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ASBESTOS

REPORT ON THE MIDWEST ASBESTOS COMPANY'S PROPERTY

NATRONA COUNTY, WYOMING

By C. A. Fisher.

Introduction: The Midwest Asbestos Company's property is located in the Front Range of the Rocky Mountains in east central Wyoming, near the town of Casper. The area comprises about 1,480 acres, which was acquired by location under the Lode Mining Claim act, and consists of claims 600 feet wide by 1,500 feet long. Of the total area located, about 360 acres is now patented or ready for patent, the official surveys having been made, and the remainder is located with all required assessment work to date completed. The property is situated on Casper, Muddy, and Deer Creek Mountains, three distinct uplifts which here constitute the Front Range of the Rocky Mountains. In an air line, Casper Mountain is about 8 miles south of the Town of Casper; Muddy Mountain 10 miles to the southeast; and Deer Creek Mountain about 15 miles southeast of the same point.

The property on Casper Mountain is in Secs. 9, 16, 17, 18, 19, 20 and 30 of T. 32 N., R. 79 W., and the property on Muddy and Deer Creek Mountains is in Secs. 11, 14, 19, 20, 22, 23, 29, and 30 of T. 31 N., R. 78 W. Practically the entire area occurs in the crystaline rock portion of the above described mountains, where the country rock consists mainly of granite associated with smaller amounts of hornblende schist, diorite and serpentine.

The asbestos deposits, which constitute the chief value of this property, are all alteration products of the serpentine. Asbestos bearing serpentine in quantities sufficiently large to be of commercial value, is of relatively small occurrence in the world. Two varieties are found, which are generally known as the amphibole or hornblende, and the chrysotile, the latter being the more valuable. The largest and most highly developed deposits of this material in the world occur in the southeastern part of the Province of Quebec, Dominion of Canada. Less highly developed deposits are found in the Ural Mountains, of Russia and Siberia, and other occurrences, which are of small commercial value, are found in Italy, France, Australia, New Zealand, Africa, (especially in the Trans. Vaal), and Japan. In the United States, it is known to occur in commercial amounts in Arizona, Wyoming, Virginia, Vermont and Georgia. Of these, only the Wyoming, Arizona and Vermont contain the chrysotile variety, the others being of the amphibole type.

The property herein described is owned or controlled by the Midwest Asbestos Company, an Arizona corporation, for whom this report is prepared.

Accessibility: The property is question is easily accessible, especially that on Casper Mountain, which is about 6 miles south of the Town of Casper, on the main line of the Chicago & Northwestern Railroad, also on the transcontinental line of the Chicago, Burlington & Quincy Road now being constructed between Seattle and Galveston. The Smith Creek property on Muddy and Deer Crrek Mountains, while slightly more remote, is nevertheless within comparatively easy reach of these same railroads at a point known as Big Muddy Station, 12 miles east of the Town of Casper. When branch transportation facilities, consisting of both aerial tram and railroad, are supplies, the deposits of this property could be placed on two main line roads, which would insure excellent transportation routes to the northwest, northeast, east, southeast and west. By rail the property in question is approximately 175 miles from Cheyenne, 275 miles from Denver, 375 miles from Pueblo, 350 miles from Salt Lake, 400 miles from Helena, 400 miles from Butte, 450 miles from Great Falls, 500 miles from Sioux City, 600 miles from Omaha, 700 miles from St. Paul, 700 miles from Minneapolis, 700 miles from Spokane, 800 miles from Winnepeg, 800 miles from Kansas City, 850 miles from Portland, 900 miles from Seattle, and 950 miles from Dallas. All of these centers of industry are on the above mentioned railroads, or connecting lines which afford more or less direct transportation routes. In fact, the property in question is more accessible to entire western half of the United States than any other chrysotile asbestos deposits in this country, the only other producing localities being in Vermont and across the line in southeastern Canada, where long freight hauls make their shipment into this part of the country almost prohibitive.

Physical Features: The surface of the country in the vicinity of these asbestos deposits is mountainous, having an elevation of about 8,000 feet. However, the country is traversed by deep canyon-like, or more or less open, valleys, which afford a means of transportation for the products with little difficulty to the plains, where an elevation of about 5,000 feet prevails. The surface generally is sparcely covered with a growth of pine and spruce, but in places dense bodies of timber occur, which could be utilized in mining development. Water is abundant in all of the mountain streams, and in the immediate vicinities of the various valuable lodes sufficient level ground can be obtained for mill sites, etc., while enough relief is also present to insure economic mining of the lodes. The gradient of the streams is also sufficiently steep for the development of water power adequate for mining purposes. Fuel oil can be obtained from the town of Casper, where the large refineries of the Salt Creek Oil Fields are located, and coal of average quality can be secured from the small mines at Big Muddy station.

Geology: The rocks outcropping on the surface in the vicinity of the asbestos property herein described are entirely igneous. They are believed to be of Archaen age and are overlain uncomformably by Cambrian sandstones, followed in turn by later sedimentary rocks, which dip away from the mountain uplift toward the plains. Two productive localities, namely, Casper Mountain and Smith Creek, the latter including the deposits on both

Muddy and Deer Creek Mountain, occur on the summits of local anticlinal uplifts, separated by a broad syncline in which occur Paleozic and later sediments. It is due to these anticlinal uplifts and the subsequent erosion from their summits that the deep seated, altered rocks containing the serpentine have been exposed on the surface.

The rocks of the asbestos area consist of granite, hornblende, schist, diorite and chrysotile asbestos bearing serpentine. The granite is a red variety, medium to coarse grained, and composed mainly of quartz and feldspar, the former sometimes being segregated into veins several feet in width. The hornblende schist is a black, medium grained variety, with black hornblende predominating over the altered feldspar and quartz. The diorite, which presents the usual appearance, is a dark-colored, fine-grained rock, in which the schistose structure is not highly developed. The serpentine, in which the asbestos occurs, is light to dark green, slightly mottled color, traversed in many directions, but mainly vertically, by pale green and yellowish green, silky-lustered, chrysotile asbestos. The granite rock is perhaps the most abundant throughout this general region, the hornblende schist and diorite being of less frequent occurrence, and the serpentine dikes constituting a relatively small proportion of the entire rock mass.

