UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
ROOM 13 POST OFFICE BLDG.
KNOXVILLE 2, TENN.

August 20, 1958

Memorandum

To: Operating Committee, DMEA - Washington

From: DMEA Field Team, Region V - Knoxville, Tennessee

Subject: Field Team Final Report - DMEA-4216, Idm-E1032, ~~Rutile~~. (Tungsten)
Tungsten Mining Corporation, Henderson, N.C.
Hamme Mine, Vance County, N.C.

Transmitted are the original and two copies of the subject final report with maps, ore reserve calculations attached.

The Field Team is in agreement with the Field Examiners in their recommendation for certification of this project.

Robert A. Laurence, Executive Officer
DMEA Field Team, Region V

V. J. Lynch, Member
Bureau of Mines (DMEA)

Im.
cc
Burmeister
Lynch
Files

Maps A, B, C, D, 1, 2, & 3 attached

Reviewed by
DMEA OPERATING COMMITTEE

(date)

AUG 25 1958

UNITED STATES
DEPARTMENT OF THE INTERIOR

DEFENSE MINERALS EXPLORATION ADMINISTRATION

FINAL REPORT

DMEA FIELD TEAM, REGION V

ON

DMEA-4216, Idm-E1032(Tungsten)HAMME MINE
Vance County, North Carolina

H. L. Burmeister, Mining Engineer
U. S. Bureau of Mines-DMEA

and

W. P. Williams, Geologist
U. S. Geological Survey
DMEA

Reviewed by
DMEA OPERATING COMMITTEE

(date)

August, 1958

FIELD TEAM FINAL REPORT ON COMPLETED CONTRACT

DMEA Docket No. 4216 (Tungsten)
Contract Dmm-E 1032
Tungsten Mining Corporation
Box 61, Henderson, North Carolina
Hanna Mine, Vance County, N. C.

The Hanna mine and company officer are located 9.4 miles westward from the village of Townsville, on a paved but un-numbered road.

INTRODUCTION AND SUMMARY

The Tungsten Mining Corporation, Henderson, North Carolina performed exploration work at the Hanna Mine, Vance County, North Carolina, under the terms of DMEA contract Dmm-E 1032, Docket 4216. The work consisted in general of drifting, crosscutting, and underground diamond drilling. Total cost of the project was $24,342.60. Drifts and crosscuts driven totaled 6699 feet and core drilling totaled 4,000 feet.

The main objective of the exploratory work was to search for ore extensions and new ore deposits at the Hanna Tungsten Mine. The work was begun on November 19, 1956, and was completed on June 16, 1958. Four amendments were made to the contract.

Economically minable ore deposits were discovered in three of the four sub-projects. The project warrants certification by the Government as a discovery.

CONCLUSIONS AND RECOMMENDATIONS

The mineral exploration project completed by Tungsten Mining Corporation under the terms of DMEA contract Dmm-e 1032 was successful in discovering minable tungsten ore deposits which average a higher tungsten

content than the normal mill feed (Table III). It is recommended that the project be certified by the Government as a discovery.

All exposures of ore in the project areas to date have been made only in drifts and crosscuts on the 900 level of the mine. The ore reserves that have been calculated on the basis of these limited exposures would be increased if further exploration in the form of raising or winzing were performed at the sites where ore has been discovered by this DMEA exploration. From the results so far obtained and from geological characteristics present, more exploration work is warranted in projects A, B, and D in the Hanna Mine.

DESCRIPTION OF WORK COMPLETED

Operations under this contract started November 19, 1956 and were completed on June 16, 1958. Work was done under four separate projects, all on the 900 level of the Hanna Mine. In all projects work consisted of drifting and crosscutting, core drilling horizontal holes from exploration openings and timbering drifts and crosscuts where necessary. Projects were designated as, A, B, C and D and completely separate records were kept under these designations.

Of the 6699 feet of 8 x 7½ foot drifts and crosscuts, crosscutting accounted for a total of 2,155 feet of which 581 feet was in diabase or diorite dike. Of the total 874 lineal feet of timbering, 313 feet was placed in drifts and 561 feet in crosscuts. Roof bolting was tried with unsatisfactory results in a 30 foot section of diabase crosscut.

In general the ground stands well without timber. Drifting, crosscutting and timbering in all faces was in general conducted on a two shift six day per week basis. The same crews did both mining an timbering, due to the fact that where timber was necessary it had to be carried close to the face. Each shift mucked the previous round, drilled a 5 to 5½ foot round,

blasted. Column and arm mounted Leyner drifters were used and an ed ½ cu. yd. capacity, 12B Eimco mucking machine was employed. Core g was limited to underground lateral exploration of the shear or ed zone during advance in exploration faces. All core was EX size.

An accurate record was kept during a total of 276.75 simultaneous and consecutive shifts in all four projects. A total of 1261 feet of advance was made in diabase, quartz vein and schist or gneiss during this period. This record indicated an overall average advance of 4.56 feet per shift. This compares favorably with the 4.39 foot average advance used in preparing cost estimates.

The following, Table I is a compilation of work accomplished in the four projects.

TABLE I
-Work Completed-

	Project A	Project B	Project C	Project D	Totals
Drifting, untimbered (ft.)	1,494	1,015	989	793	4,231
Drifting, timbered (ft.)	214	40	59	0	313
Crosscutting, untimbered (ft.)	221	245	211	914	1,594
Crosscutting, timbered (ft.)	268	0	0	293	561
Timbering (lineal ft.)	482	40	59	293	874
Core drilling (holes)	16	10	6	7	39
Core drilling (ft.)	1,617	1,041	487	855	4,000
Number of Assays	13	19	5	65	102

Table II compares the number of various units allowed by the contract and those actually accomplished.

TABLE II

	Contract	Actual
Total drifts and crosscuts (ft)	6,700	6,699
Diamond drilling (ft)	4,000	4,000
Timbering (lineal ft)	1,415	874
Assays (units)	250	102

A record of ore recovered during exploration is contained in Table III. Due to mucking machine loading and consequent wall dilution, some car sample assays are low.

GEOLOGY AND ORE DEPOSITS

The Hanna mine is located in the Piedmont physiographic province about 50 miles west of the Coastal Plain. The mine is in a northeast-trending belt of tungsten-bearing quartz veins. The belt is about 6 miles long and a mile wide and is known as the Hanna tungsten district. The location of the district is shown on figure 1 of the examination report.

In the Hanna district the country rocks are composed mainly of granite and schist. The contact between the two rock types strikes generally due north through the district and generally has a steep dip to the west. Locally the dip of the contact may be vertical or steep to the east. Granite lies east of the contact while schist lies to the west.

The metamorphic rocks are composed dominantly of chlorite and sericite phyllites and schists. The color of these rocks ranges from grayish green to very dark green and almost black. The texture may be fine grained and massive or coarser grained and schistose. In the chloritic rocks some of the harder, denser varieties contain epidote and quartz. The sericitic rocks are generally heavily speckled with martite (iron sesqui-oxide).

The age of the metamorphic rocks is thought to be pre-Cambrian or early Paleozoic.

The eastern part of the district is made up of biotite-albite granite. The age of the granite is late Paleozoic and the rocks are intrusive into the older schists and phyllites to the west.

