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REPORT

on

INSPECTION OF

CAPE BLUE ASBESTOS LTD.

UNION OF SOUTH AFRICA

CAPE BLUE ASBESTOS LTD.

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13th September, 1949.

CAPE BLUE ASBESTOS COMPANY

INTRODUCTION.

Arrangements to visit the Cape Blue Asbestos Limited mines near Kimberley were made by Mr. C.W.R. Powell in London with Mr. Giles Newton, Managing Director of Cape Blue Asbestos Company. In South Africa arrangements were made through Colonel R. Riley, Director of Cape Blue Asbestos in charge of asbestos mining in South Africa, whose headquarters are in Johannesburg.

The arrangement were to travel by train overnight from Johannesburg to Kimberley, a distance of approximately 400 miles, then fly by charter plane from Kimberley to Prieska, a distance of approximately 130 miles. After looking through the blue asbestos cleaning plant located at Prieska which is the railhead for despatch of asbestos to Cape Town the remainde of the journey to the main mining centre at Koegas was made by car, a distance of approximately 50 miles.

SUMMARY.

The main asbestos deposits of the Cape Blue Asbestos Company are located on the Orange River at Koegas in British Bechuanaland approximately 150 miles west of Kimberley. Asbestos ore has been extracted from outcrops scattered over a area of about twenty square miles during the past forty years. Until recently there has been no systematic mining and all wor including drilling was done by hand with native labour. Most of the fibre seams dip steeply and only the fibre bearing ore is extracted. No waste rock is broken and support is provide by means of timber posts.

There is no mechanisation underground either for handli ore or for tramming. In most of the stopes the ore gravitate to the loading points but elsewhere ore is shovelled by hand into mine cars. There is no mechanical underground haulage, tramming being by hand.

The extracted ore is hand picked by native women and c

at each drive entry, the barren rock being left to form a dump and the fibre-bearing ore taken to the mill for treatment Long fibre is hand cobbed at the mine entry and receives no further treatment at the mine.

Only small amounts of asbestos are produced from each working section, there being about a dozen such places in the Koegas-Westerberg area, each with its own waste dump. Each working point only produces two or three tons of fibre per day on one shift.

Koegas is the mine township on the north side of the river and there are several working areas north and south of it Westerberg is the name of a valley on the south side of the riv in which there are about eight working areas. All of these mining sections are under the control of the Manager at Koegas.

Formerly Koegas and Westerberg each operated a small mil which treated the hand picked asbestos bearing ore, producing fibre containing approximately 20% of rock and dust. The Koeg mill has now been converted to retreat mill tailings dumps fror previous years' operations to recover short or X grade fibre. The Westerberg mill which was rebuilt about two years ago trea all the ore produced at Koegas, Westerberg and the surrounding areas. A new mill is in course of construction at Koegas to treat all the fibre produced from both Koegas and Westerberg areas when the underground output is increased in the course o the next few years.

All the fibre from the various areas is brought to Prie for cleaning, blending and grading before despatch. A, B, C D grade fibre are the long hand cobbed grades and these are bl and picked over by hand to remove stone. The S grades, which the mill products from Koegas and Westerberg, are blended, cle mechanically and bagged ready for despatch. S grade is rough equivalent to Wittenoom No. 3 grade but is more open and bett cleaned.

X grade fibre from Koegas together with the tailings f the S grade cleaning plant are treated to produce the finishe X grade which is about equivalent to the proposed No. 4 grade

Wittenoom. The bagged fibre is thendespatched by rail 600 mi to Cape Town or 400 miles to Port Elizabeth for shipment overs

Production is about 800 tons of fibre per month from al sources and the cost of production is from £35 to £40 stg. per short ton equivalent to £A53 per long ton.

PERSONNEL.

Johannesburg -	Director	Colonel R. Riley
	General Agent	Mr. N. Hiskett
Kimberley -	General Mgr.	Mr. Hodgson
	Assistant	Baker
Koegas	Manager	Mr. Sinclair
	Mine Manager	Lewis
	Assistant	Todd
	Surveyor	Isaacs
	Chf. Engineer	Campbell
	Accountant	Hawkes
Prieska	Manager	Mr. Van der Veldt

Messrs. Lewis, Todd and Campbell have only been with Cape Blue Asbestos for one to two years. Prior to their engagement Mr. Sinclair was the only technically qualified person employed and was responsible for layout and operation of both the mining and the milling activities. Messr Lewis and Todd were trained on the Johannesburg goldfields and Mr. Campbell is a retired Railways maintenance engineer so that none of these officers are very well versed in blue asbestos production problems.

Unfortunately, Mr. Sinclair was absent on leave at the time the mine was visited.

The Sales and Executive Office was formerly at Kimberley under Mr. Hodgson but Colonel Riley was in process of transferring these to Johannesburg. It is understood that Colonel Riley was appointed resident Director because of the inability of the existing organisation in South Africa to cope with demands for increased output.

The lack of trained technical staff at Koegas and Prieska was most apparent. The Manager of the Prieska cleaning plant had no training of any kind and had been promote from the position of despatch clerk.

GENERAL.

Prieska is a township of only a few hundred people which serves as a railhead for some pastoral interests in surrounding areas in addition to handling blue asbestos. The surrounding country is sandy desert and the summer temperaturesreach about 120°F. The Orange River passes within half a mile of the town.

Koegas is also on the Orange River, a township consisting only of people working on the blue asbestos leases. There are approximately fifty white people at Koegas, the greater part of the labour force being nomadic natives of the Bushman tribe. The country around Koegas and Westerberg, whic are the two main mining sites and are on opposite banks of the Orange River, is broken up by irregular steep ridges rising fro 500 ft. to 1000 ft. above the surrounding plains. The vegetation consists of a dry grass (not as great a nuisance as Spini and stunted salt bush and other shrubs. The general colour of the country is not as red as at Wittenoom but is more of a brow colour. In the mined areas at least this appears to be due to greater weathering having taken place. The rainfall is very l but irrigation from wells which abound in the district or by pumping from the river enables good garden crops to be grown.

Telephone communication is available between Koegas and Westerberg, Prieska, Kimberley and other points.

There is no district power supply at Koegas so that all power is generated on the site by diesel units.

Supplies are carried into and out from Koegas by road mostly to Prieska. Approximately 20 miles of road at the Koegas end is owned by Cape Blue Asbestos.

The leases held by Cape Blue Asbestos cover a considerable area totalling some hundreds of square miles and scattered over a wide area.

MINING AREAS.

Owing to the disturbed nature of the country in which the blue asbestos occurs, asbestos seams or "reefs" (as they are called locally) lie at all angles from horizontal to vertical. There are three well defined seams known as the Inner, Main and Outer Reefs, which occur throughout the deposit.

The main production centre is Westerberg, in which the fibre outcrops round the rim of a "U" shaped valley, the arms of the "U" running north to the Orange River. The fibre seams dip from all sides towards the centre of the valley and there is every indication that the fibre is also under the valley floor being continuous from one side to the other. The seams on the west side of the valley appear to continue across the Orange River in the Koegas region. So far there has not been any record of the asbestos seams in the eastern wall of the valley continuing on the north side of the river.

Other areas worked are at Kuruman and Black Ridge about 100 miles north of Koegas and Naauwpoort, Kliphuis and Engeldewilgeboomfontein which are approximately 30 miles east of Koegas. Approximately half the output of fibre comes from the Westerberg area, one-third from Koegas and the remainder from the outlying areas.

Production Data - Table I

Average 22 shifts operated per month.
30 short tons fibre per shift.
600 " " " " month.

Westerberg	No. 2 Drive	5 tons
	4 "	4 "
	8 "	3 "
	7 "	3 "
Koegas	Weilbach	3 "
	Big Hill	3 "
	Mill Hill	2 "
Black Ridge		2 "
Kuruman, Naauwpoort Kliphuis, etc.		5 "
		30 short tons

MINING METHODS.

Koegas. In the Koegas-Westerberg area, mining is carried on at about twelve locations over a distance of several miles. A portable compressor is used to serve each two or three locations. There is a white shift boss in charg of each area controlling groups of twelve natives each group being in charge of a native ganger (certificated by the Mines Inspector) who inspects the stope face after firing and makes it safe, marks holes for drilling by the machine men, charges the holes and fires them. It should be noted that the practi of permitting natives to handle explosives is only permitted i outlying areas such as Koegas, and is not allowed anywhere on the main mining centres round Johannesburg.

100% extraction is carried out in the stopes, the hanging wall being supported by mine timbers. Australia eucalypts of various species are most used for mine timber, b grown round the Kimberley area and transported to the mine. The average stope height is about 42" but as the stopes are inclined to the horizontal, head room is not a problem. The men use the timbers as a ladderway for climbing through the stopes.

Drilling is done by means of jackhammers of about 40 lbs. weight. Pressure is applied to the drill by t feet, the native driller bracing his back against the mine timber.

Stope Layout. In an average stope the ore body has a dip of say 50° and would be worked at several lev commencing from the top, the stope face being about 100' in length measured down the dip. The stope face is usually inclined to the dip at such an angle that ore will rill dow to the loading point at the lower end of the stope face, th is to say, in a steep stope, the top of the stope face lead the bottom by perhaps 20 or 30 ft. whereas in a stope with flat dip the stope face would be either parallel to the dip with the lower end of the stope face slightly in advance of upper.

Haulage drifts are advanced with the stope face instead of being developed beforehand as is the common practice elsewhere. The development end for the haulage drift is kept a few feet ahead of the stope face always.

The inclined stope face is drilled in a series of benches with holes about 3' apart near the footwall and the hangingwall. The holes are drilled at an acute angle to the stope face, usually about 30° so that a 3' hole has a burden of 12" to 18" at the bottom of the hole. By adopting this practice (which is almost universal on the goldfields) each hole when firing acts independently and a misfire only affects one shot and not a large part of a face. The advance per round with this system is only about 1 ft. and an average stope face is about 80' long, and 42" high, so that about 290 cu.ft. of rock is broken per round (25 tons). This on an average yields one ton of asbestos.

Usually one machine man and a helper drill a stope face each shift, there being from 30 to 35 holes in a face and the actual drilling time about six hours. The holes average 3' deep so that approximately 100 ft. of drilling is done per machine shift.

1⅞" bits are used, generally of the P. & M. detachable type bit which have a life of about 3.5 ft. Tungsten carbide bits made by Cemented Carbides in Johannesburg were just coming into use and cases were on record of one bit having drilled several thousand feet. In addition to costing less per foot drilled, tungsten carbide drills faster and saves time taken up in frequent bit changes with P. & M. type. The cost of P. & M. bits is 3d. each at Koegas (cost at Johannesburg 1½d.). The cost of a tungsten carbide bit and 4' steel is £2.15. 0.

Ventilation. As the mining to date has been mostly above the general ground level, natural ventilation has been provided by air passing in through haulage ways inside to the reaches, passing up through stope face and out to atmosphere

where the asbestos originally outcropped.

Water. Water is carried to each mining place and fed to the working places from a head tank at a c venient high point.

Lighting. Carbide lamps are used exclusi for lighting within the mine.

Production. A group of four jackhammers i operated off one portable 300 c.f.m. compressor, the pressu at the drills being about 60 p.s.i. The actual production asbestos from four gangs (four machine shifts) is 3 tons of recoverable asbestos fibre.

As noted above, 25 tons of rock is broken a each group of four faces making 100 tons of rock per shift. This is concentrated by hand picking and cobbing at the ent to the mine from 100 tons to about 15 tons which is then se the mill. The quantity of recoverable fibre in the mill f therefore ranges from 20% to 30%.

Each native gang numbering twelve men cons: a ganger or boss boy, one machine man and a helper, two me: timbering, two men hauling trucks, the remainder of the ga cleaning out the stope, laying track and drawing ore at th holes.

Ore Handling. As most of the stopes are steep stope, the ore as fired, collects at the bottom of th stope and is drawn off through timbered box holes into sma mine cars of about 1 ton capacity. A native gang sweeps the stope face in preparation for the next round of drill: Generally each gang of twelve men works two stope faces,- drilling and blasting each face on alternate days. This is common Witwatersrand practice although where it is nec for safety to advance a stope face rapidly drilling, blas and cleaning are completed in one day by overlapping shif This latter method also reduces the amount of development required for a given output.