ASBESTOS MINERAL

Varieties: The term asbestos embraces a group of minerals three in number, with several subdivisions which partake in common of certain physical and chemical characteristics which render them unique in the mineral kingdom. These are a more or less fibrous character possessing fire and acid proof properties. Mineralogically, the term asbestos embraces three minerals, known as antophyllite, amphibole and serpentine. The first two bear a close chemical resemblance, being silicates of lime, magnesia and alumina, while serpentine is a hydrated silicate of magnesia. The first named mineral, antophyllite, is of little commercial importance, therefore is only mentioned in passing, while the amphibole and serpentine will be described in detail.

The mineral amphibole includes five distinct varieties, tremolite, antinolite, asbestos, mountain leather wood, and cork, and crocidolite. The first three of these varieties are similar in appearance and composition, but the asbestos is the one which possesses the easily distinguishable, long flexible fiber, which can be readily separated from the rock with the fingers. Mountain leather and cork are almost barren of alumina and low in water content. These occur in sheets of variable thickness and consist of interwoven fiber. The mountain wood is a harder, more compact, fibrous variety, resembling petrified wood. None of these are suitable for the uses to which asbestos is usually put. Crocidolite is a blue variety of asbestos, the color being due to a large content of iron. The presence of iron, notwithstanding the great tensile strength of the mineral, greatly reduces its heat resisting properties and incapacitates it for the uses for which asbestos is usually employed.

The two first named varieties of amphibole, tremolite and actinolite, are low in alumina and pass into fibrous varieties known as asbestos, that is, hornblende and amphibole asbestos. These are closely related to pyrozene rocks, while the very silky varieties derived from serpentine, free from alumina and having the proper water content, is called chrysotile asbestos.

Serpentine, which is the parent rock of silky asbestos fiber wherever found, has three distinct fibrous forms, picrolite, soapstone and chrysotile. The first and last of these serpentine varieties, picrolite and chrysotile, are very similar in chemical composition, but in appearance and physical properties are very different, the former occuring in long, harsh, broken fiber, usually found in joint planes or along the slipping surface of the rock; while the latter is short, soft and silky, occurring as cross fiber in crevices and along slickensides of the serpentine. The length of picrolite fiber ranges from 6 to 12 inches, while that of chrysotile rarely exceeds 6 inches, and is generally less than an inch in length. Soapstone is readily distinguished from the other two varieties of serpentine by its non-fibwous character and its greasy feel and tallowy appearance on the surface.

Types: Asbestos fiber occurs as three types, known as cross fiber, slip fiber and mass fiber. The cross fiber asbestos is found mainly in veins, the fiber running directly across the veins from wall to wall. The slip fiber is found in slipping planes of the serpentine rocks. The mass fiber, as the term suggests, occurs in bunches and presents a radical structure, constituting the entire mass of rock in which it is found. The cross fiber type is usually chrysotile, the slip fiber generally amphibole though often found as chrysotile, and the mass fiber is always antophyllite.

Modes of Occurrence: The occurrence of the asbestos in the rock with which it is generally associated is of four different kinds. First, as cross fiber veins of chrysotile, in serpentine rock, which is a deep seated, igneous rock; second, as cross fiber veins of chrysotile with serpentine in limestone; third, as mass fiber amphibole, occurring in large bodies, stocks or dikes; fourth, as slip fiber veins in rocks which are mainly cortlandite and proxenite. Commercial asbestos is found in the first, second and third modes of occurrence only, that is, the cross fiber veins of chrysotile in serpentine derived from peridotite, as found near Lowell, Vermont, and Casper, Wyoming; the chrysotile with serpentine in limestone, as found in the Grand Canyon of Arizona; and the mass fiber amphibole, as found in Sall Mountain, Georgia, and Kamiah, Idaho.

Physical properties; Chrysotile asbestos is a fibrous mineral, which usually varies in color from dark green to blackish green, and some varieties are found which are grass green, as those at East Broughton, Canada, while other varieties are a yellowish green, as those found in the Grand Canyon of Arizona. Blue asbestos is also found in certain parts of the world, its color being due to a large percentage of iron; and brown varieties, due to weathering or infiltration of other substances, are known to occur. While in the rock the fiber is generally a shade of green but when carded and drawn out into threads it is of white silky luster. In specific gravity asbestos ranges 2.2 to 3.3 and in luster it is greasy, pearly, wavy or silky. The fiber readily withstands a temperature of 2,000 to 3,000 F., and with some varieties a temperature of 5,000 has no visible effect. Asbestos resists acids, but for this purpose the amphibole is better than the chrysotile.

The Wyoming asbestos, when unweathered, is a pale green to a yellowish color, sometimes banded, though not often. It has a silky luster and when the fiber is separated from the rock, it is white, flexible, and shows an average tensile strength except where partings are present. It occurs as both cross and slip fiber, the former predominating. The cross fiber ranges in length from a few millimeters to 6 inches, but the average is less than three quarters of an inch long. While the fiber possesses considerable flexibility and tensile strength it is more brittle than the Canadian varieties. This quality, however, is not damaging, especially in the manufacture of the lower grade articles, which will constitute its principal use. In fact, it has certain advantages over the more flexible fibers under these conditions.

Chemical composition: The chemical composition of chrysotile asbestos is an important factor, as good spinning fiber always has a definite percentage of the different constituents, namely, silica, magnesia and water. A representative analysis of chrysotile asbestos from Thetford, Canada, is given below:

SiO_2	38.05%
MgO	40.07
FeO	2.41
Al_2O_3	3.67
H_2O	14.46
Total	98.66

The percentage of water in good commercial asbestos fiber should vary from 13.47 to 14.50. It is believed by students of the subject that the silkiness of the fiber depends very largely upon the percentage of water. The brittle fiber from the tremolite and actinolite varieties contains from 1% to 5% of water.

An analysis of Wyoming asbestos from Upper Smith Creek locality has been made by Von Scholtz & Low, commercial chemists of Denver, which is given below:

SiO_2	41.48%
FeO	0.96
Al_2O_3	0.22
MnO	0.43
MgO	41.78
Alkalines as Na_2O	0.60
H_2O	14.35
	99.82

Amount of Asbestos Bearing Serpentine Rock: The area in which lodes or dikes of asbestos bearing serpentine rocks occur comprises in all about 3 sq. mil., of which 2 sq. mi. are found on Casper Mountain and the remainder on Muddy and Deer Creek ranges. In this, as in all other areas of asbestos deposits, the proportionate area of asbestos bearing serpentine rock to the area in which such rocks are found is small. The larger, well-defined, and partially developed ore bodies have been measured on the ground and their acreage approximated. These are given in a table on page 10. However, there are a number of scattered localities, the aggregate area of which, on account of insufficient prospecting, cannot be calculated at this time. While these deposits are probably smaller than those which have been measured, they should be regarded as a reserve supply which add materially to the total assets of the Company.