TABLE III

EXPLORATION ORE - (WET TONS) (CAR SAMPLES, WO_3)

DATE	A	B	C	D	TOTAL TONS & AVER. % WO_3	S.T.U. RECOVERED	AVERAGE PRICE, $	VALUE DOLLARS	ROYALTY DUE 5 @ %	ROYALTY PAID
NOV. 1956	0	0	0	0	0	0		0	0	0
DEC. 1956	0	0	140 @ 0.27 %	0	140 @ 0.27 %	32.44				
JAN. 1957	154 @ 0.32 %	0	17 @ 0.27 %	0	171 @ 0.315	45.81				
FEB 1957	68 @ 0.14 %	0	0	0	68 @ 0.14	7.92				
MARCH 1957	0	165 @ 0.39 %	0	0	165 @ 0.39	54.49				
APRIL 1957	0	0	0	0	0	0.				
PERIOD TOTALS	222 @ 0.265 %	165 @ 0.39 %	157 @ 0.27 %	0	544 @ 0.304	140.66	32.996	4641.24	232.06	232.06
May 1957	49 @ 0.57 %	0	0	0	49 @ 0.57	23.99				
JUNE 1957	0	0	0	0	0	0				
JULY 1957	0	264 @ 0.75 %	0	0	264 @ 0.75	159.80				
AUG. 1957	0	3 @ 0.75 %	0	0	3 @ 0.75	1.84				
PERIOD TOTALS	49 @ 0.57 %	267 @ 0.75 %	0	0	316 @ 0.722	185.63	27.17	5043.57	252.18	252.18
SEPT. 1957	0	0	0	107 @ 1.34 %	107 @ 1.34	119.51				
OCT. 1957	0	0	0	594 @ 0.81 %	594 @ 0.81	406.88				
NOV. 1957	0	9 @ 0.35 %	0	283 @ 0.85 %	292 @ 0.83	208.40				
DEC. 1957	241 @ 0.22 %	0	0	277 @ 0.55 %	518 @ 0.40	179.05				
PERIOD TOTALS	241 @ 0.220 %	9 @ 0.350 %	0	1261 @ 0.807 %	1511 @ 0.711	913.84	21.67	19,802.19	990.15	990.15
JAN. 1958	12 @ 0.41 %	0	0	166 @ 0.25 %	178 @ 0.26	39.33				
MAY 1958	28 @ 0.07 %	0	0	0	28 @ 0.07	1.64				
PERIOD TOTALS	40 @ 0.17 %	0	0	166 @ 0.250 %	206 @ 0.234	40.97	20.06	821.88	41.09	41.09
GRAND TOTAL	552 @ 0.266 %	441 @ 0.607 %	157 @ 0.270 %	1427 @ 0.742 %	2577 @ 0.588	1281.10	23.659	30,309.61	1515.48	1515.48

The granite is coarse grained and is composed of albite, blue opalescent quartz, perthite, and microcline. Biotite may be nearly lacking or very abundant. Common accessory minerals are magnetite, pyrite, sphene, apatite, and zircon.

Several types of dike rocks are found in the district. An aplite granite dike cuts the granite in the vicinity of the Sheed shaft. The dike is about 500 feet thick at its thickest part, and is composed mainly of quartz and albite with some sericite and biotite. The aplite is fine grained and light gray to white. It is probably closely related to the granite but somewhat younger.

Both the schists and the granite are cut by diabase dikes of Triassic age. Dikes and sills of diabase are common throughout the district. Their thicknesses range from a few inches to as much as 200 feet, and they have been traced as much as 2 miles without reaching an end. The thinner dikes are fine grained while the thicker ones are coarser. Dark gray feldspar and black pyroxene are the main constituents, and the dikes are dark gray to black. Most of the diabase dikes have a northerly trend with steep dips.

In the mine the applicant's consulting geologist has mapped a particular type of basic dike rock as lamprophyre. This rock cuts the quartz veins and is generally of a finer granular texture, is composed of hornblende, augite, and much biotite, and is dark greenish black in color. The thickness of the lamprophyre dikes ranged from a few inches to about 10 feet.

Quartz veins are found throughout the district. They range in thickness from a fraction of an inch to 30 feet. The quartz veins cut all rock types except diabase and lamprophyre.

The quartz veins are composed of at least three main types of quartz, 1) coarse grained and glassy, 2) medium to fine grained, shattered and fractured, somewhat dull-lustered, containing tungsten mineralization, and 3) dull, fine-grained sugary-textured quartz that is usually barren of mineralization but may contain, locally, sparse huebnerite, scheelite, and metal sulphides.

The tungsten-bearing quartz veins are in a narrow north-east-trending zone that is roughly parallel to the granite-schist contact. Most of the veins are in granite but some extend into the schist.

The largest and best developed quartz veins are localized in the granite along a shear zone that extends through the district for at least 3½ miles. The main shear zone strikes about N 35° E. and dips about 75° southeast, figure 1. Figure 1 and longitudinal sections 2 and 3 give some idea of the vertical continuity and pitch of the quartz veins.

Within the shear zone the granite is altered variously from moderately sheared granite to sericite and chlorite schist. The altered and sheared zone reaches a maximum thickness of about 100 feet.

Some movement has taken place along the shear zone, as evidenced by slickensides in places along the shear. Displacement appears to have been only a few feet at most. The pitch of the slickensides is usually less than 5 degrees to the south. Drag folds associated with the shearing show that the southeast side moved south with relation to the west side.

Tungsten is found in quartz veins as huebnerite ($MnWO_4$) and scheelite ($CaWO_4$). The veins are best developed and richest in the sheared granite. The next best vein locality is the granite west of the main shear zone and east of the schist contact. Heretofore it was thought that the schists were

not good host rocks for the tungsten veins, but the Tungsten Mining Corporation has been successful in developing at least two large veins within the schist in the Hanna Mine. The largest of these, known in the Company as "22 vein", has been developed on the 500, 700 and 900 foot levels.

In addition to the vein system in the main, northeast-trending shear zone, there are several other subordinate veins which have been important tungsten producers. Chief among these is Walker No. 3 vein which strikes east-northeast and appears to join the main Walker No. 2 vein at about the location of Walker No. 5 vein, figure 1.

The quartz veins range in length from a few feet to a thousand feet, and from an inch or less in thickness to as much as 30 feet. The veins pinch and swell and in many places the quartz forms lenses. The pitch of the ore shoots in the veins is vertical in some places. In other places the pitch of ore shoots may be southeast. An intermediate southeast pitch appears to be predominant. Offshoot quartz stringers often extend from the veins into the enclosing altered wall rocks.

The principal metallic minerals in the quartz veins are huebnerite, pyrite, galena, tetrahedrite, sphalerite, chalcopyrite, and scheelite. Huebnerite is the important tungsten mineral. Scheelite practically everywhere in the veins is found as a sparse alteration product of hydrothermal alteration of huebnerite. Very little huebnerite seems to have been leached at the surface, consequently there is no significant zone of secondary enrichment at depth.

Quartz, fluorite, sericite, and rhodochrosite, in that order, are the principal gangue minerals. Huebnerite is found as long, platy, brown crystals that are arranged in irregular masses or zones that are parallel to the walls of the vein.

At least two varieties of quartz are discernible in the Hanna Mine. The huebnerite-bearing variety is duller in luster and is more granular and shattered. The barren quartz is more massive and has a more vitreous luster.

The area controlled by Tungsten Mining Corporation is situated in about the center of the district. The huebnerite quartz veins exposed on the surface in outcrops and trenches on the property are richer and more strongly mineralized than any other place in the district. This fact, however, probably has little to do with the ultimate potentialities of the district as large ore bodies have been developed in the Hanna Mine where the ore had little or no outcrop at surface.

The size of the ore bodies within the veins ranges within wide limits. Persistent veins may extend in length to as much as 500 feet or more. The larger lens-type bodies may be 250 feet long, average 30 feet in width, and extend to depths of 400 to 500 feet. The veins are discontinuous and may pinch down to a mere fracture between ore bodies. The largest single ore body has a short, narrow outcrop, has a length of 1,180 feet on the 900 level and has maximum thicknesses up to 40 feet. This body is in the southern part of the main shear zone and is known as the Walker 1-1A vein.

The geology of the Hanna district has been ably described by O. H. Rapaenhade and J. M. Parker, III. See Appendix A for references.

<u>Project A</u>: The purpose of Project A drift was to seek for projections and undiscovered ore shoots northeast of the mine workings. The special target areas were the truncated portions of the No. 2 vein north of a thick diabase dike and the down dip extensions of the ore found in shallow drill holes, known as Walker No. 5 and No. 10 veins.

The project A work disclosed that the first diabase dike is about 130 feet thick. Shortly after the dike was penetrated the ore vein was found as anticipated, figure A. As the drift progressed northeastward the vein unfortunately pinched down into a series of disconnected small lenses and finally pinched out altogether.

Project A drift, for about half its length, passed through sericitic and chloritic schists. The schists gradually gave way to grayish and brownish green granite gneiss. The drift was terminated in gneiss and schist.

A second large ultramafic dike was penetrated about 1,300 feet from the beginning of project A. The dike is about 53 feet thick. A third large dike was encountered about 1,770 feet from the beginning point. The dike is about 145 feet thick. The dike at the start of the project is diabasic. The other two, however, appear to be dioritic in texture and composition.