Trucks of ore are pushed by hand to the mine entrance, usually a distance of a few hundred feet. The ore is tipped sideways on to a dump where native women and children hand sort the ore containing fibre and reject waste rock. The contract rate for this work is one penny per 60 lb. drum of picked ore. Pieces of rock containing long fibre are put aside and hand cobbed on the site using a short handled maul weighing about 3 lbs. with a piece of rock as an anvil. This work is mostly done by native women. Contract rates of pay are 1/9 per drum of 60 lbs. or 3/6 per bag of 100 lbs. of cobbed fibre. Native pickers and cobbers work in the open usually without cover.

The piles of waste rock extend outwards as mining continues, the underground rail track being formed in a loop on the top of the pile.

The fibre bearing ore is loaded on to a 3 ton lorry for delivery to the mill where it is dumped in open heaps on the ground. Ore from the various mines is kept in separate dumps and mixed by the operator feeding the mill.

Mine Statistics. Table II

Feet drilled per ton rock broken ...	8
Tons rock broken per white man employed	15
Native boys per ton rock trammed ...	1.2
Pounds powder per short ton of rock broken	1.25
% Fibre in rock mined ...	5.5
% Fibre in ore to the mill ...	35
Fibre (and rock) recovered from milled ore	38% *

*This is reduced to about 30% when allowance is made for the rock and dust removed in the cleaning plant at Prieska.

Cost of drill repairs per hundred ft. drilled 3/6

Fibre Length. TABLE III The proportions of fibre in the various grades are as follows:-

		Length.
Grade A	: Long fibre 6%	$\frac{3}{4}$" to $\frac{3}{8}$"
" B, C & D	: 4%	+1$\frac{1}{2}$" to $\frac{3}{4}$"
" S & X	: 90%	$\frac{3}{8}$" to $\frac{1}{8}$"

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Fibre Length. TABLE III The proportions of fibre in th various grades are as follows:-

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Grade A	: Long fibre 6%	¾" to ⅜"
" B, C & D	: " 4%	+1½" to ¾"
" E & F	: "	3" to 1½"

X Grade fibre is very short and has only been recovered recently. It is recovered at Prieska from the S gr tailings and at Koegas and Westerberg from re-treatment of the mill tailings dumps.

Although some of the faces examined in the Westerberg drives carried a total of 4" to 5" of fibre with a maximum fibre length of 1½", the overall mine average appeared to be about 2½" total fibre in an average stope height of 42".

Labour Force. The total number of operators employed at Koegas and Westerberg is as follows:

Europeans	- 25
Natives underground	- 320
Natives on surface	- 280
Native women & children Contract workers	- 150
Natives employed elsewhere	- 150

Total Cost of Production of Fibre - Table IV

	£stg. per short ton	
Salaries & Wages, Mine & Mill Labour	17	
Asbestos charges (made up of working expenses for motor vehicles etc.)	2	
Transport Koegas to Prieska 6d. per ton mile contract rate	1.4	
Maintenance materials	3	
Stores (fuel, explosives, drill steel, timber)	6	2
Cleaning at Prieska	2	
Plant depreciation	3	
Administration Expenses	3	
Compensation, taxes, social services	2	1
Freight from Prieska to Cape Town	2	
Total :		4

Stores includes a cost of £1.5 per ton for s

For the eleven months ending November, 1948 total cost per ton excluding freight from Prieska to the Por was £35 stg. per short ton.

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Cleaning at Prieska	2	
Plant depreciation	3	
Administration Expenses	3	
Compensation, taxes, social services	2	10.
Freight from Prieska to Cape Town	2	2.
Total :		41.

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The cost dissections given above are as detailed as the records kept at Koegas and it will be observed that a much more complete dissection is required to enable an adequate check to be kept of the cost of individual operations Until recently the supply of cheap labour has been such that there has been no incentive to keep accurate cost records.

Stores Costs - Table V

	Sterling
Explosives per 50lb. case 4" x 7/8" dia. or 4" x 1" dia.	34/6
Drill Steel per lb.	7d.
Drill steel per ton	£65.
Rails per ton	£22.
Rails per yard	£16.
Fuel oil per gallon	1/6
Fuel oil per ton	£16.
Timber per 14 ft. pole 6" dia.	3/6
Timber per ton landed Koegas	£4.

Timber Cost Dissection -

Material cost per ton	£1.2
Rail transport cost	£1.7
Road transport cost	£1.0
	£3.9

Salaries and Charges per month and per year.

	per month sterling	per annum sterling
Shift boss	£25 to £30	£360
Mine Foreman	£40	£480
Mine Surveyor	£60	£720

A house, water, fuel and light are supplied free to such employees.

Native Rates of Pay.

Mine boy	5/- per day
Boss boy	6/- per day

There are no organised compounds and messes at Koegas or Westerberg and the natives find their own food and

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Stores Costs - Table V

	Sterling
Explosives per 50lb. case 4" x ⅞" dia. or 4" x 1" dia.	34/6
Drill Steel per lb.	7d.
Drill steel per ton	£65.
Rails per ton	£22.
Rails per yard	£16.
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accommodation. On the Witwatersrand mines the natives are paid at the rate of 5/- per day of which 2/6 is taken out to pay for food and accommodation in the compound.

DETAILS OF MINING OPERATIONS.

Koegas. Mining operations are carried on at three points north of the Orange River spread over a distance of several miles. All three operations are underground and ar on different parts of the same seam or reef. The seam has bee worked out in earlier operations wherever it outcrops over the greater part of a length of two to three miles. The areas which have been chosen for underground working are in small isolated hills where the ore body is well above the surrounding ground level so that there is no need for hoisting ore from underground operations.

Weilbach. This area is about three miles north of the Orange River. The ore body being worked dips at about 55° flattening out somewhat about 200' below the outcrop. The ore body proved is about 750' long by 500' deep on dip. Haula levels are established at approximately 50' vertical intervals which gives a stope face approximately 80' to 100' long on dip. Haulageways are continued until they break through to an entran on the side of the hill and a sorting dump is then established the entrance. A road connects the several sorting dumps so th ore can be removed by lorry. Most of the ore has been removed from the top three levels.

A European shift boss is in charge of the area and there are four gangs of twelve men each with one jackhamme The daily production from this area is about 15 tons of picked ore equivalent to about three tons of fibre from the mill.

Native women hand sort ore which is minus 6", and native boys spall any ore greater in size than 6". All o sent to the mill is minus 6".

Compressed air is supplied from a portable compressor of 300 c.f.m. capacity located at the bottom of the

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hill in which the ore body is situated. Water is carted by truck to a tank at the top of the hill. Maintenance is carried out by a "flying squad" who travel to the various mining centres from the workshop at Koegas as required.

Big Hill. This area, the most southerly of the Koegas workings, is located close to the Orange River immediately facing the Westerberg workings of which it appears to be a continuation. The ore body is V shaped in end elevation, approximately 1,000 ft. long and 200 ft. deep with the outcrops at the tops of the arms of the V about 100 ft. apart. The seam forming one arm of the V is practically vertical, while the seam forming the other arm dips at an angle of 45° to 80° to the horizontal. In some areas the seam has been stoped out completely leaving a V shaped section of barren rock entirely supported on mine timbers.

In the vertical arm of the seam, the stope face is stepped so that it lies at an angle of approximately 45° to the horizontal, in order to provide safe working. The production from Big Hill is approximately nine tons of picked ore per shift equivalent to about three tons of asbestos per day.

Most of the stopes have been followed down from an outcrop rather than worked from below as is common mining practice elsewhere. The latter method is coming into use on new developments in the Westerberg area.

Mill Hill. This ore body is somewhat similar Big Hill measuring approximately 500' long by 150' deep. The fibre from this area is a more steely blue and is more like cr shingle fibre in the way it breaks up into short sticks of fi

In parts of the workings where there are two close together on a comparatively flat dip the hanging wall i supported by packing waste rock.

Westerberg No. 2 Section. This area is bett laid out and mined on more orthodox principles than the older Koegas underground workings. There are three seams of asbes being mined referred to as the Main, Inner and Outer Reefs.

dip is approximately 80°. There is approximately 6' of barren rock between the Main and Inner Reefs and after complete extraction of the ore this membrane of rock is supported entirely by mine timbers. In places the footwall of the Inner Reef is punctured by the pressure from mine timbers supporting the hanging wall in the Main Reef. The puncturing only arises usually from failure to use headboards on the timber supports.

The stope face is benched in steps about 4' high and stepping back 4' each time. Approximately three holes 3' long are drilled in the horizontal step of each bench at an angle of 80° to the vertical with the bottom of the hole towards the stope face. (See Figure No.). A stope drive about 100 ft. below the top of the stope collects the broken ore which is then drawn through a box hole to a haulage way about 12 ft. below the stope drive. The ore is then hand trammed out to the sorting dump. The method of using a stope drive is safer than having a haulageway at the bottom of the stope. With the latter arrangement there is a danger of tramming boys being struck by ore rilling down the stope face. The stope drive acts as a buffer storage for the broken ore.

It was estimated that the average for all of the faces examined in Westerberg No. 2 area was a total of 4" of fibre, the mining width being about 48". The average face would contain from eight to twelve veins from 1/10" to 1" in fibre length.

At the south end of a development drift on the Outer Reef approximately 200 ft. below the surface, there was a total of 6" of fibre in a 48" seam over a length of approximately 50 ft. along the strike. In only a few places was much fibre seen over 1" in length.

Approximately five tons of asbestos per shift is produced from Westerberg No. 2 area from four jackhammers and there was difficulty in providing sufficient labour for picking on the sorting dumps because of the high production.

At Westerberg No. 2 there were approximately 80

native women and children hand sorting to cope with the output from four jackhammers.

The ore from this area was very friable and broke to minus 4" in the mine. The ore was discoloured with yellow ochre dust from weathered ironstone.

It was estimated by the Underground Manager that there was probably a 10% loss of fibre on the sorting dumps. No system of screening has been evolved to prevent this loss of fibre.

Some attempt was being made to recover fibre from the sorting dump by feeding the stone over hand operated shaker screens about 4' long by 2' wide having an upper deck of 1/2" mesh and a lower deck of 1/16" mesh. The material remaining on the top deck was discarded and the overs from the lower deck were sent to the mill.

Westerberg No. 4 Section. This part of the mine is on the Main Seam south from No. 2 Section at the point where the reef begins to swing round to the east. The dip in this section is flatter than farther north, being approximately 30°.

In this section there are small patches of fibre approximately 2" long, this being a D grade fibre.

In development work in this section a form of burn cut is used, referred to locally as a "diamond" cut. Four holes 5' long are drilled, spaced in the form of a square at the face, the four holes running together at the bottom so that they form the edges of a square pyramid of 18" base and 5' height. A total of eighteen holes is drilled in a round, the other fourteen holes being spread round the diamond cut which is fired first. An advance of 1½ rounds or approximately 8 ft. is made per shift.

1-3/8" diameter P. & M. detachable bits are use and these drill for 3' to 6' before being discarded.

The explosive used is 7/8" or 1" diameter by 4" long plugs of 40% ammonia-dynamite with a count of 400 sticks per 50 lb. case.

The minimum water pressure permissible at the jackhammers in order to allay dust is 15 p.s.i. The air consumption per jackhammer averages about 70 c.f.m.

Westerberg No. 8 Section. This section is on the east side of the Westerberg Valley almost directly opposite to Section No. 4. The dip here is also comparatively flat. All the upper levels in the slope above the valley floor have been worked out and a shaft was being put into operation to hoist ore recovered from seams below the valley floor.

The shaft was sunk about fourteen years ago but work was subsequently abandoned in the area and the shaft was never used.

No core drilling has been carried out to determi to what depth below the valley floor the seam dips, nor is it known definitely that the seam is continuous with the seam on th west side of the valley although it appears highly probable. The fibre from No. 8 area is dark steel blue in colour and the rock is also blue/black and shaley in appearance. This may be due to the fact that weathering and oxidation have not taken place to the same extent as on the west side of the valley where there are many small fissures throughout the ore body.