In estimating the available ore in the various lodes the tonnage has been classified into ore in sight and probable ore, as is customary in estimates of this character. In the case of the former practically three sides of the ore body could be examined, while in the case of the latter only the width and length could be ascertained, the depth being unknown. As serpentine is an alteration product of peridotite, which is a deep-seated rock, and as serpentinization is a deep-seated process, it is safe to assume that the asbestos will extend downward in the serpentine lodes as far as it is profitable to mine by quarry or (open) upon cut method. In the Canadian fields the rock has been mined to a depth of 200 feet with no change in character or amount. A shaft has been sunk in this same region which encountered asbestos at 400 feet below the surface which showed little change in character.

In the light of the above evidence, together with a study of the nature of the ore deposits in the Wyoming districts, it is regarded as safe to assume a depth of 200 feet in estimating the tonnage of an ore body. That this depth is entirely safe is further attested by the occurrence of most of the ore bodies on hillsides which present a relief of 50 to 300 feet, which permits of an examination of at least 300 feet vertical range distributed through a horizontal distance of 400 to 600 feet.

The table on the following page shows the area, available and probable tonnage of the moreimportant ore bodies on the asbestos holdings herein described; also the percentage of milling rock, the percentage of fiber, and life of the mine.

TABLE NO. 1

Table showing area available and probable tonnage of more important ore bodies on Midwest Asbestos Company holdings; also percentage of milling rock fiber and life of minesl

LOCATION	AREA ACRES	TONS ORE IN SIGHT	TONS ORE PROBABLE	DEDUCTION OF 40% FOR IMPURE ROCK		ASSUMING A5% FIBER EXTRACTION	
				TONS MILLING ROCK IN SIGHT	TONS MILLING ROCK PROBABLE	TONS FIBER IN SIGHT	TONS FIBER PROBABLE
Upper Smith Cr.	5.9317	2238436	25859756	1343061	15515853	67153	775793
Lower Smith Cr.	7.714	- - -	2832372	- - -	1699423	- -	84971
E.Star & E.Slope	5.005	552500	2437500	331500	1462500	16575	73125
Blk.Diamond Lode	1.377	- - -	975000	- - -	585000	- -	29250
Dreadnaught Claims	.138	- - -	22500	- - -	13500	- -	675
	20.1657	2790936	32137128	1674561	19276276	83728	963814

LOCATION	LIFE OF MINE AT RATE OF 12 1/2 TONS FIBER TO 250 TONS MILLING ROCK DAILY — SIGHT	PROBABLE
Upper Smith Creek	15 yrs.	175 yrs.
Lower Smith Creek	-----	18 "
E.Star & E.Slope	3.7 "	16 "
Blk Diamond Lode	-----	6.5 "
Dreadnaught Claims	-----	.15 "

Footnote:

There are several other bodies both on Casper Mountain and Smith Creek on which prospecting has been insufficient to estimate area or tonnage.

<u>Recoverable mill rock, fiber & crude:</u> As nearly all bodies of chrysotile asbestos serpentine rock are intruded by bodies of foreign material, such as granite, hornblende schist, and impure and barren serpentine rock, a substantial allowance, as shown in the table on the (above) preceding page, must be made for these impurities in estimating the available milling rock in any lode.

In the Canadian localities the percentage of milling rock of all rock mined varies from 20% to 80%, an average ranging from 30% to 60%. However, in the Canadian region very little use is made of the low grade serpentine rock, as most of their profits are derived from the crude and the mill stocks. As it is the intention of the Midwest Asbestos Company to develop a market for the lower grade mill stocks and asbestos sand, it is believed that in mining the Wyoming serpentine that at least 60% of all rock handled will be milling material. It is further believed that 5% of the milling rock will be fiber.

The percentage of crude in the total rock mined will probable not exceed .30 of 1%, although this is a difficult thing to estimate until more exploitation has taken place. In the Canadian localities, where very rich ore occurs, experience has shown that from .30 to .75 of 1% consists of Crude Nos. 1 and 2. Any estimate of the percentage of crude and mill stock in a property as undeveloped as that herein described must be regarded as only an approximation. However, it is believed that the figures set forth in the preceding table are conservative, and that the Wyoming deposits can be depended upon to meet this estimate, and they may probable exceed it.

Products Obtainable: As there are several different grades of material made at an asbestos mill, the most reliable method of arriving at the gross value derived from a ton of milling rock is first to ascertain the relative amount of each grade which can be made from the rock, and second, the market price which each grade commands.

The properties owned by this Company should turn out the following products: A small amount of Crude No. 1, a slightly larger percentage of Crude No. 2, a 5% yield of mill stock Nos. 1, 2, 3 and 4, and the remainder manufactured into a good quality of asbestic or sold as asbestos sand.

Information concerning the relative proportions of the above named products is available, as test runs of this material have been made by Mr. Brile, former mill superintendent for the companies from whom this property was acquired. His estimates as to relative proportions of the different products has been accepted as final.

As to the selling price of the various products, this information has been obtained from local dealers in Denver and other tributary points and checked against the price at which materials of the same class can be delivered into this territory by the Canadian and eastern United States dealers.

Information concerning these points is given in a table on page 18. Of course, allowance must be made for variation in the quality of the rock mined, also for variation in the cost of delivering the different grades to nearby or more remote points of consumption, and the amounts of such delivery, whether in carload or less than carload lots, all of which are factors which influence the net returns from a ton of ore. It is believed that the following tables will give an approximate estimate of what may be expected in the way of return from the milling of a ton of Wyoming asbestos. Table No. II is based on a 5% extraction of fiber as set forth above, and is followed by Table No. III showing grades produced, price per ton, percentage of grade, price per pound and value of grade in ton of ore. This is followed by a summary showing gross profits, cost of production and net profits for both Casper Mountain and Upper Smith Creek localities.

TABLE NO. II

Showing relative production of various grades of asbestos fiber and asbestic produced in tons per day or per year by a mill with a capacity of 250 tons per day.