The last 100 feet of the drift encountered lenticular, disconnected white quartz masses that contained sparse disseminated hubnerite. A strong quartz-bearing shear structure is present in the face of the project A drift. The chances appear to be good that the structure represents the southeast extremity of an ore-bearing quartz shear zone.

Project B: Project B consisted of a drift from existing mine opening; and the drift was designed to explore for southward extensions of the No. 3 vein.

The drift was driven mostly through grayish brown and green granite and gneiss. A short crosscut and drift were driven in sericite schist and gneiss, figure B. As was anticipated, an ore-bearing quartz vein structure was found at the granite-schist contact, but the ore body proved to be

disappointingly small. The huebnerite and white quartz is associated with abundant purple fluorite and disseminated pyrite and very sparse chalcopyrite.

At about three-fourths of its total length the project B drift passed through a diabase dike. The dike is about 20 feet thick. At its termination the drift is in green and brown gneiss. A small, tight shear structure is present in the face with small discontinuous white quartz lenses and, locally, very sparse huebnerite. The drift face does not appear very favorable as a site for further work.

Project C: The purpose of the Project C drift was to explore for northward extensions of what is known as the No. 25 vein. The drift also searched for down dip extensions of a mineralized quartz vein structure known on surface as Norton L-A vein, figure 1.

The drift progressed mostly through green and gray granite and granite schist. Purple and blue fluorite and disseminated pyrite are locally abundant. Scattered, thin lamprophyre and diabase dikes cross the drift at wide intervals. Toward its termination the drift disclosed that the white quartz-filled shear zone that was being followed became narrower until the shear became very tight and narrow and practically devoid of white quartz. The face of the drift does not appear promising for further work.

Project D: Project D consists of a long crosscut with attendant drifting. The work was designed to seek for the down dip extension of an outcropping ore body known as Norton Estate No. 3 vein. The broad objective was to seek for ore bodies well to the west of the main mine workings.

At the start the crosscut penetrated a diorite dike that is about 200 feet thick. After that the crosscut and attendant drifting remained in chlorite and sericite schist. Thin, scattered lamprophyre and diabase dikes were encountered at wide intervals by the crosscut.

As anticipated the crosscut eventually reached a strong, mineralized white quartz-filled shear zone. The quartz carried abundant huebnerite. The shear zone was followed by drifting which resulted in a significant ore discovery.

In the northeast drift, the quartz vein pinched down relatively rapidly. To the southwest, however, the huebnerite-bearing quartz vein is more or less continuously mineralized over a length of about 700 feet. The vein pinches to the southwest, and at the southwest drift face the white quartz vein has reduced to separated inch-wide quartz veinlets. The shear structure is well developed, however; so that the southwest drift is a very favorable site for further exploration work.

An interesting occurrence of molybdenite, MoS_2, was noted in the northeast drift. A white quartz vein, up to 3 feet thick, is visible in the northwest rib of the drift. The quartz carries a small amount of molybdenite that is associated with disseminated graphite and pyrite. Two chip samples of the vein, taken by the Operator assayed 0.19 and 0.10 percent Mo. Economic amounts of molybdenum do not appear to be present in the vein.

Projects A, B, and D can be considered as successful in discovering minable ore deposits, figures A, B and D. Project B penetrated a huebnerite ore lens but only a few hundreds of tons of ore are likely to be present. Project C may be considered as unsuccessful.

Some geologic generalizations in the ore were borne out by the work:

1) The principal shear zones and huebnerite-bearing quartz veins have a general northeast strike and dip 70° or more to the southeast.

2) At least two, and possibly three, generations of quartz are present of which only one is favorable for the presence of huebnerite.

3) Ultramafic dikes, some very thick and of long lateral extent, are comparatively young. The dikes do not appear to have had any mineralogical effect on either the enclosing rocks or the quartz veins. The dikes do truncate the ore veins and displace the cut-off ends of the veins by a distance equal to at least the thickness of the dike.

4) Huebnerite is usually associated in the quartz veins with fluorite and metal sulfides. Fluorite and sulfides are, however, commonly present in the absence of huebnerite.

5) The huebnerite-bearing quartz veins are directly associated with sheared and fractured zones in the schist-granite complex. A well developed shear zone if followed by drift or crosscut or explored by drilling will, in many cases, show the presence of favorable white quartz.

A total of 4,000 feet of EX size exploratory diamond drilling was performed in the four project headings. Nearly all of the drilling was used in short holes from the sides or ends of drifts in the effort to guide the drifting by locating quartz lenses or shear structures. Only one hole, No. U-1283, figure B, may be considered as penetrating hitherto unknown ore. Assays of samples taken by the Operator in the various drifts and crosscuts are shown on figures A, B, and D.

ORE RESERVES

Ore reserves were developed in Projects A, B and D. No minable ore was found in Project C. Due to the fact that all ore has been exposed only in a drift on one level, reserves are here reported as the sum of indicated and inferred tonnage.

In calculating all ore reserves, the Operator considers 25 feet above and 25 feet below a drift to be proven or measured ore. He also considers the next 25 feet above and below his measured ore to be the total of indicated and inferred ore. The writers do not subscribe to this method. The writers calculations include no measured ore, but do assume that such ore should include the sum of indicated and inferred ore contained in a block 50 feet above and 50 feet below the drift and having a length equal to that of the ore lens as exposed in the drift. Lenses as designated in Table IV are indicated on maps A, B and D. A factor of 12 cubic feet has been used in calculating tonnage.

Figures 2 and 3 are representative longitudinal sections of ore bodies as they occur in this mine. These sections indicate that when a lens or series of lenses is of considerable horizontal extent, the vertical measurement is also extensive. This habit may well be followed in project D. Based on mine experience, it is believed that the Field Team's estimate of ore reserves is conservative.

EXPENDITURES

The original total approved amount of the contract was $250,340.00. By amendment No. 1 this was changed to a total of $246,660.00.

TABLE IV
ORE RESERVES

CALCULATED RESERVES								ORE MINED		RESERVE PLUS ORE MINED	
PROJECT	LENS NO.	LENGTH	WIDTH	HEIGHT	CUBIC FEET	TONS	AVERAGE GRADE % WO_3	TONS	AVERAGE GRADE % WO_3	TONS	AVERAGE GRADE % WO_3
A	1	75	9.39	100	70,425	5,869	0.56	552	0.266	6,421	0.535
B	2	45	5.2	100	23,400	1,950	0.63				
B	3	85	4.9	100	41,700	3,475	0.51				
TOTAL B					135,525	5,425	0.55	441	0.607	5,866	0.554
C								157	0.270	157	0.270
D	4	30	4.8	100	14,400	1,200	0.88				
D	5	130	6.9	100	89,700	7,475	0.96				
D	6	140	3.0	100	42,000	3,500	0.80				
D	7	80	6.8	100	54,400	4,533	0.74				
D	8	120	2.9	100	34,800	2,900	0.42				
D	9	65	4.5	100	29,250	2,437	0.42				
TOTAL D					264,550	22,045	0.74	1,427	0.742	23,472	0.740
GRAND TOTAL					470,500	33,339	0.68	2,577	0.588	35,916	0.670

Total approved	$246,660.80
Total cost of project (Report of review)	244,342.60
Government's share of cost at 75%	183,256.95
Government's share unexpended	1,738.05
Value of production during operations	30,309.61
Royalty due the Government on production	1,515.48
Royalty paid to the Government	1,515.48

EFFICIENCY OF OPERATIONS

All work under this contract was conducted in a highly efficient manner. No errors were found in progress reports. Safety rules were rigidly adhered to and no accidents occured.

EQUIPMENT PURCHASED

No equipment was purchased for this project.

W. F. Williams, Geologist
U. S. Geological Survey

H. L. Burmeister, Engineer
U. S. Bureau of Mines

August, 1958

APPENDIX A

1. Espenshade, G. H. Tungsten Deposits of Vance County, North Carolina and Mecklenburg County, Virginia: U.S.G.S. Bull. 948-A, 1947.

2. Parker, J. M. Geology and Structure of Part of the Hanna Tungsten District, Vance County, North Carolina, and Mecklenburg County, Virginia: U.S.G.S. progress report (unpublished) in cooperation with North Carolina Department of Conservation and Development, Division of Mineral Resources, 1951.

3. Advisory Board to the District Engineer, Corps of Engineers: Report on the Investigation of the Hanna Tungsten District in its Relationship to the Buggs Island Reservoir, Roanoke River, Va.-N.C., April 26, 1948.

