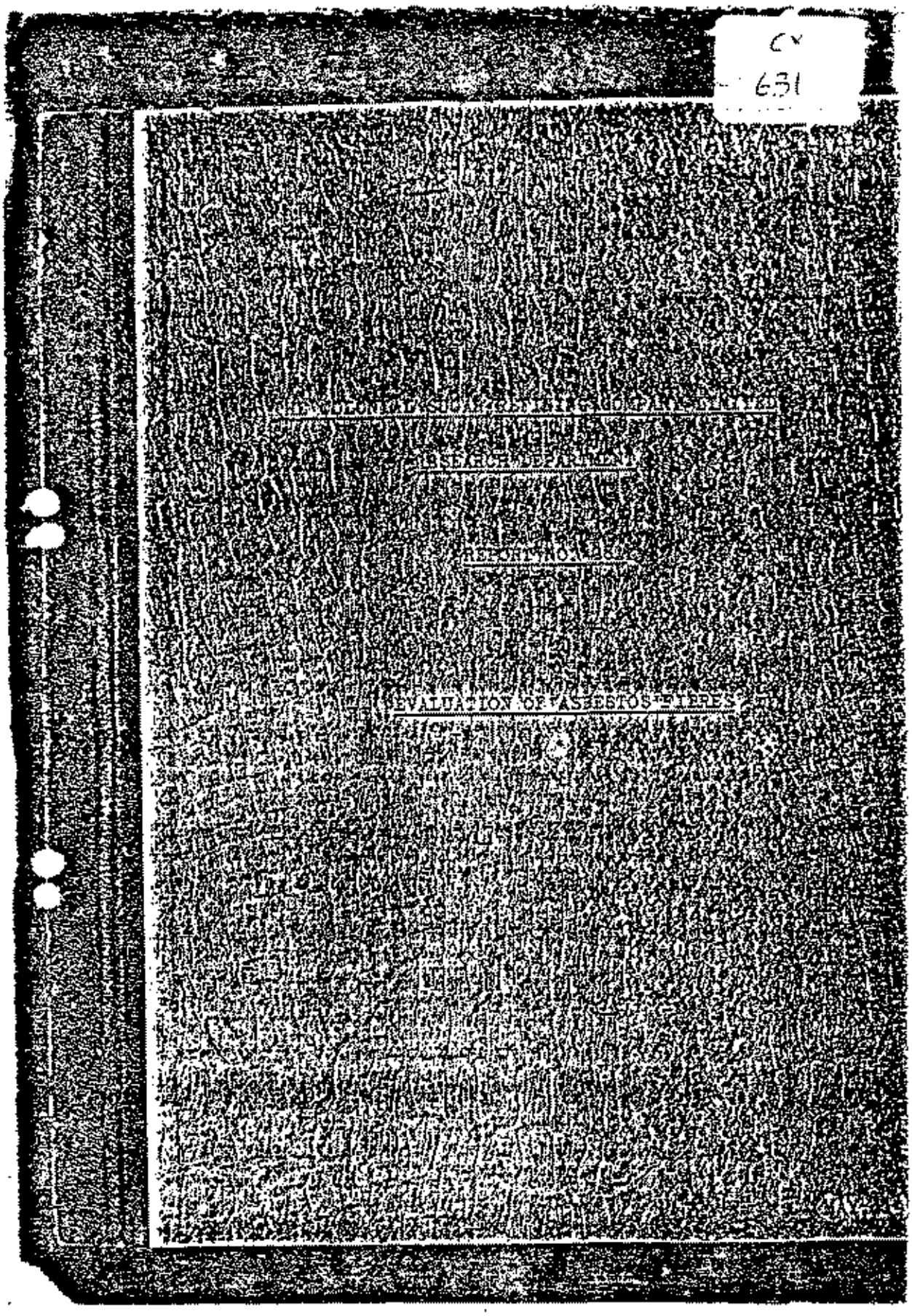

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- TABLE OF CONTENTS -

		Page
I.	INTRODUCTION	1
II.	EXPERIMENTAL - EQUIPMENT AND METHODS	3
	A. Properties of Fibres	3
	(1) Grading According to Length	3
	(2) Filterability	3
	(3) Peltability	4
	(4) Viscosity	5
	(5) Tensile Strength	6
	(6) Surface Area	7
	B. Preparation and Testing of Boards	8
	(1) Equipment and Methods for Board Preparation	8
	(2) Apparatus and Methods for Testing	10
III.	RESULTS	12
	A. Properties of Fibres	12
	(1) Grading According to Length	12
	(2) Filterability	15
	(3) Peltability	29
	(4) Viscosity of Slurries	29
	(5) Tensile Strength	29
	(6) Surface Area	30
	B. Properties of Asbestos Cement Boards	35
	(1) Preliminary Work	35
	(2) Measurement of Yield	36
	(3) Ultimate Strength of Asbestos Cement Sheets	43
	(4) Impact Strength	70
	(5) Flexibility	75
	(6) Water Absorption	78
	(7) Green Strength	81
IV.	DISCUSSION	83
	A. Rate of Production	83
	B. Ease of Handling	85
	C. Yield	86
	D. Quality of Product	86
V.	CONCLUSION	92

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-EVALUATION OF ASBESTOS FIBRES-

No Previous Reports

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- S U M M A R Y -

The object of this investigation was to compare the properties of several varieties of asbestos fibre and to determine the effect of these fibres on the properties of asbestos cement sheets.

The properties of the fibres which were studied included length distribution, fibril diameter, surface area and tensile strength. The filterability and feltability of slurries of fibres and cement in water were also investigated.