GRADES	PRODUCTION PER DAY -- TONS	PRODUCTION PER YEAR -- TONS
Crude No. 1	1/4	75
Crude No. 2	1/2	150
Mill Stock No. 1	1 1/4	375
" " " 2	2 1/2	750
" " " 3	3 3/4	1,125
" " " 4	4 1/2	1,350
" " " 5	13 3/4	4,125
" " " 6	58 3/4	17,625
" " " 7	100	30,000
Asbestos Sand	64 3/4	19,425

TABLE NO. III.

Showing grades produced, price per ton, percentage of grades pounds, price per pound and value of grades in ton or ore.

GRADES	PRICE PER TON	PERCENTAGE OF GRADE	PRICE PER POUND	VALUE OF GRADE IN TON OF ORE
Crude No. 1	$350.00	2 lbs.	$0.175	.35
Crude No. 2	200.00	4 "	.10	.40
Mill Stock No. 1	80.00	10 "	.04	.40
Mill Stock No. 2	55.00	20 "	.0275	.55
Mill Stock No. 3	40.00	30 "	.02	.60
Mill Stock No. 4	35.00	40 "	.0175	.70
Mill Stock No. 5	32.00	190 "	.016	3.04
Mill Stock No. 6	12.00	474 "	.006	2.85
Mill Stock No. 7	6.00	800 "	.003	2.40
Asbestos Sand	4.50	430 "	.00225	.9675
		2000 lbs.	Val. per ton --	12.25

TABLE NO. IV.

Showing in detail cost of production on Casper Mountain, operating at the rate of 250 tons per day.

MILLING PER TON	MINING PER TON	SACKING PER TON	TRANSPORTATION PER TON	DEV'L ASSMT WORK	OVERHEAD CHARGES PER TON	INTEREST & DEPRECIATION PER TON	TOTAL COST PRODUCTION PER TON
$ 1.08	$0.97	$0.23	$1.00	$0.07	$0.25	$0.14	$3.74

SUMMARY for Casper Mountain.

Gross Profits	$12.25
Cost of Producing	3.74
Net Profit	$ 8.51

Showing in detail cost of production on Upper Smith Creek, operating at a rate of 250 tons per day, assuming ore taken to Big Muddy Station.

MILLING PER TON	MINING PER TON	SACKING PER TON	TRANSPORTATION PER TON	DEV'L ASSMT WORK	OVERHEAD CHARGES PER TON	INTEREST & DEPRECIATION PER TON	TOTAL COST PRODUCTION PER TON
$1.08	$0.97	$0.23	$5.00	--	$0.25	$0.19	$7.72

SUMMARY for Upper Smith Creek.

Gross Profits	$12.25
Cost of Producing	7.72
Net Profit	$ 4.53

TABLE NO. V.

Showing relative selling prices per ton at Mines of similar Mill Stocks from Wyoming and Canadian Fields, and freight rates per ton from Mines to Denver. Denver may be regarded as a characteristic Western Point.

	per TON f.o.b. CASPER	FRT. CASPER TO DENVER	PER TON F.O.B. DANVILLE	FRT. DANVILLE TO DENVER	PER TON F.O.B. THETFORD	FRT. THETFORD TO DENVER	PER TON F.O.B. NO. WALES	FRT. NO. WALES TO DENVER
Mill Stock No. 1	80.00	5.00	-------	- -	125.00	18.30	125.00	- -
Mill Stock No. 2	55.00	5.00	- -	- -	100.00	18.30	50.00	- -
Mill Stock No. 3	40.00	5.00	- -	- -	- -	- -	45.00	- -
Mill Stock No. 4	35.00	5.00	67.00	18.30	- -	- -	- -	- -
Mill Stock No. 5	32.00	3.00	28.00	18.30	20.00	18.30	- -	- -
Mill Stock No. 6	12.00	3.00	15.00	11.60	- -	- -	- -	- -
Mill Stock No. 7	6.00	3.00	7.50	11.60	- -	- -	- -	- -
Asbestos Sand	4.50	- -	- -	- -	- -	- -	- -	- -

It will be noted by reference to the table No. V that a ton of Wyoming asbestos mill stock No. 1 will cost the consumer $80.00 per ton and $5.00 per ton for freight, or $85.00 per ton f.o.b. Denver, while a ton of Thetford mill stock No. 1 will cost the consumer $125.00 per ton and $18.30 per ton for freight, or $143.30 per ton f.o.b. Denver, which is one-third more than the same class of Wyoming material would cost the Denver consumer. This difference in price would certainly prohibit the shipping of Canadian material to Denver and other western points.

Method of Mining: The method of mining universally employed in working asbestos is that of quarrying or open cut work. Underground mining in the usual way has not proven economical thus far, owing to the irregularity in the occurrence of the pay rock. In one of the mines at Thetford, Canada, considerable underground mining has been carried on during the past three years largely in the nature of an experiment. While the method was in a measure successful at this mine, undoubtedly due to the richness of the ore and the size of the ore body, it is generally conceded that the method is not broadly applicable to the average asbestos deposits.

The method in detail is as follows: Quarters or open pits are dug, the size depending upon the size of the ore body. If the ore body occurs on a hillside an open cut is driven into the and the ore carried by tram cars out on the downhill side of the opening, from where it is taken to the mill. As most of the deposits in the Wyoming localities occur in such manner that they can be opened on the hillside the open cut method is especially applicable. Where the deposits are found on a level, an open pit is excavated and aerial trams are used for handling the ore.

In quarrying asbestos bearing serpentine the rock is shot from the walls of the pit or open cut, as the case may be, considerable care being taken to select advantageous places for shooting with respect to the slipping planes of the country rock. After the material is thus shot down from the walls it is usually in large blocks, and it is necessary to again shoot or break the blocks into pieces ranging in size from 10 to 12 inches in diameter. At this stage the crude fiber is separated from the rock by hand while it is still in the pit. The crude fiber is placed in boxes and sent to the cobbing house, while the other material is hoisted and carried by tram to the mill.