July 12, 1958

Mr. Harry Burmeister
Mine Examination & Exploration Engineer
United States Department of the Interior
Bureau of Mines, Region V
College Park, Maryland

Re: DMEA 4216, Idm-E 1032 (Tungsten)
Hamme Mine Vance County, N.C.

Dear Mr. Burmeister:

The above captioned Defense Minerals Exploration Contract agreed to November 2, 1956, between the United States of America, acting through the Department of the Interior, Defense Minerals Exploration Administration and Tungsten Mining Corporation, Henderson, North Carolina, was completed on June 16, 1958.

Attached hereto please find the final report, five (5) copies, which covers the work conducted under this project. Also, as part of this report, we are mailing you under separate covers by parcel post, five (5) prints each of the required Maps for the report and five (5) copies of the Diamond Drill Logs.

We trust that the report properly meets the requirements under the Contract and also conforms with the suggestions advanced by you and your associates to Mr. A. M. Szynklewski, our Chief Engineer, for its compilation.

Very truly yours,

TUNGSTEN MINING CORP.

J. R. Sweet

J. R. Sweet
Vice-President & Gen. Mgr.

JRS:mlb

Enclosures

July 12, 1958

FINAL REPORT

DMEA EXPLORATION PROJECT

at

Hamme Mine, Vance County, N.C.

for

Tungsten Mining Corp.

Docket No. DMEA 4216
Contract No. Idm-E 1032

TUNGSTEN MINING CORP.

J. R. Sweet
Vice-President & Gen. Mgr.

CONTENTS OF REPORT
(Five Copies)

Summary and Evaluation of Entire Project

Brief General Geology of the Hamme Mine

Table-I, Cost Summary of Entire DMEA Project.
Table-II, Summary For Projects A,B,C and D.
Table-III, Summary of Royalty Payments by Tungsten Mining Corp. to DMEA for Ore Mined During Exploration Period.
Table-IV, Summary of Ore Mined From DMEA Projects During Exploration Period.
Table-V, Overall Ore Reserve Summary And Tonnage Mined in Exploration Work.

Operators Unit Cost and Progress Report, (Form MF-104A)

Operators Monthly Report and Voucher, (Form MF-104)

Report on Each Project A,B,C and D Under Following Sub-titles:-
- Evaluation of Project
- General Geology of Project
- Narrative Summary of work for Project.
- Summary of Progress for Project
- Total Exploration and Cost for Project
- Ore Reserves for Project

Maps Submitted:
- 5 - prints, 40 Scale, Geology Map of Project A
- 5 - prints, 40 Scale, Geology Map of Project B
- 5 - prints, 40 Scale, Geology Map of Project C
- 5 - prints, 40 Scale, Geology Map of Project D
- 5 - prints, 100 Scale, Composite Mine Map, of the Projects with skeletonized geology of the Projects and DMEA Boundaries

Diamond Drill Logs: -
- 5 - sets of Drill Logs for all DMEA Diamond Drill Holes.

Docket No. DMEA 4216
Contract E-1032

Summary and Evaluation of Entire Project

The Exploration Project Contract No. Idm E-1032, Docket No. DMEA-4216, between the United States Dept. of the Interior, Defense Minerals Exploration Administration, and Tungsten Mining Corporation was dated November 2, 1956 and was received by Tungsten Mining Corporation on November 17, 1956.

Exploration work was started on November 19, 1956 and was completed on June 16, 1958.

Work was performed in four separate Projects, A, B, C, D. Under the contract, the following footages of drifts and crosscuts were allocated to each Project:

Project A	-	2200 ft.	(2200 ft. actually driven)
Project B	-	1300 ft.	(1300 ft. actually driven)
Project C	-	1200 ft.	(1199 ft. actually driven)
Project D	-	2000 ft.	(2000 ft. actually driven)

Diamond drill footage was also allocated to each Project, but by Amendment No. 2, the original contract was changed to permit the Operator to transfer unused drill footage from one Project to another Project, with prior government approval.

A total of 6699 ft. of drifts and crosscuts were driven. Of this 874 ft. or 13% required timber. Diamond drilling amounted to 4000 ft. 102 assay determinations were made. Below is a tabulation showing contrast allowances compared to actual work performed.

		Contract	Actual	Per Cent Utilized
Drifts and Crosscuts	-	6700 ft.	6699 ft.	99.99%
Diamond Drilling	-	4000 ft.	4000 ft.	100.00%
Timbering	-	1415 ft.	874 ft.	61.77%
Assays	-	250	102	40.80%

The Contract as amended allowed a total expenditure of $246,660.00. Actual Contract expenditure was $244,342.60 as shown in Table I.

Table II shows a Summary of Work Performed in each of the four Projects, namely A,B,C,D, and the tons of ore produced from each Project. Table IV also shows tons of ore produced from each Project.

As a result of the exploration work performed under this Contract, 2,577 tons of exploration ore was mined at an average grade of 0.57% WO_3. From this ore 1276.10 short ton units of WO_3 were recovered. (Table II and Table IV show the tonnage mined from each Project.)

Royalty payments to the Government on this tonnage amounted to $1,515.48. Tables III and IV show data pertaining to royalty payments and ore production.

Calculated Ore Reserves obtained as a result of the work under the Contract amount to 27.992 tons at an average grade of 0.69% WO_3. Table V shows data relative to Ore Reserves and tonnage mined in the four Projects.

Exploration work under the Contract resulted in an Ore Reserve of 27,992 tons plus 2577 tons of ore mined, a total of 30,569 tons, at an average grade of 0.68% WO_3.

Mineable ore bodies were located in three of the four Projects, namely A, B, and D. In the fourth, Project C, mineralized vein was encountered, especially

in Project D.

Following is a brief analysis of each Project.

Project A- Results somewhat disappointing. One relatively small ore body was located.

Several areas require additional exploration

Calculated Ore Reserve	-	6452 tons @ 0.49% WO_3
Tons Mined	-	552 tons @ 0.27% WO_3
Total		7004 tons @ 0.47% WO_3
Cost of Project		$81,345.85

Project B- Results rather disappointing. Two small ore bodies were located.

Additional exploratory work in several areas is justified.

Calculated Ore Reserve	-	6408 tons @ 0.51% WO_3
Tons Mined	-	441 tons @ 0.61% WO_3
Total		6849 tons @ 0.52% WO_3
Cost of Project		$47,410.65

Project C- Results were disappointing. A small narrow vein was encountered but it is not regarded as being mineable.

Calculated Ore Reserve	-	None
Tons Mined	-	157 tons @ 0.27% WO_3
Total		157 tons @ 0.27% WO_3
Cost of Project		$42,984.15

Project D- Results were good. In the drift on the main vein system, there is continuous mineralization over a length of about 740 ft. there are at least two mineable ore lenses and portions of four other lenses may be mineable.

Additional lateral exploration is warranted as both faces in the drift still contain mineralization. Exploration in the form of raises and/or winzes could locate additional mineable ore lenses.

Calculated Ore Reserve	-	15132 tons @ 0.85% WO_3
Tons Mined	-	1427 tons @ 0.74% WO_3
Total		16559 tons @ 0.84% WO_3
Cost of Project		$72,601.95

The remainder of this report includes a brief outline of the Geology of the Hamme Mine; and a section devoted to each of the four Projects in which there is outlined the following:

(a) Evaluation of the Project
(b) Geology of the Project
(c) Narrative Summary of Work Performed
(d) Summary of Progress for Project
(e) Total Exploration and Cost for Project
(f) Ore Reserves for Project

Summary and Evaluation of Entire Project - Page 3 - 7/9/58

Included with this report are also:

1 - 5	prints	40	scale	Geology Map of Project A
2 - 5	"	"	"	Geology Map of Project B
3 - 5	"	"	"	Geology Map of Project C
4 - 5	"	"	"	Geology Map of Project D
5 - 5	"	100	"	Composite Mine Map, with skeletonized geology of the Projects and DMEA Boundaries.

6 - 5 sets of Drill Logs for all DMEA diamond drill holes
7 - 5 copies Form MF-104A
8 - 5 copies Form MF-104

Docket No. DMEA 4216
Contract E-1032

Brief General Geology of the Hamme Mine

The Hamme Mine, located in northern Vance County, N.C. was discovered by the Hamme brothers in 1943.