Kliphuis. Kliphuis is a small settlement about 40 miles east of Koegas and also on the north side of the Orange River. It was inspected mainly because it was thought to resemble the Wittenoom deposit more closely, so that the mining system under such conditions could be observed. Whereas the asbestos seams or reefs in the Koegas area are mostly steep inclined and headroom is therefore not a problem, at Kliphuis the seams are comparatively flat.

For the most part, mining in this area has been carried out by contractors who have not worked to any system and a start was being made at the time the mine was inspected to adopt a systematic layout.

There is about 2,000 ft. of driving divided between several drives and crosscuts, the height generally bei only about 4 ft. to 5 ft.

The dip is about 5° into the hill from the mine entrance. The first drives made were across the dip to avoid hauling up hill and in consequence are unnecessarily long. It is now proposed to have a main haulage on dip and develop by the stoping method used elsewhere.

Ventilation is obtained by natural circulation from an open ended crosscut up through the main haulage drift.

From examination of the faces at a number of points the area appeared to average about 2" total length of fibre. In places the total length of fibre in a face was as much as 5" and the longest individual fibres seen were about 1½" in length.

MILLING.

General. The milling is a comparatively simple process as the ore contains approximately 30 to 40% fibre and there is thus comparatively little rock to get rid of. The general circuit in both the Westerberg and Koegas mills consists of a primary jaw crusher followed by a trommel and picking belt, a shaker screen to remove fines, then a stage of roll crushing again followed by a trommel to remove fines and oversize. The middlings product from the trommel is then passed through a disintegrator and after further trommel screening to remove fines and short fibre, the milling is complete and the fibre coming from the last trommel is bagged. However, this product is further treated at Prieska where approximately 20% of dust and stone is removed.

Attention is drawn to the fact that at no stage in the milling is an aspirating process used for separating rock from stone or for cleaning fibre. This work is done exclusively by reducing the rock to dust by roll crushers and disintegrators and removing the dust by means of a trommel screen.

This process results in a much more open or teased fibre than is produced by the mill at Wittenoom.

Westerberg Mill. Details. The ore is brou to the mill by road from the areas in Koegas and Westerberg Val and also from Kuruman, Black Ridge and other outlying centres. Ore from each area is dumped in separate stock piles so that it may be treated separately. The maximum size of ore handled is about 6".

The ore is wheeled in barrow loads from the various dumps and tipped on a steel plate for convenient shovelling, above a small jaw crusher. The crusher is about 14" x 8" and is fed by hand shovelling. The ore from various working places differs considerably in its appearance and each ore is milled separately in order to keep a check on the tonnage produced and the yield.

The ore from the Westerberg area is considera weathered and contains a lot of yellow ochre which tends to discolour the fibre. On the other hand ore from the Black Rid area is of a dark blue colour and has a flaky fracture like sha

From the jaw crusher which has a minus 2" product, the ore passes through a tapered trommel 6ft. long, 4ft. d of 1/2" mesh revolving at 16 r.p.m. Oversize goes to a pickin belt about 40 ft. long running at approximately 30 ft. per minu where six native women remove approximately 10% of waste rock. The ore then passes through a second jaw crusher being reduced minus 3/4", and discharges together with the throughs from the trommel on to a 1/16" mesh 10 ft. x 3 ft. shaker screen driven approximately 600 strokes per minute to remove fines which go t waste.

The overs from the shaking screen are furthe reduced by a pair of rolls 24" diameter, 12" face, running at approximately 100 r.p.m. and then pass through a 1/16" mesh tr driven at about 12 r.p.m. The throughs from this trommel go waste and the overs, approximately 1/4" in size, pass to a disintegrator running at 1800 r.p.m. The machine is made by Christy and Norris and has four quickly detachable arms with separate beater heads (see drawings and sketches Fig: &).

It is possible to change the disintegrator beaters in about three minutes plus approximately five minutes lost milling time The beater arms are changed every four hours.

The crushing roll surfaces are ground by hand each week to remove ridges and about every six weeks are turned in the lathe. The life of a set of roll shells is about 18 weeks, in which time about 7000 tons of ore would be crushed.

It was estimated from a visual examination that the throughs from the 1/16" mesh trommel contained approximately 10% of fibre of 1/8" and less in length.

The disintegrator opens out the fibre to approximately the condition in which it is used in an asbestos cement plant. The fibre from the disintegrator is passed throu a trommel 9 ft. long, 4 ft. dia., 12 r.p.m., the first half of which is covered with 3/16" screen and the rest with 3/8" screen The throughs from the first section are sent to an adjoining tailings treatment plant for recovery of X grade fibre, the throughs from the 3/8" section, consisting mainly of stone and small bundles of unopened fibre, are returned to the disintegrat and the overs are bagged as S grade fibre to be sent to Prieska for cleaning.

The fibre discharging from the trommel drops on to a grid of inclined bars which further assist in removal of stone from the fibre, short sticks of fibre and stone dropping through the bars are shovelled up and returned to the disintegra The fibre is picked up on forks and filled into bags of 100 lb. Heavy hand ramming is necessary to get the quantity of fibre in the bag. Jute bags of a similar quality to those at Wittenoom are used.

There was a considerable dust nuisance in the plant although some attempt was made at the shaking screen and the disintegrator to house over the units causing dust. There were no exhaust fans used for removing dust.

Plant Capacity. It was claimed that all ore to produce 25 tons of fibre per day was treated in the Westerbe mill. This requires a throughput of 60 tons of ore per day

assuming that 20% stone and dust remains in the fibre. The average hourly rate is thus about 6 tons per hour through the jaw crusher and about 4 tons per hour through the disintegrator.

Mill Building. The plant is arranged on the side of a small hill to obtain gravity flow where possible. The building is timber framed with corrugated iron covering, about 20 ft. wide by 60 ft. long. See photograph, page .

Labour. One European and eighteen natives per shift produce 24 tons of Asbestos Fibre per day on one 12 hour shift. The European acts as Mill Foreman and Maintenance Fitter

Koegas Mill. Tailings Treatment. Originally the Koegas Mill was similar to the Westerberg Mill but since extensive re-treatment of tailings dumps has been undertaken, the Koegas Mill has been used exclusively for this purpose. A new mill is in course of construction at Koegas and is described late

The tailings are reclaimed from dumps around th Mill and fed through a Christy & Norris disintegrator. The mate ial discharged from the disintegrator is passed through a trommel having 1/8" screen from which the oversize material is bagged as X grade fibre. Throughs are fed to a trommel having 1/16" scre opening, the oversize from this trommel being returned to the disintegrator and the throughs discarded as tailings. The X gr fibre from this plant still contains a considerable amount of du and stone and the fibre is given further trommel treatment at th cleaning plant in Prieska. See sketch of mill circuit, Fig.

The New Koegas Plant. The new Koegas Plant w designed primarily by Mr. Sinclair and follows the general princ used in the other Cape Asbestos Mills, depending on trommel scre for cleaning and separation of the fibre from the rock.

The plant is arranged on the side of a slope : that for the most part gravity feed is obtained through the pro cess. The plant is driven by line shafting from an engine hou in a dustproof building alongside the mill.

Ore will be fed by hand from a steel "lashing plate into a jaw crusher set to about 1½" discharge. The

maximum size of ore is about 6". The jaw crusher discharges to a trommel having 1/2" openings from which oversize passes on to a horizontal picking belt about 30 ft. long which discharges to second jaw crusher. Undersize also drops on to a belt conveyor

The fines from the belt conveyor and the throughs from the jaw crusher discharge on to a shaking screen of 1/8" mesh, the throughs from which go to the tailings treatme plant. Oversize from the shaker screen is elevated in an inclined bucket elevator to a set of crushing rolls about 16" diameter by 12" face set to 1/4". A second pair of rolls in series follows set to 1/8".

The discharge from the second set of rolls pas through a trommel, the first part of which is covered with 1/16" mesh and the second part covered with 1/2" mesh. Throughs from the first section go to waste and oversize from the second sectic is returned to the second set of rolls. Throughs from the seco section are fed to a disintegrator which discharges to a 1/16" trommel.

Throughs from this trommel go to waste and ove size goes to another trommel, the first section of which is covered with 3/16" mesh and the second section with 5/16" mesh. Throughs from the first section go to tailings treatment plant and throughs from the second section are returned to the disintegrator. The oversize product from this trommel is the finished fibre.

As this plant was not working it was not possible to determine the speeds of the various units or the mi capacity. It was anticipated, however, that this mill would have at least 50% more capacity than the Westerberg Mill.

CLEANING PLANT - PRIESKA.

General. Fibre is received at Prieska from all the mining areas at Koegas, Westerberg, Kuruman and Kliphuis. The fibre has already been milled and roughly graded into X, S, A, B, C or D grades and the treatment at Prieska is to blend, open and remove stone from the fibre in order to obtain a cleaner and more uniform product.

There are large storage warehouses at Prieska sufficient for several thousand tons of fibre. Prieska also serves as a base for the receipt and despatch of stores to the various mining areas. The total operating labour employed at Prieska numbers 130 natives and there are 10 Europeans including clerical staff.

Power is generated as required from oil engine

Blending. S grade fibre is put through the cleaning plant in batches of 1200 bags (60 short tons).

The number of bags in each batch from each of the different areas is roughly proportional to the production fr the area and a constant "formula" for this blending is worked t This is necessary because fibre from different areas varies in colour and texture and a fixed proportion must be maintained to give a uniform product. The fibre is emptied from the bags in a large open bin on the floor, the fibre from different areas being placed in layers right across the whole area. The bin measures approximately 60 ft. x 50 ft.

Feeding. The fibre is fed by hand using a multi pronged fork to shovel the fibre into the boot of an inclined open bucket elevator, the tail pulley of which is abo 3 ft. below the floor level. There are three feed points and three parallel lines of similar cleaning plant.

From the three feed points the bucket elevat travelling at 180 ft. per minute, deliver to three trommels in parallel, the trommels being 9 ft. long, tapering from 3 ft. t 5 ft. diameter, revolving at 16 r.p.m. and covered with 3/16" screen. The throughs from the trommels drop on to a belt

conveyor and are delivered to a disintegrator for further treatment. The oversize from the trommels drops into a second inclined elevator consisting of slats attached to a rubber belt conveyor. This elevator delivers to a hammer mill running at 1200 r.p.m.

Hammer Mill. The hammer mill is locally designed and built in Johannesburg and consists of a light mild steel casing with a serrated wear plate covering an arc of approximately 45° of the circumference. The plate is spring loaded and has a screw adjustment for taking up as it wears. Th life of the plate is from two to three weeks. The hammer mill rotor is approximately 18" diameter and has four beaters attached by two radial arms to the rotor, the beater blades being 10" wide and 2" x 1" cross section. (See drawings and Figure No. The beaters are reversed after two shifts' running and have a total life of three days.

The hammer mills discharge to a third inclined elevator which feeds the fibre into a cleaning trommel similar to the first trommels and covered with 3/16" mesh. The throughs from the three cleaning trommels drop on to a belt conveyor and are returned for further processing. The fibre discharged from the trommel is filled into bags as the finished S grade product.

Bagging. At each bagging station there is a native shovelling fibre into the bag, a second native stamping down the fibre using two heavy wooden clubs and a third man carrying bags away for sewing and stacking. Natives working around the discharge from the trommels wear gauze pads strapped across their mouths.

Retreatment. The throughs from the three cleaning trommels are returned to a fourth trommel of 3/16" mesh in line with the first set of trommels. Oversize materia from this trommel which should be all fibre, is conveyed back t the blending bin and passed through the cleaning circuit to be recovered as S grade fibre. The throughs from the trommel joi the throughs from the three other primary trommels and are elev to a fourth hammer mill arranged in line with the other three.

The product from the hammer mill which is driven at 1800 r.p.m. as compared to 1200 r.p.m. for the other three, is elevated to a trommel in line with the three S grade cleaning trommels. The first half of this trommel is covered with 1/8" mesh screen and the rest with 5/16" mesh screen. The throughs from the first section are collected on a belt conveyor and delivered into a 3/4 ton mine car for delivery to the adjoining tailings treatment or X grade plant. The throughs from the second section of the trommel join the throughs from the cleaning trommels and go through the return circuit. Overs from the trommel are bagged as S grade fibre.

Dust Collecting. All trommels and the elevator between the hammer mills and cleaning trommels are enclosed and connected to a dust collecting system. There are four fans, one located alongside each hammer mill. Each fan draws through a 5" duct from each of the two trommels and a 6" duct from the hammer mill discharge chute on each of the four parallel lines of treatment plant.