Present development: The Midwest Asbestos Company's property in the vicinity of Casper, Wyoming, has been developed to some extent and some fiber produced and shipped to Denver. Two mills have been constructed, open cuts made in the deposits, and some tunneling done. A small aerial tram has been installed at one of the mills and an ore shute built. Mountain roads leading to the mills have been constructed at a considerable cost, and cabins and other necessary buildings erected on the property. The details and cost of the development on both Casper Mountain and Upper Smith Creek is given in the following captions:

CASPER MOUNTAIN: The Casper Mountain property, located about 6 miles south of the Town of Casper, is supplied with a mill having a capacity of 75 tons per day, which is in fairly good repair and ready for immediate operation. This mill is provided with an ore house 30 by 50 feet in size and 8 feet under the eaves, with an ore capacity of 500 tons, a 10 x 12 (two?) inch jaw crusher, a fiberizer of corresponding capacity; to impact screens, two 12 and one 20 mesh, with suction pipes leading to a No. 5 Sturdivant and a No. 7 Buffalo force rotating fans; one receiving bin; and one classifier, which contains a rotating screen 17 feet long with zones of different mesh screens, from which shutes lead to the basement, where the different mill stock grades, Nos. 1 to 7, are sacked and labeled for shipment. The motive power of the mill consists of a 150 h.p. Corliss engine; two return tubular flue boilers with a capacity of 100 h.p. each, provided with oil burners, injectors and pumps, and a small upright auxilliary boiler for starting the larger boiler. All of the equipment except the engine is in good working condition.

A cement reservoir has been constructed a short distance below the mill, from which water is pumped to tanks above the plant, and a small steel oil tank has been installed. The ground plan of the mill is sufficiently large for another 75 ton unit to be added, but to raise the capacity of the mill to 250 tons a day an addition to the building would be necessary. From the ore house a tunnel nearly 400 feet long has been excavated to the ore body, and from the end of this tunnel there is a shaft to the surface, around which is an open cut 40 feet square. The entrance to the tunnel is about 50 feet above the floor of the ore house. Cabins, a small bunk house, stable and other buildings have been erected at the mill, and a mountain road, with a maximum grade of 9½% leads from the bottom of the mountain to the mill, a distance of about 4½ miles, and from the foot of the mountain a road with easy grade has been built to Casper, a distance of about 4½ miles.

The development work on Casper Mountain, aside from the tunnel and shaft above described, consists of an open cut 60 feet long by 10 feet wide, located near the bunk house and at west end of the ore body, which exposes good fiber at the face. In addition to these openings all the claims on Casper Mountain have been, or are being, prospected by small pits, cross cut trenches, or shafts. The location and numbers of such prospecting are too numerous to be described in detail.

The estimated cost of mining development, road building and mill equipment on Casper Mountain to date would aggregate about $50,000.00.

Upper Smith Creek: The property on Upper Smith Creek is provided with a mill having a capacity of 100 tons of rock a day. The ore bin of this mill, which is 12 by 14 feet, constitutes a part of the main building, and is provided with a 12 by 14 inch jaw crusher, also a hammer crusher, Jeffrey type; two inclined, impact shaking screens ranging from 16 to 20 mesh; a fiberizer of corresponding capacity; five impact shaking screen, four of which lead to two fiber receiving bins, and from there the ore passes through shutes to two classifiers, where it is separated on a rotary screen, which is provided with zones of different mesh, into the various grades, then placed in sacks in the basement. From the mill there is a tunnel, nearly on a level with the ore bin, extending into the hill about 300 feet. An ore shute, 18 inches wide and lined with sheet iron, extends from the highest open cut in the first hillside to the ore house. An aerial tram has been installed, although in bad repair, which connects the upper end of the ore shutes with an exploited ore body in the second hill to the west of the mill. A surface tram has also been constructed connecting the first and second hills, so the aerial tram is not used. A number of cabins, a stable, water and oil tanks, a powder house and other necessary buildings surround the plant. The motive power consists of a 75 h.p. engine; a 75 h.p.boiler, return tubular flue type, provided with a small auxiliary vertical boiler.

The estimated cost of mining and mill construction on the upper Smith Creek property is also $50,000.00.

New Equipment Necessary: In order to enlarge the Midwest Asbestos Company's property to a scale commensurate with its size and value, also the demand for the products which it affords an enlargement of the present plants must be made, and transportation should be furnished these mills from their sites to the foot of the mountain, thence to the railroad.

The plans proposed for the enlargement of this property by the Company from whom it was acquired was to provide the two districts, upper Smith Creek and Casper Mountain, with separate means of transportation to the railroad, the output of the former to be milled at the mouth of Smith Creek Canyon and the material taken to Big Muddy Station; while that of the latter was to be milled on Casper Mountain and taken to Casper. Accordingly, the general cost of production by the above outlined method, assuming a mill in each district with a capacity of 250 tons, is considered in the following pages of this report; also a new plan of development which calls for only 250 tons production to be supplied by a combination of the two mills now on the property, although slightly enlarged and connected by aerial tram, all products reaching the railroad at Casper. The two alternate methods of development are discussed in detail and cross calculated, so that their relative advantages can be comparted. From the best information which it has been possible to obtain thus far, the demands of the market at the present time range somewhere between the amount of material which could be produced by a 250 and a 500 ton capacity plant.

Whatever method of enlargement is employed, the principal lodes of Casper Mountain and Lower Smith Creek should be prospected more thoroughly and a greater tonnage of ore brought in sight. Some underground tunneling is also necessary at Casper Mountain, and on many of the outlying lodes more prospecting should be done in order to arrive at a more definite knowledge of the tonnage available in these outlying districts, which constitute the reserve supply of the Company's deposits. A number of additional buildings should be erected at both places in order to accommodate an increased number of employes, and some improvements should be made on those already on the ground.

The enlargement of the mill on Casper Mountain, owing to its nearness to the railroad, would naturally be the first improvement to be undertaken. According to the first method outlined, this should consist of an increase in the mill capacity from 75 tons, its present capacity, to 250 tons daily. This can be accomplished by increasing the present capacity of the mill two more units the same size as the one now on the ground and by the installation of a crusher adequate for the three units. The tunnel leading to the ore body should be straightened, or a new tunnel excavated, an aerial tram 2,000 feet in length, connecting theore body with the East Slope Claim with the mill, should be constructed; The property developed by an open cut: an aerial tram leading from the mill to the base of the mountain, 1¼ miles, with a capacity of 500 tons, and preferably 1,000, every twenty-four house, (hours?) is necessary; slight improvements in the road from the base of the mountain to Casper should be made; a store house at Casper would probably be necessary, and a number of cottages for miners and mill employes should be provided at the mill, lumber for which can be obtained from adjacent property by purchase from the government.