Since that time it has become one of the major tungsten producers in the United States.

The geology of the district has been described quite thoroughly by G. H. Espenshade in Bulletin 948A, U.S. Dept. of the Interior, Geological Survey, titled "Tungsten Deposits of Vance County, North Carolina, and Mecklenburg County, Virginia". Therefore no comprehensive report on geology will be made in this report.

The area is underlain by a granite-gneiss complex in the eastern part of the district and by schist in the western part. The granite is generally gneissic near the contact and adjacent to major shear zones, but is more massive elsewhere.

The schist is quite varied in appearance and composition but is generally a monotonous chlorite schist, quite often chlorite-epidote schist. Some sericitic schist is also present.

In the central part of the district there is a well-defined shear zone striking approximately N30E and dipping to the southeast at about 70 degrees. This is the main shear zone or Walker No. 2 Vein shear zone. In the areas adjacent to this zone the granite has been considerably sheared, sometimes for a width of 80 to 100 ft. This shearing varies considerably from slightly sheared granite to schistose gneiss, to sericitic schist.

Near the northern end of the district another major shear zone diverges away to the southwest from the main shear zone. This shear strikes about S50W and dips to the southeast at about 70 degrees. However further to the west in this zone the dip is reversed to the north at about 70 degrees. This shear zone is known as the Walker No. 3 and Walker No. 6 shear zone. Relatively speaking this zone is considerably tighter than the main shear zone, but has been economically important.

The main shear zone which is within the granite complex has been mapped on the surface for a length of about 2 miles. It had been developed in the mine for a length of about one mile (previous to DMEA Project A).

Mineralization in the district has been noted over a distance of about 8 miles.

The tungsten deposits occur as quartz veins, carrying huebnerite and a lesser amount of scheelite along with numerous accessory minerals including pyrite, fluorite, rhodochrosite, tetrahedrite, galena, chalcopyrite, sphalerite and several others.

The veins usuall occur as lenses en echelon within the main shear zone and within the other shear zones. Vein widths vary from a few inches to over 40 ft., the average being 12 to 14 ft. The individual lenses vary in length from a few feet to over 800 ft. in length.

Most of the veins occur in shear zones within the granite-gneiss complex but there are several economically important veins in the schist.

Within the district are several major diabase and diorite dikes, which have spread or displaced the veins. Major dikes occur on both the north and south ends of the mine. Minor dikes occur elsewhere.

TABLE I

Docket No. DMEA 4216
Contract No. E-1032

COST SUMMARY FOR ENTIRE DMEA PROJECT

	UNIT	PROJECT A UNITS	PROJECT A COST	PROJECT B UNITS	PROJECT B COST	PROJECT C UNITS	PROJECT C COST	PROJECT D UNITS	PROJECT D COST	TOTAL UNITS	TOTAL COST
Drifting, bare@$35.00	FT	1494	$52,290.00	1015	$35,525.00	929	$32,515.00	793	$27,755.00	4231	$148,085.00
Drifting, timbered@$32.40	FT	214	6,933.60	40	1,296.00	59	1,911.60	--	--	313	10,141.20
Crosscutting, bare@$35.00	FT	224	7,840.00	245	8,575.00	211	7,385.00	914	31,990.00	1594	55,790.00
Crosscutting, timbered@$32.40	FT	268	8,683.20	--	--	--	--	293	9,493.20	561	18,176.40
Timbering @ $6.00	FT	482	2,892.00	40	240.00	59	354.00	293	1,758.00	874	5,244.00
Diamond Drilling @ $1.65	FT	(a) 1617	2,668.05	(b) 1041	1,717.65	(c) 487	803.55	(d) 855	1,410.75	(e) 4000	6,600.00
Number of Assays @ $3.00	ea	13	39.00	19	57.00	5	15.00	65	195.00	102	306.00
			$81,345.85		$47,410.65		$42,984.15		$72,601.95		$244,342.60

(a) 16 holes
(b) 10 holes
(c) 6 holes
(d) 7 holes
(e) 39 holes

TABLE II

Docket No. DMEA 4216
Contract No. E-1032

SUMMARY FOR PROJECTS A,B,C, and D

	Drifts (Bare) $35.00/ft	Drifts (Timbered) $32.40/ft	Crosscuts (Bare) $35.00/ft	Crosscuts (Timbered) $32.40	Total Drifts and Crosscuts	Timber $6.00/ft	Diamond Drilling $1.65/ft	Assays $3.00each	ORE PRODUCTION Wet Tons	WO_3
Project A	1494	214	224	268	2200	482	(a) 1617	13	552	0.27
Project B	1015	40	245	-	1300	40	(b) 1041	19	441	0.61
Project C	929	59	211	-	1199	59	(c) 487	5	157	0.27
Project D	793	-	914	293	2000	293	(d) 855	65	1427	0.74
TOTAL	4231	313	1594	561	6699	874	(e) 4000	102	(f) 2577	0.59%

(a) 16 holes
(b) 10 holes
(c) 6 holes
(d) 7 holes
(e) 39 holes
(f) 1276.10 S.T.U.'s Recovered

Docket No. DMEA 4216
Contract No. E-1032

TABLE III

SUMMARY OF ROYALTY PAYMENTS BY TUNGSTEN MINING CORPORATION
TO DMEA FOR ORE MINED DURING EXPLORATION PERIOD

Date of Payment	Period Covered	S.T.U.'s Recovered	Calc. Ave. Selling Price	Amt. of Royalty Payment	Remarks
May 18, 1957				$ 92.82	
July 2, 1957	Nov.1,1956-April 30,1956	140.66	$32.9962	139.24	Royalty Settlement No.1
Sept.28, 1957	May 1,1957-Aug 31, 1957	185.63	$27.1700	$ 252.18	Royalty Settlement No.2
Jan. 28, 1958	Sept.1,1957-Dec.31,1957	908.84	$21.6700	$ 990.15	Royalty Settlement No.3
June 30, 1958	Jan.1,1958-June 30,1958	40.97	$20.0605	$ 41.09	Royalty Settlement No.4
		1276.10	$23.6668	$1,515.48	

Payments are based on 5% of gross value of tungsten concentrates

TABLE IV

Docket No-DMEA 4216
Contract E-1032

SUMMARY OF ORE MINED FROM DMEA PROJECTS DURING EXPLORATION PERIOD

Month	Year	PROJECT A Wet Tons	PROJECT A Grade	PROJECT B Wet Tons	PROJECT B Grade	PROJECT C Wet Tons	PROJECT C Grade	PROJECT D Wet Tons	PROJECT D Grade	TOTAL Wet Tons	TOTAL Grade	S.T.U.'s Recovered	
November	1956	—	—	—	—	—	—	—	—	—	—	—	
December	1956	—	—	—	—	140	0.27	—	—	140	0.27	32.44	
January	1957	154	0.32	—	—	17	0.27	—	—	171	0.315	45.81	
February	"	68	0.14	—	—	—	—	—	—	68	0.14	7.92	
March	"	—	—	165	0.39	—	—	—	—	165	0.39	54.49	
April	"	—	—	—	—	—	—	—	—	—	—	—	
Sub-Total		222	0.265	165	0.390	157	0.270			544	0.304	140.66	Royalty Settlement No.1
May	1957	49	0.57	—	—	—	—	—	—	49	0.57	23.99	
June	"	—	—	—	—	—	—	—	—	—	—	—	
July	"	—	—	264	0.75	—	—	—	—	264	0.75	159.80	
August	"	—	—	3	0.75	—	—	—	—	3	0.75	1.84	
Sub-Total		49	0.570	267	0.750	—	—	—	—	316	0.722	185.63	Royalty Settlement No.2
September	1957	—	—	—	—	—	—	107	1.34	107	1.34	119.51	
October	"	—	—	—	—	—	—	594	0.81	594	0.81	406.88	
November	"	—	—	9	0.35	—	—	283	0.85	292	0.83	203.40	
December	"	241	0.22	—	—	—	—	277	0.55	518	0.40	179.05	
Sub-Total		241	0.220	9	0.350			1261	0.807	1511	0.711	908.84	Royalty Settlement No.3
January	1958	12	0.41	—	—	—	—	166	0.25	178	0.26	39.33	
February	"	—	—	—	—	—	—	—	—	—	—	—	
March	"	—	—	—	—	—	—	—	—	—	—	—	
April	"	—	—	—	—	—	—	—	—	—	—	—	
May	"	28	0.07	—	—	—	—	—	—	28	0.07	1.64	
Sub-Total		40	0.172	—	—	—	—	166	0.250	206	0.234	40.97	Royalty Settlement No.4
GRAND TOTAL		552	0.266	441	0.607	157	0.270	1427	0.742	2577	0.588	1276.10	