The fans are approximately 24" diameter running at 1800 r.p.m. and have 14" diameter delivery ducts. It is estimated that each fan has a capacity of approximately 4000 c. The fans deliver to a dust room, a brick building 40 ft. long x 20 ft. wide x 12 ft. high alongside the mill building. The air enters the dust room through the ceiling at one end, passes under a central baffle and is discharged through two stacks 3 ft. diameter, 20 ft. high. The discharge from the dust room appears as a fine haze.

There are two cleaning doors in the wall of the building (see photograph, page) and the dust is shovelled into bags at the end of the treatment of each batch. Approximately 20 bags or 1 ton of dust and short fibre is recovered from each batch of 60 short tons. This material is sent to Cape Asbestos Insulation plant at Benoni near Johannesburg. The maximum length of fibre in the shorts is 1/16".

Power. All of the above plant is driven by 42 h.p. National oil engines through a series of counter shaft belt drives.

Buildings. The main mill building is approximately 180 ft. x 75 ft. wide x 20 ft. high. The walls and roof of the building are covered with corrugated iron and the framework is of steel sections. An area of the building 50 ft. x 75 ft. is used for the storage and blending of fibre. The cleaning plant takes up approximately 80 ft. x 75 ft. and the remaining 50 ft. x 75 ft. is used for sewing and stacking clean fibre.

There are two storage warehouses, approximately 400 ft. long x 40 ft. span with a rail track between.

Labour. The operating crew for the cleaning plant consists of 50 natives and 3 Europeans, the latter being responsible for maintenance and running of the plant. The plant operates for approximately ten hours per day.

The natives are paid 5/- per day with a maximum of 6/- per day for boss boys. Quarters are provided for the natives but they provide and cook their own food. Of the 5/- per day, 2/6 is intended to represent living allowance.

Plant Capacity. The plant treats fibre at the rate of about 100 bags (5 short tons) per hour and a batch is put through in from 1 to 1½ shifts.

20% to 25% stone and dust is eliminated from the feed. The bagged fibre contains an average of 3% stone and should not contain more than 5%.

Of the material screened out of the S grade fibre, approximately 16% is recovered from the tailings treatment plant as X grade fibre so that the overall recovery from the S grade fibre fed to the cleaning plant is from 80% to 83%.

Testing. The Prieska Manager (Plant Superintendent) checks the amount of stone in the fibre by hand pick through a 40 oz. sample each day.

Tailings Treatment Plant. General. The tailings treatment plant has been built as an annexe to the main plant (see photographs page), and is being operated on two shifts at present to cope with the output from the Koegas tailings treatment plant in addition to the handling of the

tailings from the Prieska S grade cleaning plant.

Plant. The tailings from the S grade plant are elevated on an inclined conveyor and fed into a Christy & Norris disintegrator running at 1800 r.p.m. The product from the disintegrator is discharged into a trommel 9 ft. long, tapering from 4 ft. to 6 ft. diameter, and driven at 8 r.p.m. The first half of the trommel is covered with 1/16" mesh and the throughs from this section go to waste. The rest of the tromme is covered with 1/8" mesh screen and the throughs from this section are returned to a 1/16" mesh 6 ft. x 3 ft. Hummer vibrating screen driven at 1200 r.p.m. by a 1½ kw M.G. set. The over from the trommel are bagged as X grade fibre.

The Hummer screen is mounted on twelve flat springs set at an angle of approximately 45° to the vertical. Throughs from the Hummer screen go to waste and the oversize joi the feed to the disintegrator.

There is a second trommel 9 ft. long, tapering 4 ft. to 6 ft. diameter, covered with 1/16" mesh through which the X grade fibre from Koegas is passed for a final cleaning.

The oversize product from this trommel is mix in the proportion of two parts to one with the product from the Prieska X grade fibre and bagged as the finished X grade produc

The whole of the above plant including the M. set is driven by a 27 h.p. Ruston engine.

Eighteen men and one European per shift are employed in the plant and it is operated for two shifts.

The output of X grade fibre is approximately short tons per day.

Long Fibre. Hand cobbed fibre which is sold as A, B, C or D grade is sorted, blended and cleaned by hand a Prieska. Several bags of fibre are tipped out on to a concre platform approximately 10 ft. square and picked over by hand (see photographs page), to remove any discoloured fibre o fibre which is of a higher or lower length grade.

There is a considerable proportion of what

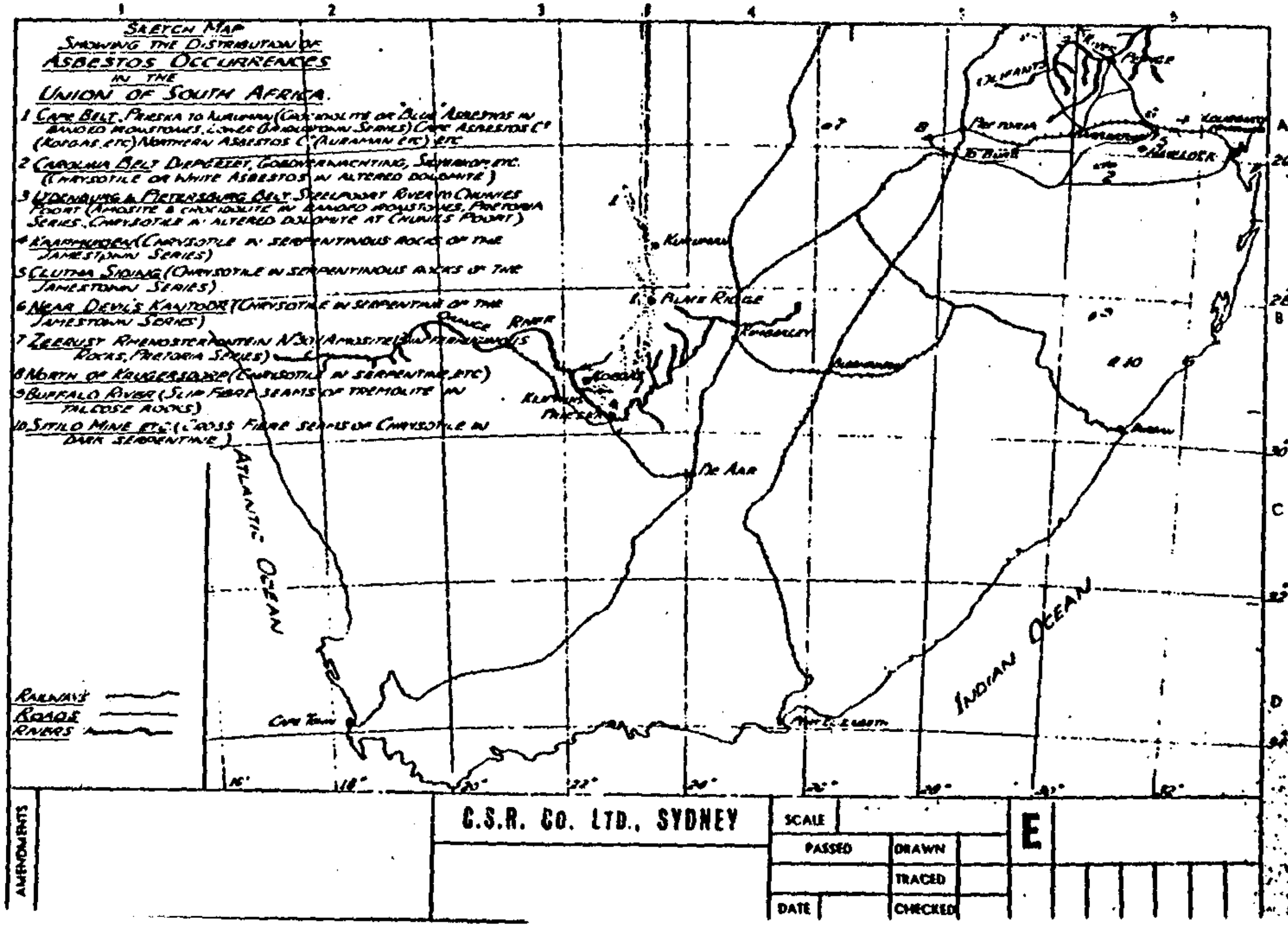
referred to locally as "discoloured" fibre, which is somewhat similar to the material known at Wittenoom as dead fibre. The fibre is of a reddish colour and somewhat more brittle than good quality blue fibre and appears to have suffered some oxidat: from weathering. Apparently the fibre has a market value but i: presence in blue fibre is a serious defect.

Differences in colour and texture of fibre fro: the different areas are most apparent in the longer grades.

After the sorting and cleaning, fibre is bagge: again by hand.

The total of A, B, C and D grades represents 10% of the total output.

Including the variations of A, B, C and D grad: which include discoloured grades and different quality fibres of the same grading, there is a total of approximately 30 grades of fibre.



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NO 1161 OF 1987

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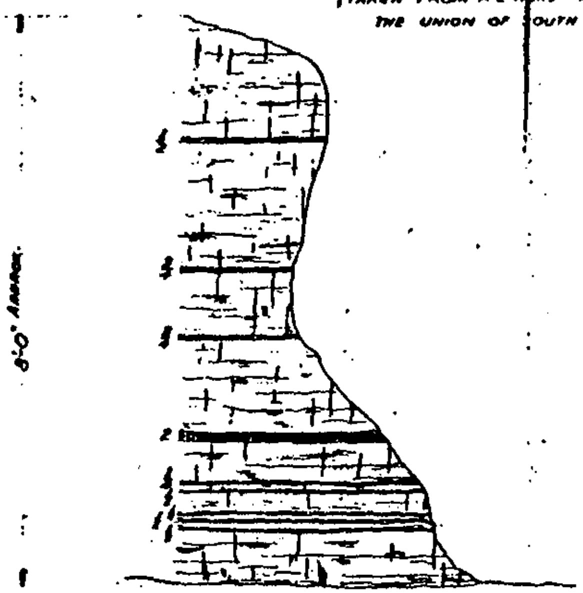
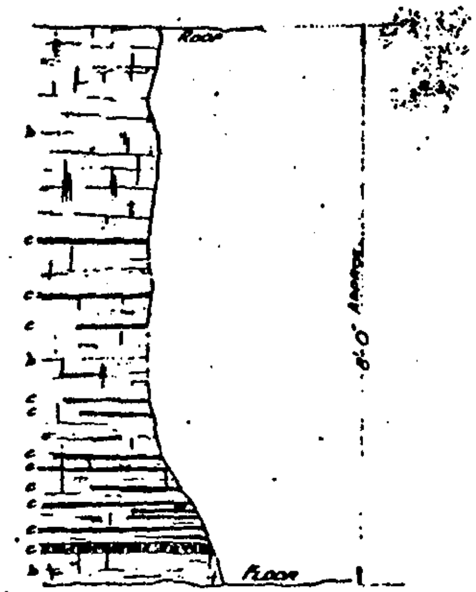
TYPICAL SEAMS OF NORTHERN SECTION
OF BLUE ASBESTOS DEPOSIT
SOUTH AFRICA.

(TAKEN FROM A L H...'S "ASBESTOS IN THE UNION OF SOUTH AFRICA")



APPROX. SCALE 1:20. NINE INTERBEDDED SEAMS OF CROCIDOLITE WITH THICKNESS IN INCHES IN HARD JASPERY BANDED ROCKS.



APPROX. SCALE 1:20. FROM 12 TO 15 INTERBEDDED CROSS FIBRE VEINS OF BLUE CROCIDOLITE.
c MAXIMUM WIDTH OF 2" MANY UNDER 1". b BANDED MAGNETIC IRONSTONES FROM ROOF TO FLOOR IS 8 FEET.