The above improvements would make this mill capable of handling 250 tons of ore per day, with a production of crude and mill stock of about 12½ tons per day. In order to mill 250 tons of rock daily, assuming a 40% waste, it would be necessary to mine about 416 tons daily. Some provision in the way of a short tram for disposing of waste rock should be made, as it has been found by experience in other asbestos mines that it is more economical to remove the waste rock than to allow it to remain; and improvements on the present tunnel, or the running of a new tunnel, will have to be made for the purpose of conveying the ore from the pit to the mill.

An approximate estimate of the cost of the above described enlargement is itemized in the following table:

COST of mining 250 tons of milling ore.

Powder	$62.50
Candles	4.50
Caps	3.13
Fuse	1.40
Coal	4.20
Wear & tear, steel rail cars	5.00
Grease for cars	1.00
Superintendent, distribution wages & expense	2.00
Three shaft bosses at $4.00 a day	12.00
One blacksmith	4.00
Forty-four men at $3.00 a day	132.00
	231.73

Number of men employed at mine & mill.

Miners and trammers	48
Mill hands employed	35
Total	83

Cost of mining 1 ton of mill rock	$ 0.97
Cost of milling 1 ton of mill rock	1.08
Cost of mining and milling 1 ton mill rock	$ 2.05

At Upper Smith Creek the mill at present has a capacity of 100 tons a day, but this should be enlarged to 250 tons. Such enlargement can be accomplished by adding one and a half units to the present mill, and increasing the building sufficiently to enclose same. A crusher large enough to accommodate the improved plant will have to be installed, an aerial tram about 3½ miles long will be necessary to convey the ore from the mill to the foot of the mountain, from where it can be hauled to the railroad at Big Muddy Station; and several buildings for the accommodation of employes should be constructed.

With the above improvements this mill will be capable of handling 250 tons of ore a day, with 12½ tons recovery of fiber of the various grades. Assuming a 40% waste in milling, it would be necessary to handle 416 tons of rock per day, the same as on Casper Mountain. The estimated cost of the above outlined enlargement is given below:

Estimated Statement.

Enlargement of mill	$60,000.00
Cost of water plant on Smith Creek to develop 150 h.p.	17,608.50
Construction of tram to base of mountain .	40,000.00
Construction of necessary buildings . . .	2,600.00
Improvements on road from base of Mountain to Big Muddy Station	3,000.00
Air compressor and drill	5,000.00
Total	$128,208.00

The above estimate provides only for wagon haul of products from base of mountain to Big Muddy Station, a distance of 16 mi. ~~from~~ If a railroad were build this distance it would cost at least $100,000.00.

The estimated cost of operating this mill would naturally be about the same as that given for the plant on Casper Mountain, viz: $2.05, but the transportation charges per ton would be materially increased, also interest charges, depreciation, etc.

Combination of Casper Mountain and Upper Smith Creek Mills: A plan of development, referred to on a previous page, is believed to present many advantages, over the one above described, viz: that of two 250 ton capacity plants with separate routes of transportation to different points on the railroad, is one which provides for connection between Upper Smith Creek and Casper Mountain plants by means of an aerial tram across the mountains, a distance of about 9 miles. This plan is not only more advantageous but calls for a smaller initial expenditure to secure an output of 250 tons a day, which is probably all that the market will justify at the present time, and at the same time permits of expansion to meet future needs.

Given in detail, the plan consists of the enlargement of the Casper Mountain mill from its present capacity of 75 tons daily to 150 tons, which can be done without the enlargement of the mill building; the construction of an aerial tram across

~~the mountains from Upper Smith~~

..e mountains from Upper Smith Creek to Casper Mountain, passing the East Slope lode and thus obviating the necessity of a local tram from that lode to Casper Mountain mill: operating the Upper Smith Creek mill with its present capacity of 100 tons daily, which would make a total daily output from the two mills of 250 tons. Water power could be developed on Lower Smith Creek for operating Upper Smith Creek mill, and the power now used at that place could be employed to operate the aerial trams. As the demands from the products of the field increase both plants could be enlarged, and ultimately, aerial tram connection be made between Lower and Upper Smith Creek properties and all material carried to the railroad by way of Casper.

The initial cost of enlarging the Casper Mountain mill to a capacity of 150 tons daily, and the equipment of Upper Smith Creek mill with water power, and a few necessary minor additions also the construction of an aerial tram between the two mills, and the cost of production by this method of development, are given below:

Estimated Cost of Enlarging Casper Mountain Mill.

Enlargement of Mill	$ 20,000.00
Construction of tram to base of mountain	17,000.00
Construction of tunnel to lode	2,000.00
Construction of necessary buildings	2,000.00
Improvements on road to Casper	2,000.00
Air compressors and drill	5,000.00
Total	$48,000.00

Estimated cost of improvements on Upper Smith Creek

Development of water power on Smith Creek	17,608.50
Construction of necessary buildings	2,600.00
Aerial tram connection Upper Smith Creek and Casper Mountain	90,000.00
Air compressors and drill.	5,000.00
Total	$115,208.50

Casper Mountain Mill	$ 48,000.00	
Upper Smith Creek Mill	115,208.50	
		$163,208.50

Detailed Cost of Production.

MINING PER TON	MILLING PER TON	SACKING PER TON	TRANSPORTATION PER TON	OVERHEAD CHARGES PER TON	INTEREST & DEPRECIATION PER TON	TOTAL COST PRODUCTION PER TON
$0.97	$1.08	$0.23	$1.10	$0.25	$0.27	$3.90

Gross profits per ton	$12.25
Cost of production per ton	3.90
Net profits per ton	$ 8.35

<u>Other Asbestos Deposits in the United States:</u> The localities in the United States where asbestos deposits of commercial value are known to occur are six in number, of which three are the amphibole variety of serpentine, and three are chrysotile, the latter being the variety found in the Wyoming localities. The amphibole asbestos does not produce a spinning fiber, consequently need not be considered as competing in any way in the development of chrysotile deposits. The three amphibole serpentine localities are found in Bedford, Virginia; Sall Mountain, Georgia, and Kamiah, Idaho, while the three chrysotile localities are in Lowell, Vermont, Grand Canyon, Arizona and Casper, Wyoming. The locations of these serpentine deposits are indicated by stars on the key map. Of the three chrysotile asbestos deposits the one at Lowell, Vermont, constitutes a part of the Canadian deposits occuring just across the line, and is so far removed from the Wyoming localities as to render competition between the two practically impossible; while the asbestos found in Arizona, though very superior in quality, is too small in amount and too inaccessible to be regarded as of sufficient importance to become a competitor.