Note: Grade is Percent WO_3

TABLE V

Docket No. DMEA 4216
Contract No. E-1032

OVERALL ORE RESERVE SUMMARY, AND TONNAGE MINED IN EXPLORATION WORK

	CALCULATED ORE RESERVES				TONNAGE MINED		RESERVE PLUS ORE MINED	
	Tons Proven	Tons Probable	Tons Total	$\%WO_3$ Grade	Tons	Grade $\%WO_3$	Tons	Grade $\%WO_3$
Project A	3226	3226	6452	0.49	552	0.27	7004	0.47
Project B	3204	3204	6408	0.51	441	0.61	6849	0.52
Project C	--	--	--	--	157	0.27	157	0.27
Project D	7566	7566	15132	0.85	1427	0.74	16559	0.84
	13,996	13,996	27,992	0.69	2577	0.59	30,569	0.68

Form MF-104A
(April 1952)

Budget Bureau No. 42-R1151.2

UNITED STATES
DEPARTMENT OF THE INTERIOR

DEFENSE MINERALS EXPLORATION ADMINISTRATION

OPERATOR'S UNIT COST AND PROGRESS REPORT

FINAL REPORT

Month of ..... 195.... Docket No. DMEA 4216 Contract No. E-1032

Operator's Name TUNGSTEN MINING CORPORATION Minerals TUNGSTEN

Address BOX 931, HENDERSON, N. C.

OPERATION	UNIT	COSTS THIS MONTH	UNITS THIS MONTH	COSTS TO DATE	UNITS TO DATE	UNIT COSTS TO DATE	AUTHORIZED BY CONTRACT	
							Units	Unit Costs
Drifting Not timbered	Ft	-	-	$148,085.00	4231	$35.00		
~~Cross cuts~~ Drifts timbered	Ft	-	-	10,141.20	313	32.40		
~~Raises~~ XC not timbered	Ft	-	-	55,790.00	1594	35.00		
~~Shafts~~ XC timbered	Ft	-	-	18,176.40	561	32.40		
Winzes								
Drilling: Core	Ft	-	-	6,600.00	4000	1.65		
Churn								
Auger								
~~Stripping~~ Sampling	Ea	-	-	306.00	102	3.00		
Trenching								
Test Pits								
Roads and Trails								
Timbering	Ft	-	-	5,244.00	874	6.00		
TOTAL DISTRIBUTED COSTS		-	-	$244,342.60				TOTAL COSTS AUTHORIZED BY CONTRACT
Operating Equipment Purchased								
Initial Rehabilitation and Repairs								
New Buildings, Improvements, etc								
TOTAL COSTS								

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this report is correct and complete to the best of their knowledge and belief.

Date JULY 11, 1958 Operator TUNGSTEN MINING CORPORATION

Per J. R. Sweet Title VICE PRES & GEN MGR.

J. R. Sweet

REMARKS:

NOTE.—Title 18, U. S. Code (Crimes), section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

(Instructions on reverse)

(For Government use only)

INSTRUCTIONS

Preparation of Form MF-104A—Operator's Unit Cost and Progress Report.—Applicable places on Form 104A should be filled in by the Operator. The purpose of this form is twofold as follows: (1) to furnish the supervising engineers and other administrators with statistical information necessary to better determine the progress of the project; and (2) to furnish more permanent information on mining costs for future use. The more important phases of operation on which permanent information is desired have been outlined in the form. There are blank lines, however, for those unusual phases which may need to be reported for a particular project. It will be necessary for the Operator to distribute his costs among the applicable phases reported with the exception of three items the costs of which are not to be distributed by the Operator. These three items are: "Operating Equipment Purchased", "Initial Rehabilitation and Repairs", and "New Buildings, Improvements, etc." The reason for not distributing these items on a monthly basis is doubtless clear to the Operator, since such distribution might well overstate the cost for any one month or period short of the entire contract period.

Form MF-104A has been designed to tie in with Form MF-104 for both monthly and cumulative costs. The "Total Costs" on Form MF-104A for each month should equal the monthly "Total Costs" as reported on Form MF-104. This is also true of the "Total Costs To Date".

In preparing Form MF-104A, it will be necessary frequently to distribute certain costs over a number of items. For instance, supervisory and engineering costs may have to be distributed over several phases, such as, drifting, crosscutting, raising, etc., provided that these items were reported active for the month. Such distributions should be made on the basis of time spent on the various phases, on man days of labor charged to such phases, or on some other equitable basis. "Operating Equipment", "Initial Rehabilitation and Repairs", and "New Buildings Improvements, etc.", will be distributed to the several phases of the project by the Washington Office of DMEA at the close of the project if determined necessary. The last two columns headed "Authorized by Contract" will be filled in by the Operator if such information is found in the contract. This information is usually a part of Exhibit "A" of the contract. A space for remarks has been provided for the use of the Operator to call attention to any unusual circumstances causing excessive or disproportionate unit costs.

GPO 872894

Form MF-104 (Rev.)
(April 1952)

Budget Bureau No. 42-R1036.5

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
OPERATOR'S MONTHLY REPORT AND VOUCHER

Month of FINAL REPORT, 195..... Docket No. DMEA 4216 Contract No. E-1032
Operator's Name TUNGSTEN MINING CORPORATION Minerals Tungsten
Address BOX 931, HENDERSON, N. C.
Contract Amount, $ 246,660.00 Government Participation: 75 % Amount, $ 184,995.00

ITEMS OF COSTS	FOR OPERATOR'S USE			FOR GOVERNMENT USE ONLY		
	Monthly Total	Totals Previously Reported	Totals To Date	Approved Monthly Total	Approved Totals Previously Reported	Approved Totals To Date
(1) Independent Short Form Contracts:						
~~Drifting~~ Drifts not timbered	-	$148,085.00	$148,085.00			
~~Drifting~~ Drifts timbered	-	10,141.20	10,141.20			
Crosscutting not timbered	-	55,790.00	55,790.00			
~~Drifting~~ XC timbered	-	18,176.40	18,176.40			
Timbering	-	5,244.00	5,244.00			
(2) Labor and Supervision:						
~~Labor~~ Core drilling	-	6,600.00	6,600.00			
Supervision						
Technical Services						
(3) Operating Mat'ls. and Supplies:						
Timber						
Explosives						
Pipe						
Track						
(4) Operating Equipment:						
Rental						
Purchase						
Depreciation						
(5) Initial Rehabilitation and Repairs						
(6) New Bldgs., Improvements, etc.						
(7) Miscellaneous:						
Repairs to Equipment						
Sampling and Analysis		306.00	306.00			
Payroll Taxes						
Liability Insurance						
(8) Contingencies (specify):						
TOTALS		$244,342.60	$244,342.60			

I certify that the above bill is correct and just and that payment therefor has not been received.

Date JULY 11, 1958 *Payee TUNGSTEN MINING CORPORATION

Per J. R. Sweet Title VICE PRES & GEN MGR.

J. R. Sweet

*When a voucher is signed or receipted in the name of a company or corporation, the name of the person writing company or corporate name, as well as the capacity in which he signs, must appear. For example: "John Doe Company, per John Smith, Secretary," or "Treasurer," as the case may be.

NOTE.—Title 18, U. S. Code (Crimes), section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

(Instructions on reverse)

Pursuant to authority vested in me, I certify that this account is correct and proper for payment in the amount of:

$.....

Signature .....
(Authorized Certifying Officer)

Date ..... Vou. No. .....
(See other side)

(For Government use only)

CERTIFICATION BY GOVERNMENT REPRESENTATIVE:

I certify that to the best of my knowledge and belief the contractor submitting this voucher is operating a Defense Minerals Exploration Administration project under Contract No. ..... in accordance with the terms of the contract.

Signature ..... Title ..... Date .....

APPROVAL BY DMEA EXECUTIVE OFFICER OR ALTERNATE:

Signature ..... Title ..... Date .....