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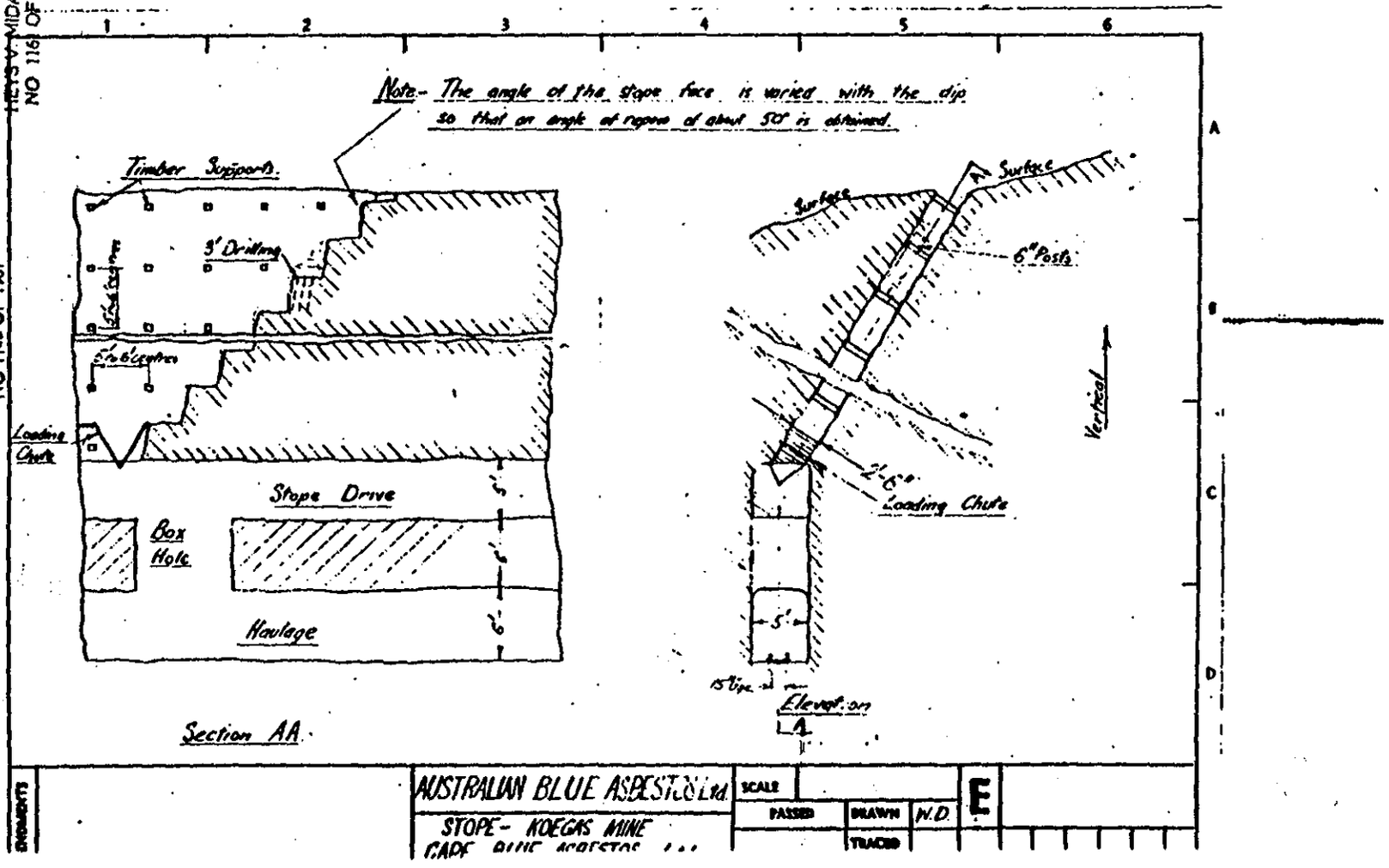