<u>Uses of Asbestos:</u> The commercial application of asbestos at the present time is so wide and varied, and new and important uses for the raw material are so constantly being discovered which quickly assume commercial importance, that it is difficult if not impossible, to give a complete list of the uses to which this very valuable mineral may be put. And the task is made more difficult by the jealous desire on the part of the manufacturers of asbestos products to keep secret everything in connection with the bringing out of a new article. Therefore no attempt is here made to give a list of all the articles which are made in part or entirely of asbestos fiber, but only the general class of manufactured products, together with their present relative importance and probable future demand. The application made of as-

bestos by the different countries varies. The United States market calls mainly for short fiber for use in insulation or construction, while the European markets run more to the long fiber for spinning and weaving purposes.

At the present time the principal application of asbestos pertains to the manufacture of mill boards, paper coverings of various kinds for different materials, and all allied articles. Cirkel estimates that in 1910 at least 50% of all mill stock utilized was consumed in the manufacture of this general class of articles. Another very important application of mill stock, and one which bids fair to surpass all others, is the general slate and shingle business. Cirkel estimated that the time is not far distant when 75% of all the asbestos produced in the world will be used in the manufacture of this class of articles. Other important applications of the general class of articles, only briefly mentioned here but described below, is the manufacture of ornamental wall decorations, asbestos woods for electrical insulation, asbestos wood "alignum" - used for window shutters, sashes, etc., asbestos flooring, "asbestolit", etc., all of which require the introduction of a certain amount of cement with the short fiber.

The above statements refer more especially to the general class of manufactured articles in which asbestos mill stock plays an important part. To be more specific, there is given below a detailed list of the general commercial uses made of asbestos at the present: Steam packing, including metalic asbestos packing; asbestos cloth coated and treated in various ways: Asbestos rope yarn and twine, the rope usually strengthened by a cord of steel wire; asbestos as insulating material, such as non-heat-conducting coverings for steam pipes, boilers and all heated surfaces where radiation is to be prevented; asbestos mill boards used in stoves, ranges, packing for steam pipe, joints, gaskets, etc., asbestos lining for furnaces; asbestos building materials, such as interior linings where fire-retarding materials are needed, plaster, paint, asbestos outer coverings in the way of shingles, corrugated siding, mill boards, roofing, felts, asbestos in various forms as domestic utensils, chemical laboratory appliances, and in mines for the insulation of steam connections.

<u>Market</u>. As the Wyoming asbestos deposits are located in the center of the western half of the United States, the natural marketing territory for the products from these deposits extends from the Mississippi River to the Pacific Coast and includes twenty-one states, besides territory in Canada and Mexico adjacent to these states. The limits of the marketing territory of any product are naturally fixed by freight rates. The unique geographic location of the Wyoming asbestos deposits of Canada and the eastern United States, especially in the mill stock and lower grade products which enter into the manufacture of pipe covering, mill boards, shingles, roofings, etc. etc. The grades of crude, Nos. 1 and 2, of which there is a relatively small percentage produced but for which there is a great demand at a high price, must be marketed in the East, where there are factories equipped for spinning and weaving this material into various products.

The natural avenues of a consumption of the mill stock grades are two in number, viz: The small pipe covering factories that make their own covering and place it in buildings, and the larger factories that manufacture by the Guy process and sell their products to both the small pipe covering concerns and the larger machine supply companies. The small pipe covering concerns, also the plants which both manufacture and install their products, use mill stock Nos. 1 and 2 and 3 in their moulded coverings, and asbestos paper, purchased from the larger manufacturing plants for their air cell covering. Small plants of this kind are operating in most of the larger western cities, and their consumption of raw fiber constitutes one source of market.

Another source is found in the larger factories, which use such a process as Guy's and turn out mill boards, flooring, shingles, paper usedin air cell covering, pipe covering of all kinds, cement, etc. etc. These plants consume mill stock Nos. 4, 5,6 and 7, also asbestos sand. For pipe covering, paper, etc. the machine supply houses are their chief customers, while for mill boards, shingles, flooring, etc., the lumber and building supply companies are their principal patrons. In the western part of the United States a few factories are in operation, and others should be placed at centrally located places to supply the present demand for these products. When the size, total population, industrial interests, and location with respect to other asbestos deposits afford unique possibilities for profitable development.

The following table which is self-explanatory, is introduced for the purpose of showing the probable asbestos fiber consumption throughout the marketing territory tributary to the Wyoming fields.

TABLE NO. VI.

Showing estimated consumption of asbestos products in the following states, based on population 1910 census and on the annual consumption per 1,000 in Denver.

States	CRUDE NOS. 1 & 2 TONS	MILL STOCK NOS. 1 to 4 USED BY DEALERS & PIPE MANUFACTURERS TONS	MILL STOCK NOS. 5 to 7 USED BY DEALERS & PIPE MANUFACTURERS TONS	MILL STOCK NOS. 4 to 7 USED BY SHINGLE MILLS TONS	TOTAL TONNAGE
Colo.		863	1,598	2,250	4,711
Ark.		5,583	10,348		15,931
Ariz.		220	408		628
Calif.		2,481	4,754	2,250	9,185
Idaho		349	650		999
Kans.	225	1,826	3,380	2,250	7,456
Minn.		2,235	4,150	2,250	8,635
Mo.	TONS	3,549	6,586		10,135
Mont.		508	952		1,460
Nebr.	SOLD	1,288	2,384		3,672
Nevada		86	162		248
N. Dak.	IN	617	1,154		1,771
Okla.		1,785	3,314		5,099
Oregon	EASTERN	728	1,344	2,250	4,322
S. Dak.		627	1,166		1,793
Texas	MARKET	4,208	7,772		12,000
Utah		407	746	2,250	3,403
Wash.		1,232	2,282		3,514
Wyo.		157	290		447
Total		28,749	53,460	13,500	95,709

A mill with a capacity of 250 tons daily would furnish an annual output of 75,000 tons, which is slightly less than the annual consumption figures above.