MONTHLY REPORT OF OPERATOR

The Operator (Contractor) of an exploration project is required to make a monthly report to the Government through the Regional Executive Officer. This report consists of three parts as follows:

(a) *Form MF-104—Operator's Monthly Report and Voucher.*—This form details expenditures and constitutes a voucher for reimbursing the Operator for the Government's share of costs;

(b) *Form MF-104A—Operator's Unit Cost and Progress Report.*—This is a statistical report of expenditures which shows costs for the various types of operation; and

(c) *Narrative.*—A concise narrative description of progress made, results accomplished, and any unusual difficulties encountered must be furnished as an attachment to this Report and Voucher. Wherever possible, the narrative is to be illustrated with maps or sketches showing formations penetrated and location and assays of samples taken as well as advances in workings. In the case of diamond drilling or churn drilling, the location and inclination of holes is to be shown on a map; logs and assays also are to be submitted.

The Monthly Report of Operator should be prepared in an original and four copies all of which must be sent to the Executive Officer of the Region not later than the 15th of the month following.

Preparation of Form MF-104—Operator's Monthly Report and Voucher.—All the applicable spaces in Form MF-104 should be filled in by the Operator, and the Operator or his agent should sign the certification in the lower left corner of the form.

The items of costs are arranged in the order they appear in Article 6 (a) of Form MF-200 (Revised February 1952), however, this form is readily adaptable for use in reporting activities under other contract forms.

Under Item (1) delete words "Short Form" if the contract is a sub-contract under Form MF-200; and delete word "Independent" if the contract reported is on Form MF-200 (A). Also, report work paid for on a unit basis under contract Form MF-200 as though it were performed under an independent contract.

Under Item (2) include labor, supervision and technical services incurred for the exploratory operations. Do not include labor, supervision and technical services used for work performed under items (5) and (6).

Under Item (3) include the costs of material and supplies used in the project other than that used under items (5) and (6).

Under Item (4) appear the three types of operating equipment expenditures, that is, rental, purchase and depreciation. The expenditures made for renting equipment belonging to a third party will be reported under "Rental". The amount paid or duly obligated for payment for the purchase of equipment will be reported under "Purchase". The amount of expenditures due the Operator to reimburse him for depreciation of equipment owned will be reported under "Depreciation".

Item (5) comprises costs of labor, supervision, technical services, materials, etc., which are used in the initial rehabilitation and repair of existing buildings, installations, fixtures, and equipment. These costs, therefore, should not be reported under items (2) and (3).

Item (6) includes the labor, supervision, technical services, materials, etc., used in the installation or construction of new buildings, fixed improvements, etc., necessary for the project. These costs, therefore, should not be reported under items (2) and (3).

Item (7) covers miscellaneous types of expenditure such as payroll taxes, liability insurance, workmen's compensation insurance, repairs to equipment and sampling and analysis. Only that part of payroll taxes, liability insurance and workmen's compensation which are paid by the operator should be reported under item (7). The share paid by the employee as a payroll deduction is to be included under item (2) as labor costs.

Item (8) includes any unforeseen costs not included in the other seven categories.

The original of Form MF-104 when submitted for reimbursable expenses incurred under contract Form MF-200 must be supported by original documentation or by certified copies of purchase orders, payrolls or transcripts of payrolls, unless such documentation has been waived by the Regional Executive Officer. This certification may be stated thus, "Certified True Copy (or Transcript)", followed by appropriate signature. If the Executive Officer of the Region determines that a contract under Form MF-200 should have an "on-site" audit, that is, a Government auditor should make an audit of the Operator's books and records of account, the Operator need not support his monthly voucher with original or certified documents except in cases of equipment purchases whose individual costs exceed $50.00. In these cases the original or a certified copy of the purchase order or invoice should be attached to the Monthly Voucher. N. B.—Only the *original* of Form MF-104 is required to be documented. The four copies of Form MF-104 are not to be thus supported.

Form MF-104 submitted for reimbursement under fixed price contracts on Form MF-200 (A), however, are not required to be supported by documentation of any kind. The Operator will submit his claim under item (1) of Form MF-104 by deleting as stated above the word "Independent" and by showing the number of feet or other units immediately after the appropriate descriptive word, such as, drilling, bulldozing, crosscutting, drifting, etc., and giving the "Monthly Total" amount due. "Totals Previously Reported", and "Totals to Date" columns should also be filled in.

GPO 872893

Docket No. DMEA 4216
Contract E-1032

Evaluation of Project A

2200 Lineal feet of drifting and crosscutting, and 1617 ft. of diamond drilling were expended in Project A. 482 lineal feet of timber was installed.

One medium sized ore body was opened up which is of mineable size and grade. Scattered mineralization is present for a distance of about 690 ft. north of this ore body, just north of the first dike.

Ore Reserves are calculated to be 6452 tons at 0.49% WO_3. Tonnage mined as a result of this exploration is 552 tons at 0.27% WO_3

The results obtained in Project A are not very rewarding. However it must be pointed out that in the area north of the mineable ore lens just beyond the first dike, to a point near survey station 1439, a strike distance of about 690 ft., there is considerable mineralization present in small veins. Additional exploratory work in this area in the form of raises and/or winzes could locate economically important ore. It may be that this mineralization represents either the top or bottom of mineable ore lenses.

It should be noted that just north of the dike on the 900 Level in Project A we have one mineable ore lens. On the 700 Level in the same area we have some fair mineralization. It is quite possible that these are on the same ore lens.

Beyond this point northward, the Project is definitely disappointing with very little mineralization being present. The last 112 ft. of drift at the end of the Project contains some mineralization in narrow quartz seams and further exploration work is justified northward.

Docket No. DMEA 4216
Contract No. E-1032

GENERAL GEOLOGY OF PROJECT A

Exploration in Project A was performed on what is locally called the No. 2 Vein shear zone. This shear zone has been by far the most productive zone in the mine.

On the surface it has been traced for a length of about 2 miles with mineralization present for the entire length.

Within the mine it has been developed for lengths approximating 1 mile on all except the lower levels.

South of the Sneed Shaft, this shear is displaced into the footwall by a large diabase dike. This shear has been picked up south of the dike and an excellent ore body known as the No. 22 Vein has been developed.

The developed mine limits to the north on the No. 2 Vein shear zone (with the exception of the 700 Level) terminated against a large diabase dike. On the 700 level favorable structure and some fair mineralization was encountered north of the dike but this occurence was not considered to be mineable.

North of this dike surface drilling on the Walker No. 5 and Walker No. 10 veins indicated favorable structure and scattered mineralization.

Project A was designed to explore the area on the 900 Level below the outcrops and drill hole intersections of the Walker No. 5 and Walker No. 10 veins.

The shear zone upon which drifting was performed in Project A is entirely within the granite-gneiss complex. The shear zone strikes about N 30 E and dips to the southeast at about 70 to 75 degrees.

same as 1st dike

Crosscutting the shear are three major diabase or diorite dikes which are post-mineral in age. The first dike is about 130 ft. thick, the second about 55 ft. thick and the third about 140 ft. thick. Each of these dikes have spread or displaced the vein structure to the east. Crosscuts were designed to pick up the structure on the north side of each of these dikes.

The structure followed consists of shearing in altered granite-gneiss, and schistose facies of this granite-gneiss complex developed along the shear zone. Varying amounts of hydrothermal alteration and gouge is present. In the livelier portion of the shear zone, sericitization is more abundant and quartz lenses are more numerous.

In brief, the first 750 ft. north of the first dike and the last 112 ft. of Project A present the liveliest structure present in this Project. The area between these points is generally much tighter and lacks evidence of much hydrothermal alteration and therefore less chance for ore occurence.

Docket No. DMEA 4216
Contract No. E-1032

FINAL REPORT - PROJECT A

Narrative Summary of Work

Crosscutting in Project A was started on November 19, 1956, on a bearing of N 80 E through a diabase dike. This dike is about 130 ft. thick in the crosscut.

About 25 ft. east of the north dike contact a mineralized vein was encountered. At this point the vein is about 16 ft. wide. Drifting to the northeast on this vein followed but in about 25 ft. the lens pinched out. (Back-drifting to the southwest on this ore was not undertaken until December 1957. At that time, 55 ft. of drifting was done to the southwest. This advance opened up a mineable lens of ore about 90 ft. long. 9 chip samples on this ore lens averaged 8.6 ft. wide and assayed 0.49% WO_3. The ore is cut off very abruptly by the dike on the south west end.)