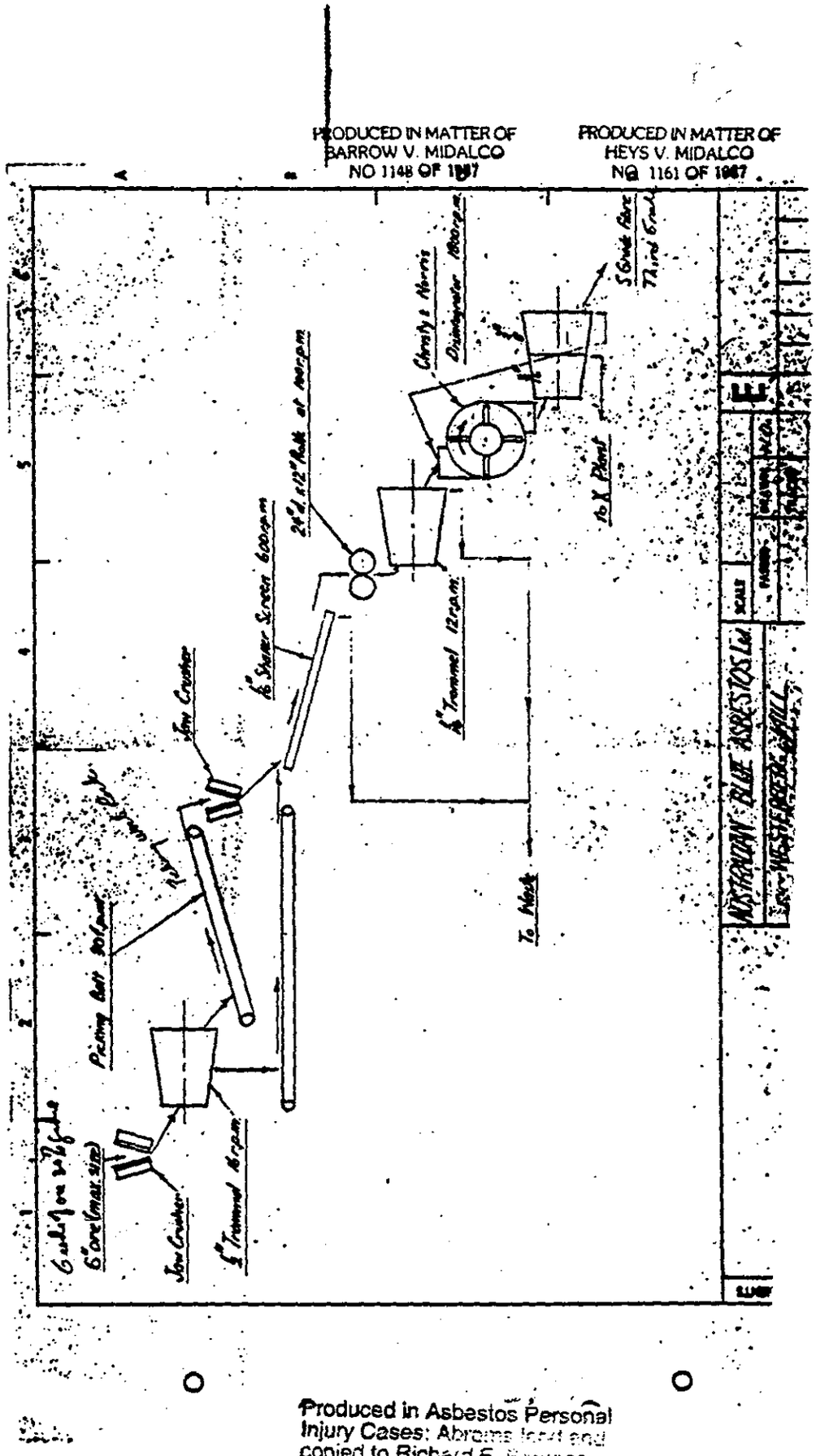

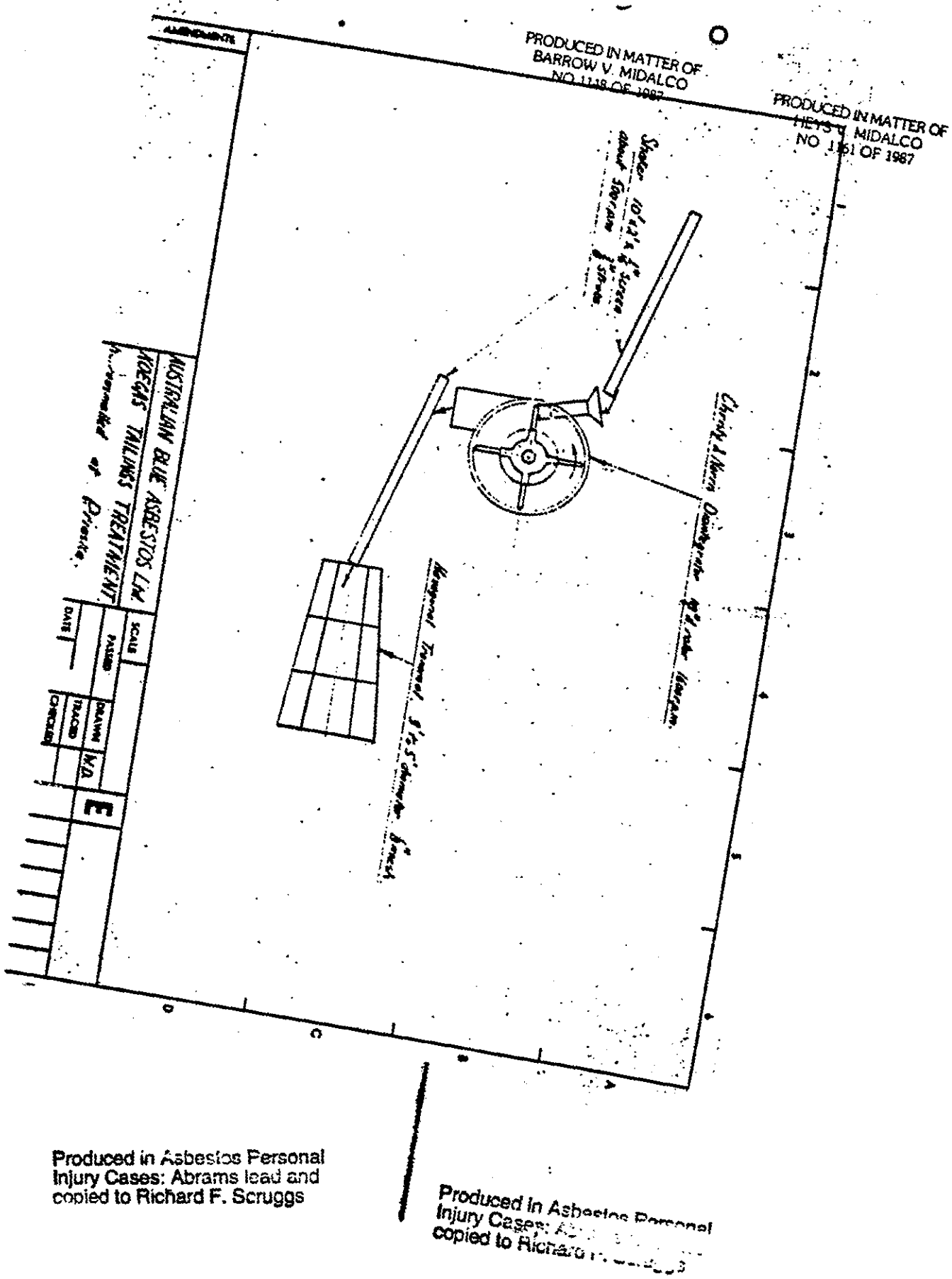

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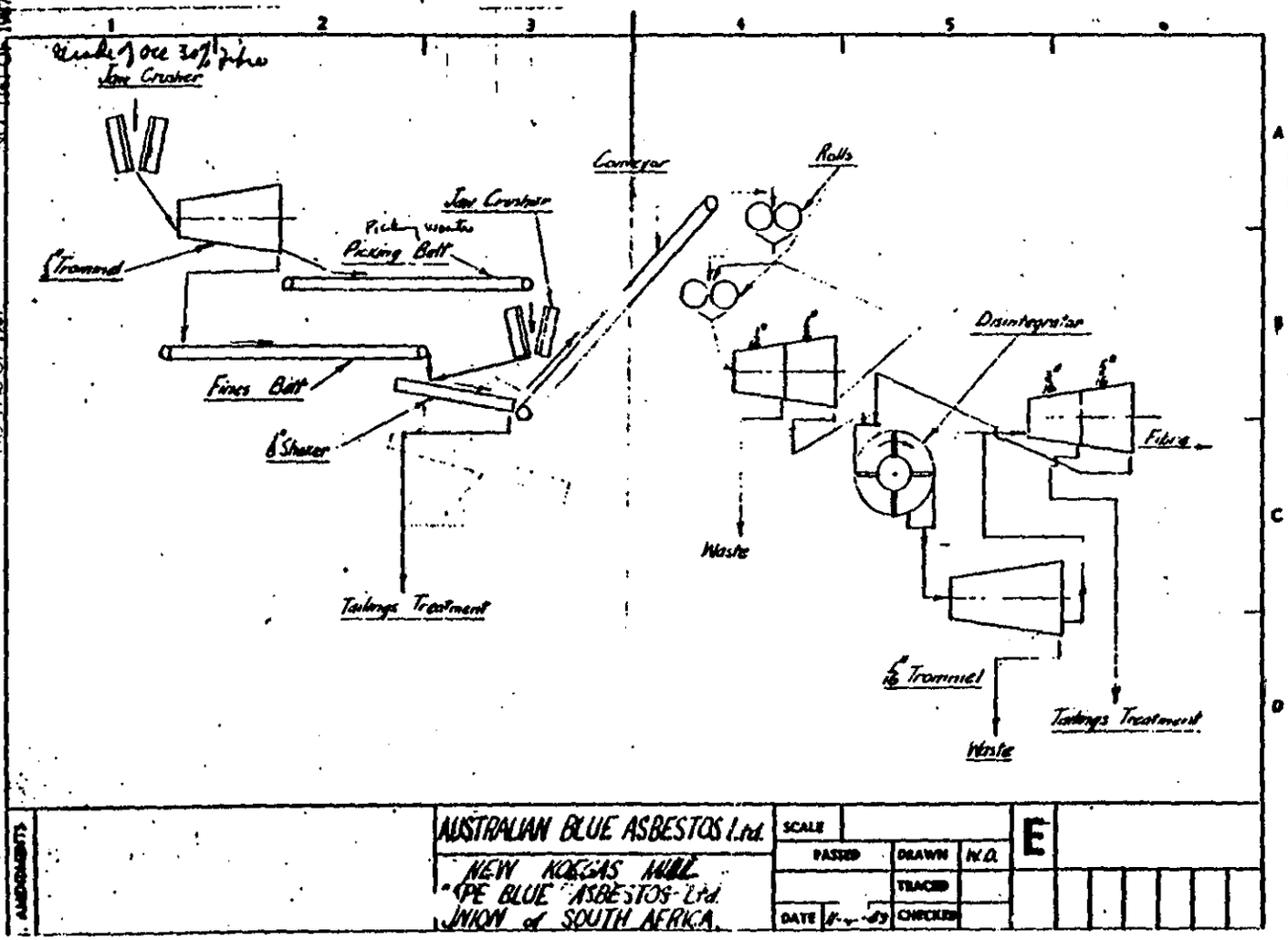