Conclusion: The Midwest Asbestos Company's property contains exceptionally valuable asbestos deposits, which, under proper development and adequate facilitties for the manufacture and marketing of its products, affords unique and far reaching possibilities. It is the largest body of chrysotile asbestos known in the western part of the United States. Its physical occurrence is such as to insure cheap mining, and the deposits are sufficiently near railroad transportation to be regarded as readily accessible. The available tonnage, calculated along conservative lines, insures operation for many years, considerably more than the average life of deposits of this character. The centrally located position of these deposits with respect to the western half of the United States, into which all asbestos material consumed at the present time must be shipped from far away Canada, insures unique possibilities for building up a large market for the Wyoming products. The quality of the fiber, while possessing slightly less tensile strength and flexibility than the famous Canadian deposits, which renders it a little less desirable for spinning and weaving purposes, is better adapted in many ways for the manufacture of the various building materials, such as mill boards, shingles, cement, pipe covering, roofing, etc., etc. which are the coming uses to which asbestos will be put. Therefore, these deposits may be said to combine the necessary properties for the manufacture of goods for which there is a rapidly growing demand, and into which probably 75% of the asbestos fiber will enter.

Owing to the above reasons I regard this asbestos property as one combining so many excellent points, such as geographic position of the deposits and their fitness for manufacture into products for which there is a continually growing demand, as to render it an exceptionally desirable investment, absolutely safe at the outset, and one which must steadily increase in value and insure the investor splendid returns.

R E C A P I T U L A T I O N

PHYSICAL FEATURES

Location: The Midwest Asbestos Company's property is located in the Rocky Mountain Front Range of east central Wyoming, near the town of Casper. It is tributary to the transcontinental line of the Chicago, Burlington & Quincy Railroad extending from Seattle to Galveston, and the Chicago & Northwestern Road from the Rocky Mountains to Chicago.

Topography: The land in question is mountainous, having an elevation of about 8,000 feet, and is easily accessible both as to the development of the ore body and the transportation of its products to the nearest railroad.

Geology: The asbestos occurs in a pale green serpentine rock which is an alternation product of peridotile and associated with hornblende schist, diorite and granite. The ore bodies range in length from a few feet to half a mile, and in width from 6 to 400 feet, and its depth will undoubtedly continue to the depth of practical open cut mining, which is 200 to 400 feet.

Asbestos: The asbestos is a chrysotile variety occurring in cross and slip fiber veins, also distributed in minute particles in the serpentine rock. The veins vary in width from a millimeter to 6 inches, the average being less than three-quarters of an inch. In color the fiber is pale green to yellowish green, but when carded, and generally possessed average flexibility and strength. It is almost free from iron, and in composition compares closely with the Canadian deposits.

DETAILS OF PROPERTY.

Size: The holdings of the Midwest Asbestos Company comprises in all about 1,480 acres.

Titles: The property consists of 360 acres which is patented or ready for patent, and 1,120 acres of located land on which assessment work is being done.

Present Development: The property contains two mills, one on Casper Mountain with 75 tons daily capacity, and one on Upper Smith Creek with 100 tons daily capacity; about 700 feet of underground tunneling; several open pits; assessment trenches; etc. etc. The mills are equipped for immediate operation, and have necessary accessory buildings. Good mountain roads have been constructed to all the properties.

Proposed Development: a. Either the enlargement of each mill to a capacity of 250 tons daily, supplying separate transportation to the railroad, Casper Mountain to the Town of Casper, and Upper Smith Creek to Big Muddy Station. b. Or connecting Upper Smith Creek with Casper Mountain by aerial tram and conveying all products from there to Casper by way of Casper Mountain, the combined mills having a capacity of 250 tons daily. The initial cost of development according to the former plan would be on Casper Mountain $93,600.00, and on Upper Smith Creek $128,208.00, making a total of $221,208.00 for two mills with a daily capacity of 250 tons each. According to the latter plan the initial cost of production would be, on Casper Mountain, $48,000.00, and on Upper Smith Creek $115,208.00, making a total of $163,208.00 for two mills with a combined capacity of 250 tons a day.

ASBESTOS TONNAGE.

Mill Rock:	Amount in sight on Casper Mountain	552,500	tons
	Amount in sight on Upper Smith Cr.	2,238,436	"
		2,790,936	"
	Deducting 40% for impure rock	1,116,425	"
		1,674,561	"
	Probable ore in lodes developed on Casper Mountain	3,435,000	"
	Probable ore in lodes developed on Upper Smith Creek	25,859,656	"
	Probable ore in lodes developed on Lower Smith Creek	4,948,125	"
		34,242,881	"
	Deducting 40% for impure rock	13,697,153	"
		20,545,728	"

REVENUE

Casper Mountain Mill with a capacity of 250 tons daily -

Gross Profits per ton	$12.25
Cost of production	3.74
Net profits per ton	8.51

Upper Smith Creek with a capacity of 250 tons daily -

Gross Profits per ton	$12.25
Cost of production not including railroad	7.72
Net profits per ton	4.53

Combination of mills with a capacity of 250 tons daily -

Gross profits per ton	$12.25
Cost of production	3.90
Net profits per ton	8.25

A mill of 250 tons daily capacity would produce annually, assuming 350 working days, 75,000 tons of mill stock, which, at a net profit of $8.35 a ton, would amount to $626,250.00 a year; or assuming 360 working days, which is entirely practicable, 87,500 tons of mill stock, at a net profit of $8.25 a ton, would amount to $730,625.00 a year. The present consumption would probably exceed 87,500 tons a year, in which event a slight enlargement of the mills would increase the annual net earnings.

RECOMMENDATIONS

By the adoption of the consolidation method of development the saving in mill construction alone would build the aerial tram connecting Upper Smith Creek with Casper Mountain, and the combined capacity of the two mills would be approximately commensurate with the present demands of the market, and an enlargement would easily be effected to keep pace with any increase in the demand. While to develop Smith Creek separately and provide it with its own transportation, could not be done for a plant smaller than 250 tons daily capacity, an amount which, added to a similar amount on Casper Mountain, would make a tonnage too large for present market requirements. Therefore, I have no hesitancy in recommending the combination method of development as the one requiring the least initial expenditure, most economical operations, and affording the greatest efficiency.

(Signed) C. A. Fisher

Consulting Geologist & Engineer.