Properties of asbestos cement sheet which were studie included bulk (i.e. yield of product), ultimate strength, impac strength, flexibility, water absorption, and green strength.

Laboratory apparatus was developed for the preparatio of asbestos cement sheets. This enabled detailed comparisons between the effects of many fibre mixtures to be made readily. Observations made as a result of these trials were then tested by carrying out full scale trials in two different factories.

To test the significance of our results and the validity of our conclusions, factorial experimentation and statistical analysis were used in each trial. Our original figures and the corresponding analyses of variance have been reproduced in this report. This furnishes complete reference data for an independent check on our statements.

The asbestos varieties used were No.3 Blue crocidolit (W. Australian), 4K chrysotile (Canadian) and amosites A2 and DCA/D (S. African). The main purpose of the work was to compa the properties of these four fibres and to determine the effect

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of adding No.3 Blue to 4K chrysotile or to mixtures of this chrysotile and an amosite. The conclusions which have been reached concern only these materials. It is not claimed that similar results would not be possible with varieties of fibre other than those tested.

The results show the following facts:

(1) No.3 Blue crocidolite has a greater proportion of long fibres than has 4K chrysotile. Its fibrils are of greater diameter but the surface area is also greater than that of chrysotile in the same state of preparation. The tensile strength of No.3 Blue is less than that of two South African chrysotiles but greater than that of amosite A2. The effect of these properties is no doubt linked with the properties of asbestos cement sheet although exact relationships are unknown.

(2) No.3 Blue crocidolite and the amosites give slurries of higher filterability than those of the chrysotile. The amosit exert the greater effect on filterability but either type of fibre potentially raises the rate of production on account of this property.

(3) No.3 Blue crocidolite, by increasing the yardage of produc for a given weight of material, has an additional possibility of increasing the rate of production.

(4) It is probable that addition of No.3 Blue crocidolite increases the green strength of the product compared with that [illegible] alone. The effect of the amosites was not

[illegible] of No.3 Blue to chrysotile 4K or to mixtures with

this fibre and an amosite has the effect of increasing the bulk or yield of the product. This effect was found in four laboratory tests and two long plant trials carried out under differe conditions. The increase in one plant trial was 7.5% when 25% of the normal fibre mixture was replaced by No.3 Blue. This property is not shared by any of the other fibres tested.

(6) The ultimate strength of asbestos cement sheets was found in some trials to be unchanged by the addition of No.3 Blue crocidolite to the fibre mixture. However, in three factory trials, including two on a modern two-vat machine, a significan increase was found to result as the proportion of No.3 Blue was raised. The increase was significant in one trial when 25% of the total mixture consisted of this fibre. Under some conditi even smaller amounts of No.3 Blue gave significant increases in the other tests.

A2 amosite was found to lower the strength seriously. DCA/D amosite probably has little effect, up to 45 parts per 10 parts 4K chrysotile, but barely significant decreases in streng were noted in some trials.

(7) Impact Strength - determinations of impact strength were carried out in the laboratory of Asbestos Products Pty. Ltd., and were not completely satisfactory. They have been subjecte to statistical analysis, however, and it has been shown that No.3 Blue crocidolite is without effect or tends to raise the impact strength. No effect was found for A2 amosite while DCA/D amosite tends to lower the impact strength.

(8) Flexibility - it is clearly shown that addition of No.3

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Blue crocidolite to a fibre mixture allows the asbestos cement product to bend further without fracture. This is considered a desirable property for many of the uses of asbestos cement sheet. The amosites do not increase the flexibility.

(9) Water Absorption - due probably to its lower density No.3 Blue asbestos has the undesirable effect of increasing water absorption slightly. The absorption, as measured after total immersion, is increased about from 22.5% to 25% when this fibre is added to the extent of 75 parts per 100 parts of 4K chrysotile.

The evidence generally indicates that use of No.3 Blue crocidolite in conjunction with chrysotile and amosite gives asbestos cement of improved properties except as regards water absorption. Use of this fibre also leads to a greater production rate and to a higher yield of product.

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I. INTRODUCTION

Late in November, 1953, the Research Department was asked to investigate the properties of various types of asbestos fibre and their effect on the quality of asbestos cement sheets. In particular, the aim of the work was to compare the properties of Australian crocidolite with those of various types of imported asbestos fibre - e.g., chrysotile (Canadian), and amosite (South African).

The scope of the work was designed to include both a literature survey and laboratory scale work, involving the determination of various physical and chemical properties of asbestos fibres. This was to be followed by a study of the physical and mechanical properties of asbestos cement sheets made with the various compositions of Australian and imported fibres. For this part of the work it was found that factory scale trials were valuable.

At the present time, apart from two grades of asbestos fibre which are mined in Australia, all the other types used are imported either from Canada or South Africa. Of the locally produced material the most important for use in the manufacture of asbestos cement sheets is No.3 Blue asbestos, mined in Wittenoom, W. Australia.

Asbestos Products Pty. Ltd., consider that the use of some No.3 Blue asbestos in asbestos cement manufacture has definite advantages. This belief is based on a number of empirical facts about the behaviour of Blue asbestos which have been derived from factory observations.

For example, it has been known for some time that the presence of Australian Blue asbestos in the stock increased the filtrat rate and hence the rate of board manufacture. It also increased the yardage of board of a given thickness.

We have endeavoured to obtain precise quantitative information on these and other properties. The information we have gained has been subjected to statistical analysis and we believe that the conclusions which we put forward can be accepted with confidence.

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