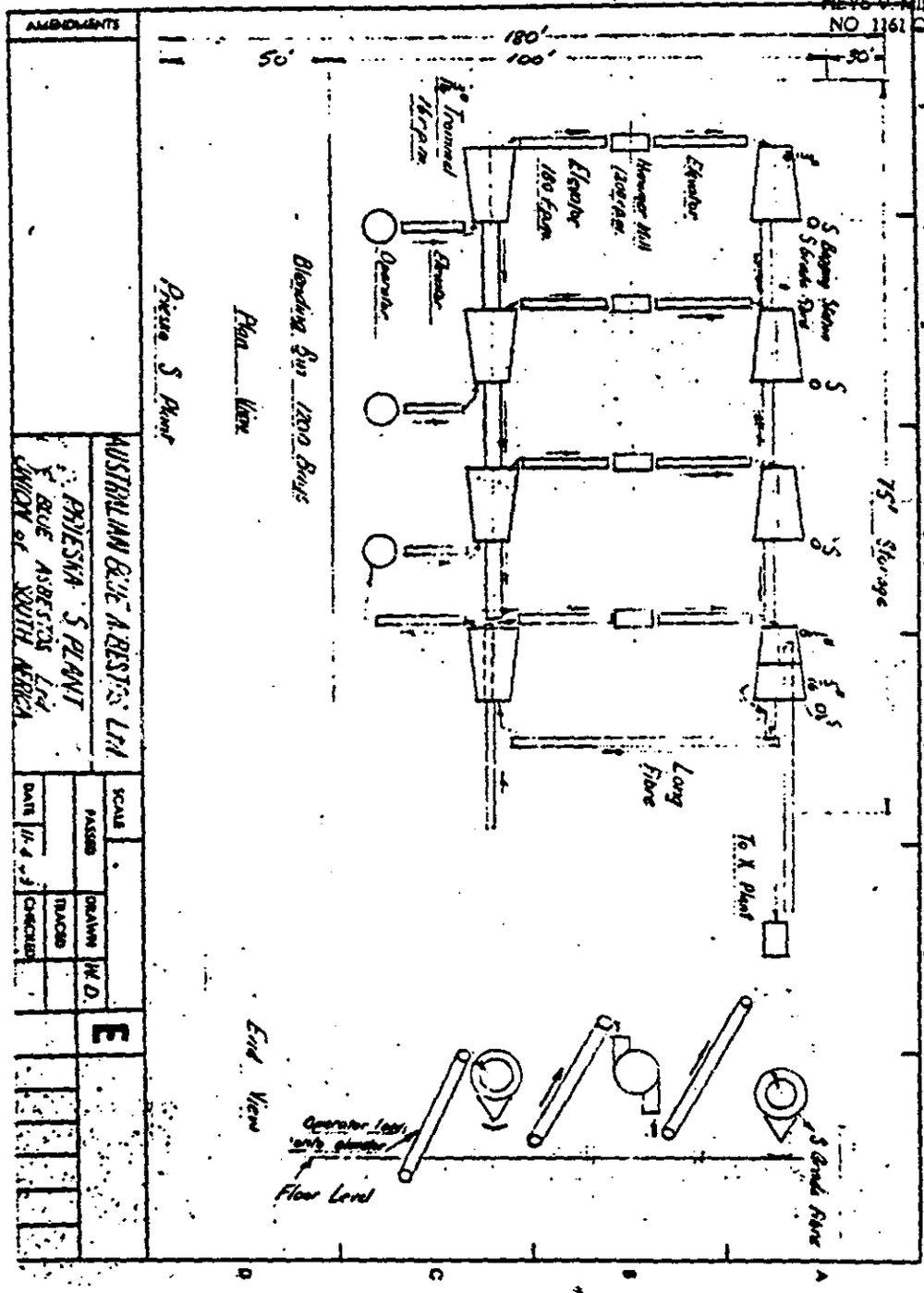

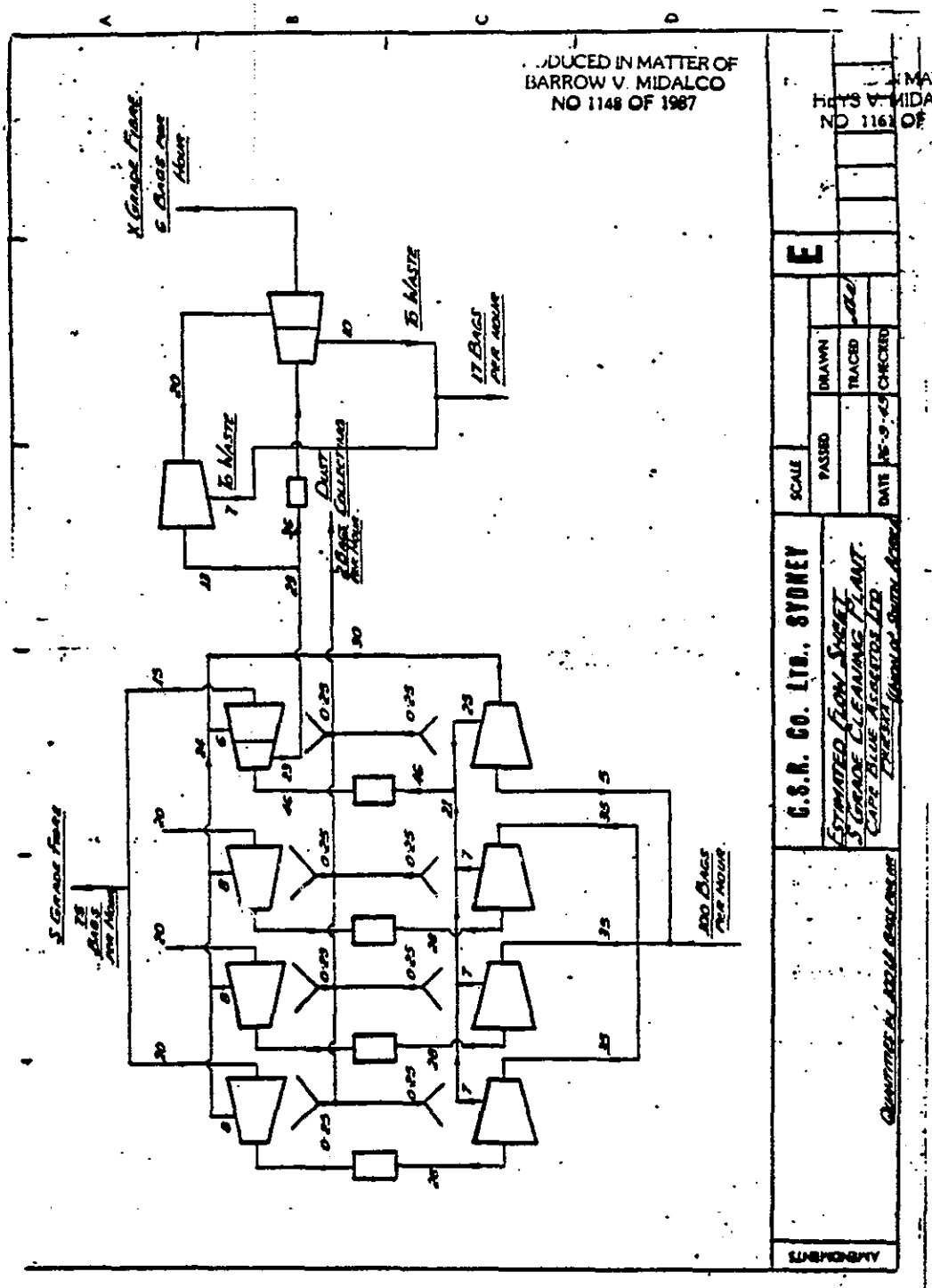

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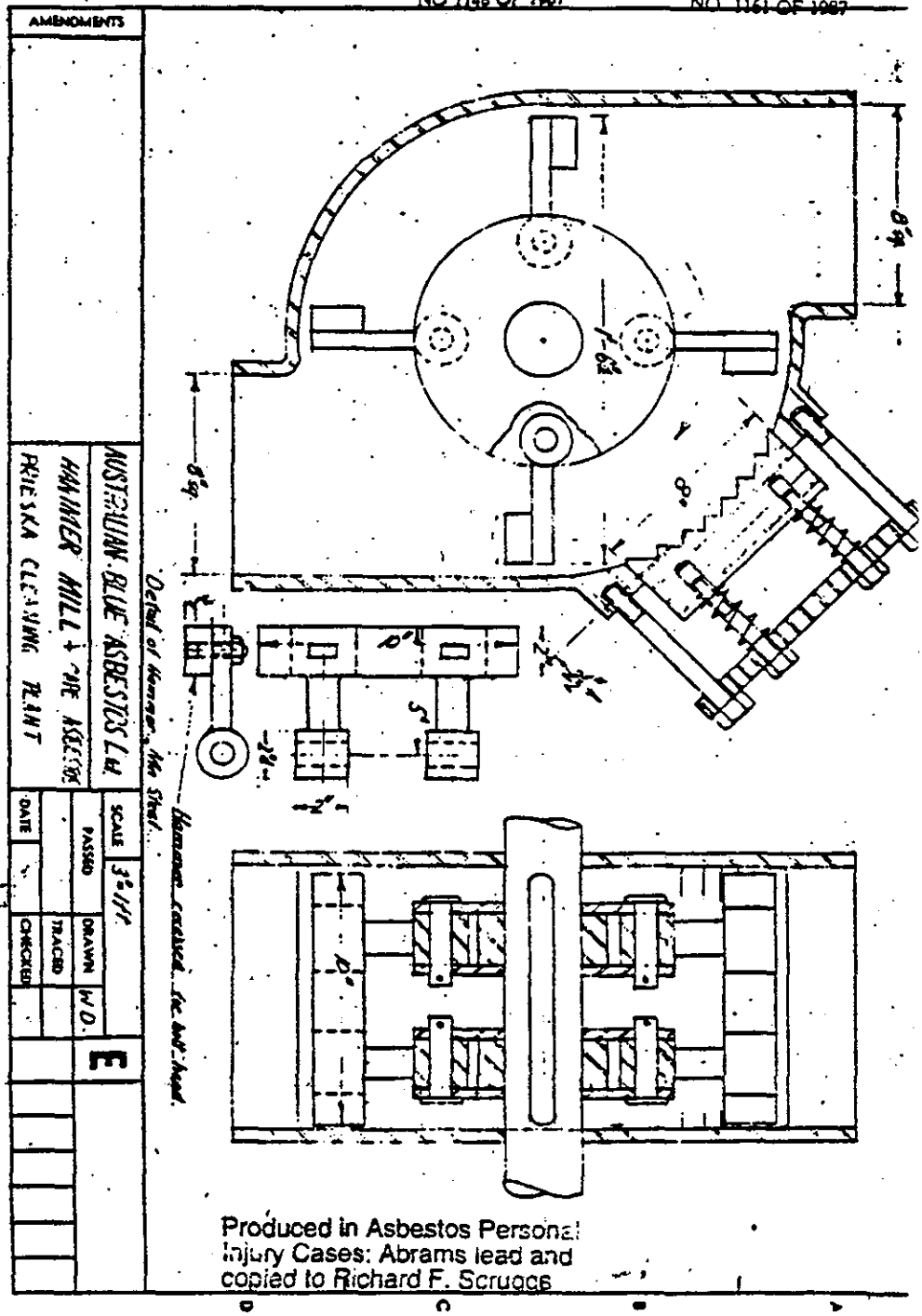

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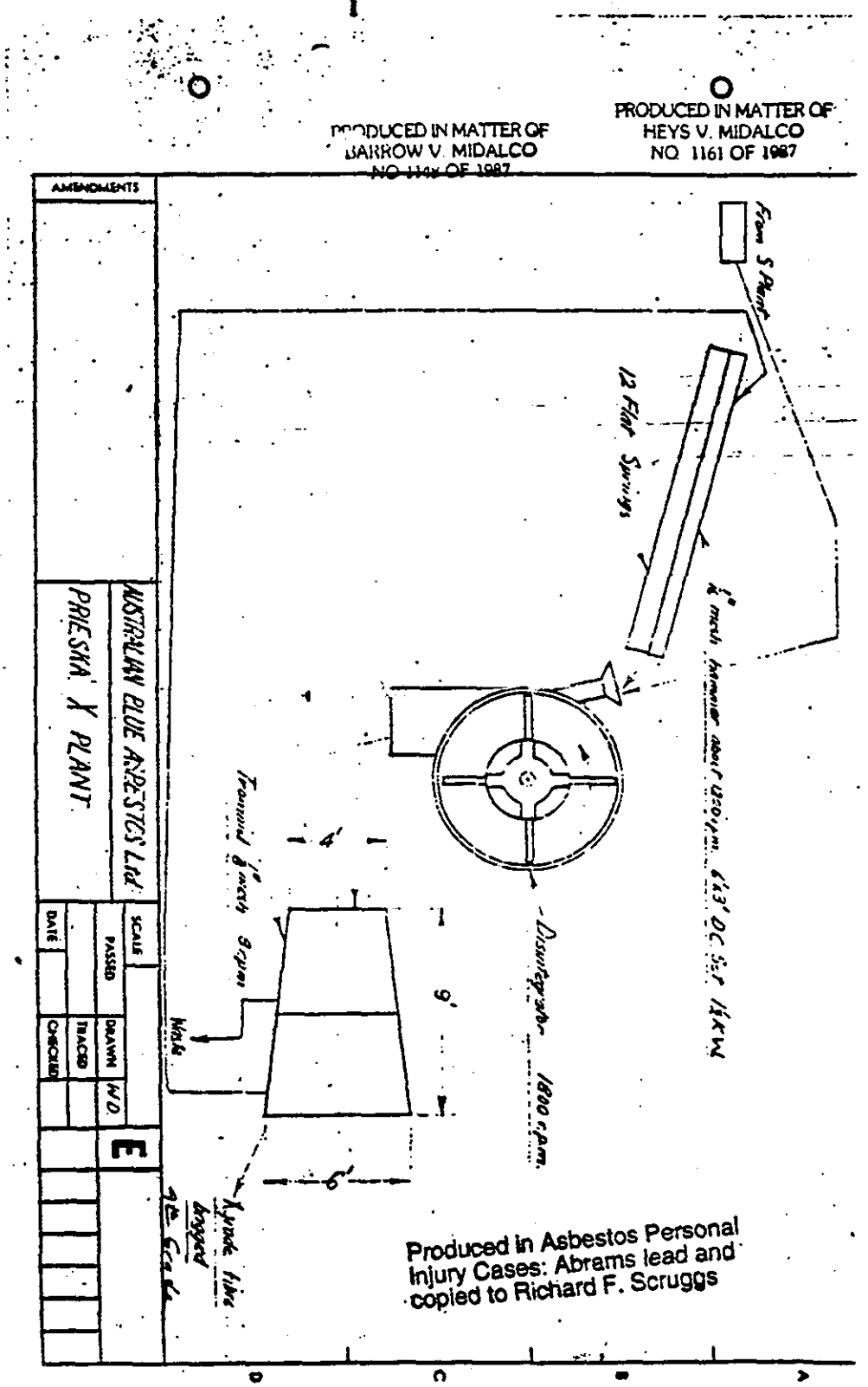

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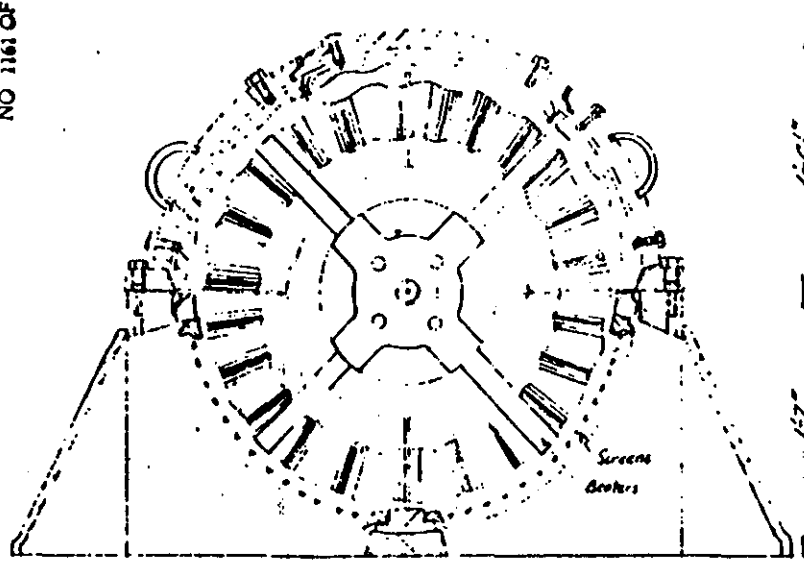

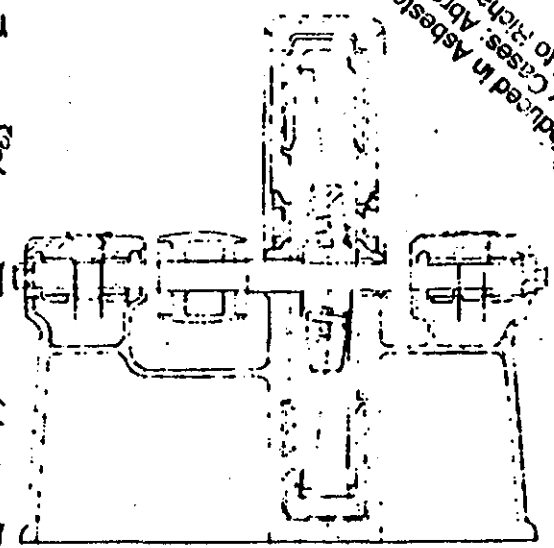

2'-5" 2'-5" 1'-10½" 1'-3½"
4'-10" 3'-2⅛"

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AMENDMENTS	AUSTRALIAN BLUE ASPESTOS Ltd	SCALE	½"=1ft	E	
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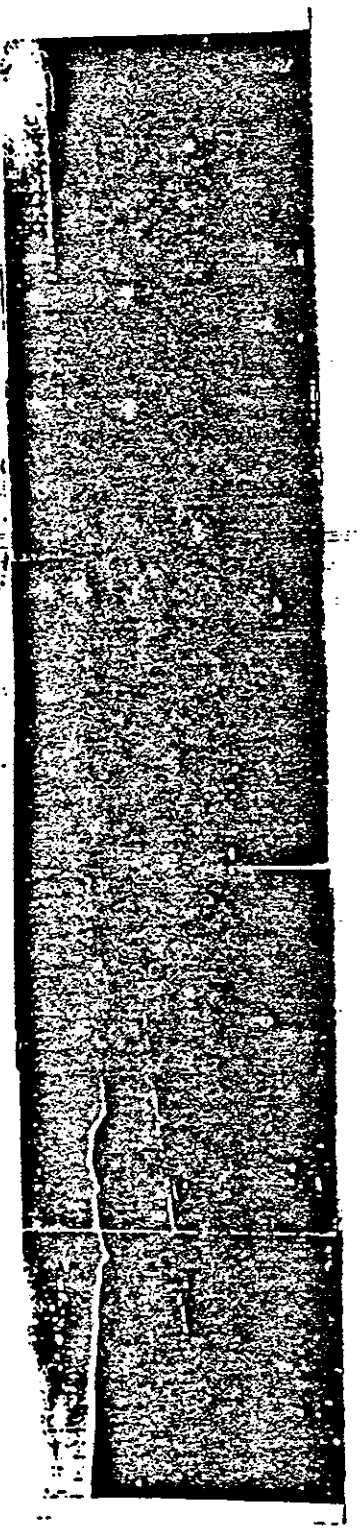
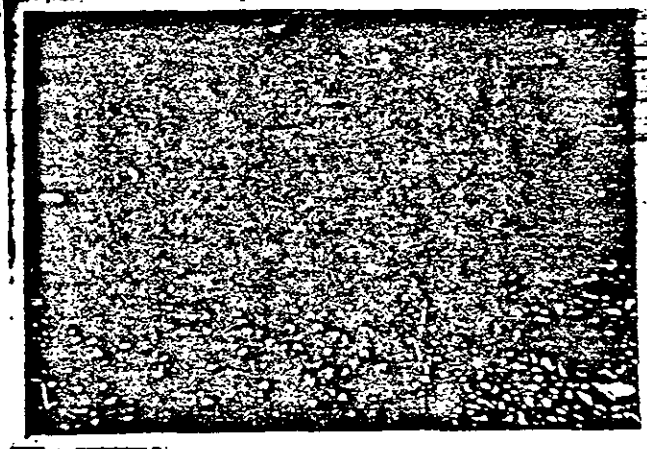


Looking south into Westerberg Valley with "pont" crossing Orange Valley in the foreground.



West side of Westerberg Valley showing a large sorting dump in the centre foreground.

West side of Westerberg Valley showing sorting dumps in the foreground and centre and vertical stopes in the hill in the background.

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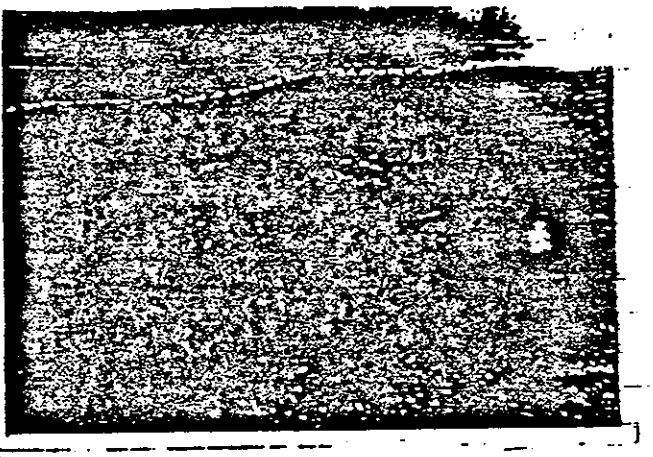
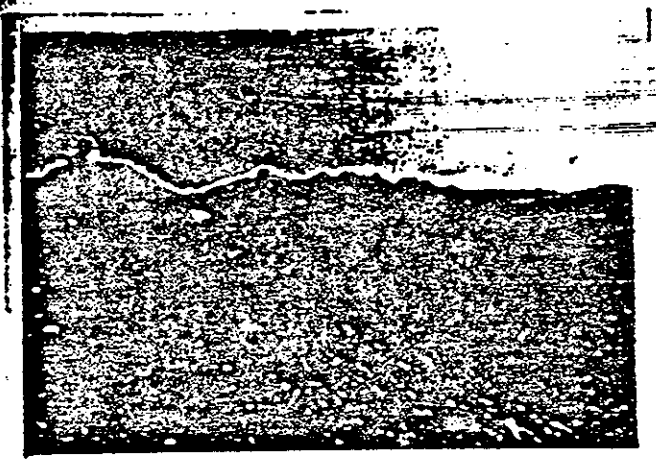
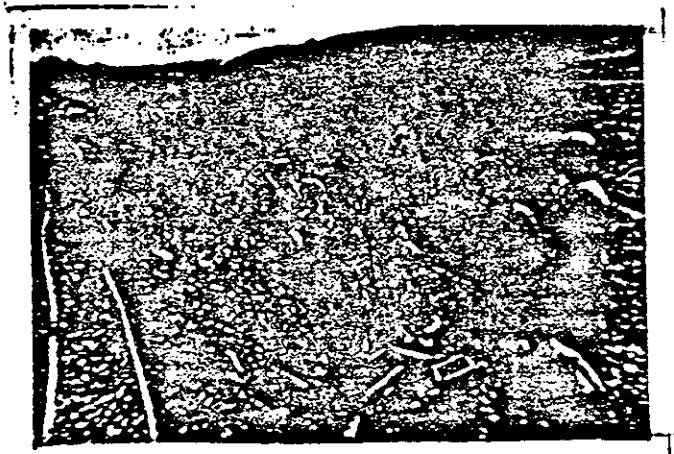


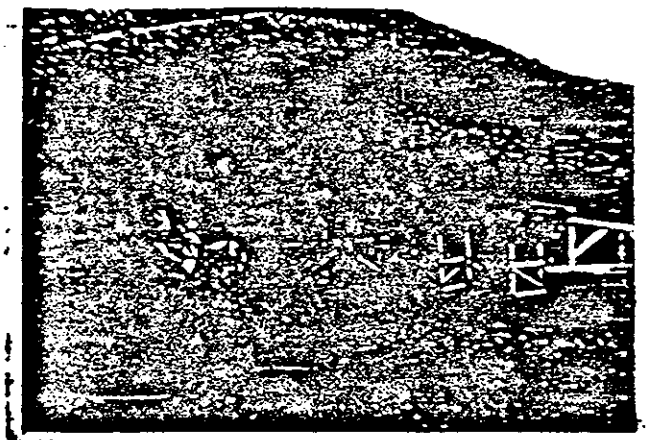
West side of Westerberg Valley showing sorting dumps at two mine levels



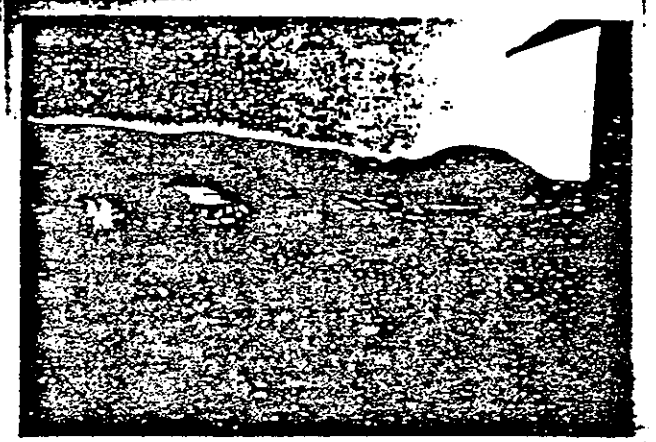
Natives sorting ore at the edge of sorting dump, Westerberg Valley.



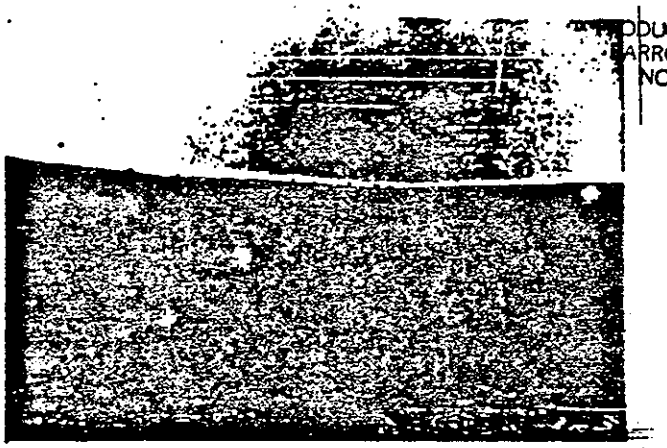
Natives sorting ore at the edge of sorting dump, Westerberg Valley



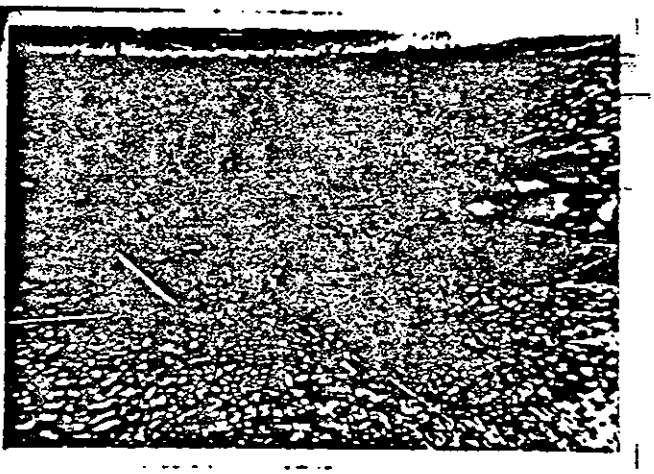
Hand screening tailings dumps to recover short fibre.



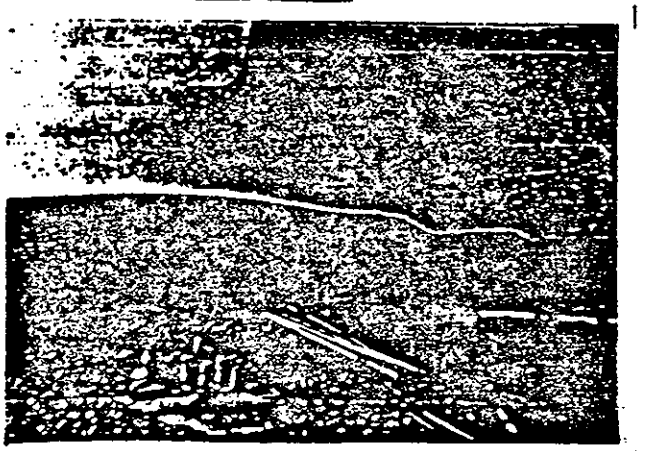
Miners' houses in Wasterberg Valley, Kaaras hills in foreground



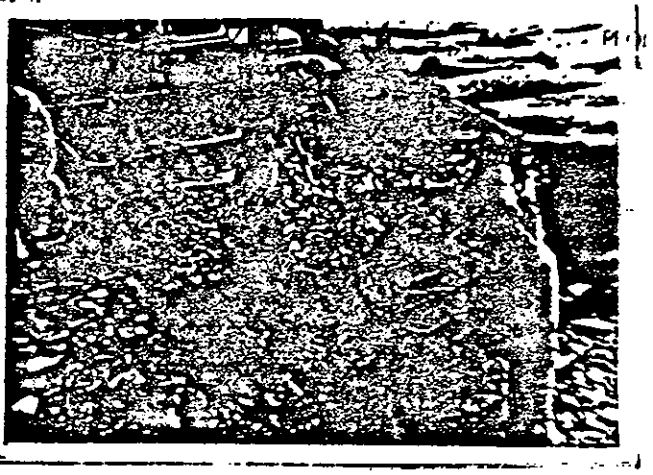
Asbestos Fibre bearing strata in hills at Kliphuis.



Drive entry, Kliphuis.



Hand cobbing station, Kliphuis.

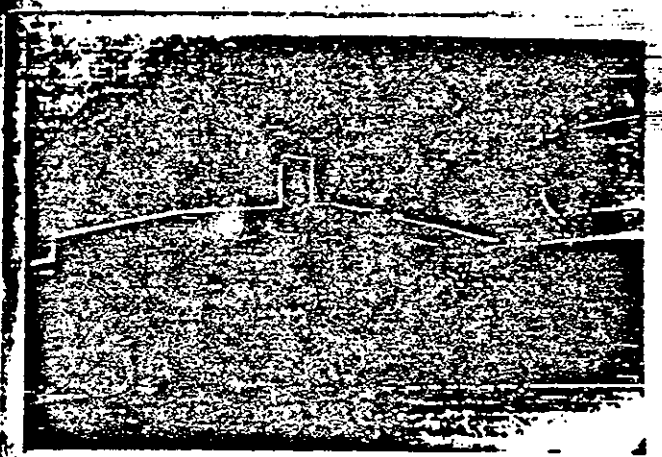


Hand cobbing long fibre ore in foreground. short fibre ore being loaded into truck in background.

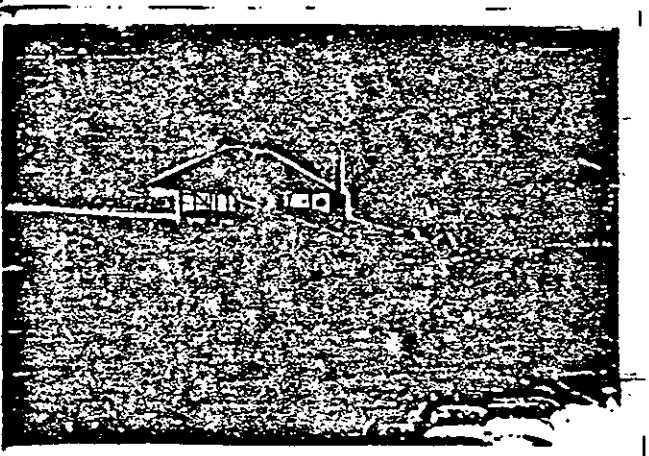
Native women hand cobbing long fibre.

Native women hand cobbing long fibre.

The town of Prieska as seen from the north side of the Orange River.



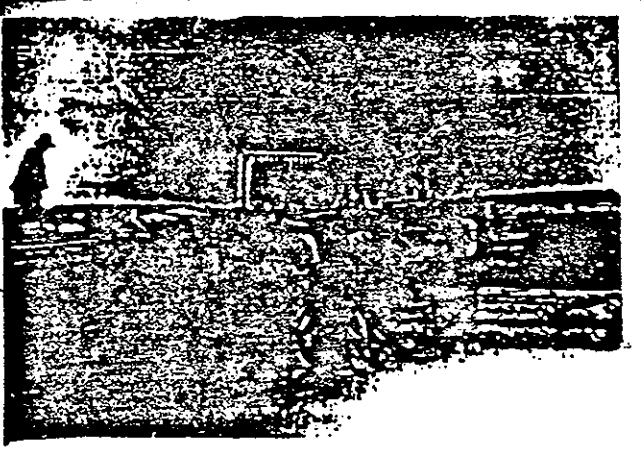
Cleaning plant at Prieska showing dust collecting rooms in the foreground and the building housing the cleaning plant in the rear.



Cleaning plant at Prieska showing short fibre recovery plant.

Cleaning plant at Prieska showing blending and bagging of long fibre.

Cleaning plant at Prieska showing cleaning and blending of long fibre.



Loading mine timber at Prieska.