Drifting the northeast was continued until the vein and structure pinched out. When the drift was at point about 30 ft. NE of survey station 1385, two diamond drill holes U1241 and U1242 were drilled into the hanging wall and indicated good structure and mineralization. As a result of this drilling, a crosscut to the east was started and encountered four distinct mineralized zones each 1 to 2 ft. wide. Drifting to the northeast was undertaken on the last zone but it pinched out within a few feet. Two additional diamond drill holes U1252 and U1254 were drilled to test the walls. U1254 in the hanging wall did not encounter any mineralization. U1252 cut 1-1/2 ft. of vein from 6 to 7-1/2 ft. in the footwall. Drifting was resumed on a bearing of about N 30 E and intercepted the vein which was cut in drill hole U1252. The vein varied in width from 6 inches to 2 feet and had some fair but spotty mineralization. This vein is located near survey station 1407 and was drifted upon for a length of about 45 ft. The next 135 ft. was on tight structure with little quartz. The following 370 ft. of drift was on very lively structure with small and scattered lenses of mineralized vein usually 1 to 3 ft. wide. These lenses, lying between survey stations 1418 and 1439 are not of mineable size or grade at this level. However it is quite possible that either above or below the level anyone of these might open up into a mineable ore body. They could represent either the top or bottom of mineable ore bodies. Further exploratory work in the form of raises and/or winzes is justified to determine this possibility. In the area described above three additional drill holes were drilled to test the walls, indicating the presence of other structures, but no mineralization to speak of.

The next 500 ft. was on tight structure to a point near survey station 1466 where a second diabase dike was encountered. Two additional drill holes were drilled in this area to test the walls but nothing of interest was shown up. The heading then was turned further to the northeast to crosscut the dike, which is about 55 ft. wide in the crosscut.

A structure was located about 20 ft. beyond the dike but the crosscut was continued into the hanging wall to eliminate the possibility of another structure, since surface drilling indicated two definite mineralized structures. Since no favorable structure was located drifting to the northeast was resumed on the structure first encountered.

A small amount of mineralization in a narrow vein 1 to 1-1/2 ft. wide was present for a few feet but this pinched out and the structure also tightned up until a third diabase dike was encountered near survey station 1476. Four drill holes were drilled in the area between these two dikes but failed to indicate anything note worthy except the presence and location of the two dikes.

The dike was crosscut on a bearing of about N 56 E and is about 140 ft. wide in the crosscut. At a point about 30 ft. beyond the dike a fairly lively structure was intersected. The structure consists of one, sometimes two or more narrow veins, which pinch and widen, but usually are under 1 ft. wide. Some mineralization is present. This structure has been drifted upon for a length of about 112 ft. to the end of the Project. At a point about 8 ft. back from the present face one of these narrow veins widened out to about 4 ft. but it pinched out rapidly. This structure looks favorable for ore and additional drifting to the northeast is certainly in order.

Two drill holes were drilled near the present face, U1316 was drilled into the hanging wall. U1317 was drilled into the footwall. No promising structure or veins were intersected. Drill hole U1317 was in diorite dike from a depth of 40 ft. to the end of the hole at 108 ft. The following tabulations show the units of each type of work performed in Project A in chronological sequence, as well as a summary of the costs involved.

Docket No. DMEA No. 4216
Contract No. E-1032

SUMMARY OF PROGRESS FOR PROJECT A

	Drifts (Bare) Ft.	Drifts Timbered Ft.	X-Cuts Bare Ft.	X-Cuts Timbered Ft.	Timber Ft.	Diamond Drilling Ft.	Assays No.	Ore Production Wet Tons	Grade % WO_3
November 1956			16	18	18				
December 1956			5	50	50				
January 1957	23		31	40	40		1	154	0.32
February 1957	114		54			190	2	68	0.14
March 1957	148					210			
April 1957	182		-5*	+5	5	-	-		
May 1957	82	70	-	-	70	269	-	49	0.57
June 1957	85								
July 1957	177						2		
August 1957	32	85			85				
September 1957	155								
October 1957	84		11			269			
November 1957	20		23	75	75				
December 1957	151					45	5	241	0.22
January 1958	136					348	1	12	0.41
February 1958	60 +59 *	+59	66* -66	+66		70			
March 1958			20	14	139				
April 1958	22		69				1		
May 1958	82					45	1	28	0.07
June 1958						171			
Totals	1494	214	224	268	482	1617 (16 holes)	13	552	0.27%

*Reported as untimbered, later partially or all timbered as indicated by negative numbers

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TOTAL EXPLORATION AND COST, PROJECT A

Drifting, bare @ $35.00	1494 ft.	$52,290.00
Drifting, timbered @ $32.40	214 ft.	6,933.60
Crosscutting, bare, @ $35.00	224 ft.	7,840.00
Crosscutting, timbered, @ $32.40	268 ft.	8,683.20
Timbering @ $6.00	482 ft.	2,892.00
Diamond Drilling @ $1.65	1617 ft.	2,668.05
Number of Assays @ $3.00	13	39.00
		$81,345.85

ORE RESERVES ** PROJECT A

There is only one lens in Project A for which Ore Reserves may be calculated. This is the first vein cut north of the first dike in the Project:

This lens is 90 ft. long. Average width and grade is based on sampling. The width is 8.6 ft. The grade is 0.49% WO_3.

Reserves are calculated on the same basis as are the reserves for the remainder of the mine. The first 25 ft. above the level and the first 25 ft. below the level is classed as Proven Ore. The next 25 ft. in both directions, is classed as Probable Ore. Tonnage factor is 12 cu. ft. per ton of ore.

On this basis the Ore Reserve is:

3226 tons Proven @	0.49% WO_3
3226 tons Probable @	0.49% WO_3
6452 tons Total @	0.49% WO_3

Half of this ore is above the 900 Level and half is below the 900 Level.

Docket No. DMEA 4216
Contract No. E-1032

FINAL REPORT - PROJECT B

Evaluation of Project B

1300 lineal feet of drifting and crosscutting and 1041 ft. of diamond drilling were expended in Project B, and 40 lineal feet of timber was installed. Two small ore lenses were discovered. The total ore reserve calculated is 6408 tons at 0.51% WO_3. Tonnage mined as a result of this exploration work is 441 tons at 0.61% WO_3.

Generally speaking, the results did not live up to our expectations. However the presence of ore in the vicinity of station 1419 is encouraging in view of the fact that on the 500 Level in this same general area we do have some good ore, although narrow. Thus there is a vertical height of approximately 400 ft. in which additional ore may occur. Also on the 1100 Level there is one diamond drill hole which indicates mineralized vein about 150 ft. northeast of the ore occurence on the 900 Level in Project B.

Thus we have ore 400 ft. vertically above this point and mineralization 200 ft. below and northeast of this point.

Potentially, a fair tonnage of ore may be present, but this will have to be shown by further exploratory work in the form of raising and winzing.

The second ore lens (stations 1440 and 1462) at this stage is difficult to evaluate. Its persistence up dip and down dip is unknown. Additional exploratory work in the form of raising and winzing is indicated. However the presence of good mineralization is encouraging, and there is a good possibility of a fair sized ore body on the northeast - southwest segment of this ore lens.

Two other geological possibilities are present:

1. The shear indicated on the mapping between survey stations 1420 and 1429 should encounter the granite-schist contact about 300 ft. west of its position at station 1429. This shear is a relatively strong shear and does contain quartz with traces of mineralization. The point where this shear intersects the granite-schist contact may be a likely location for an ore body. One drill hole U1318 failed to indicate anything of interest, but additional drilling is justified.

2. The continuation of the No. 3 Vein structure to the southwest still offers promise especially where the shear would encounter the granite-schist contact.

   On the 100 Scale Map the relationship of Morton Estate No. 3 Vein, Morton Estate No. 2 Vein, and No.3 Vein in Project B is interesting in that they seem to align themselves quite well. This possibility will certainly be explored at a later date.

General Geology of Project B

Exploration in Project B was performed on the southward extension of the No. 3 Vein shear Zone. This shear zone diverges to the southwest from the No. 2 Vein zone, but is considerably shorter. The average strike is about N 50 E, with a dip of about 70 degrees to the southeast.

The No. 3 Vein shear zone is not as strong as the Main Shear Zone (No. 2 Vein Shear Zone). It has however been productive from the surface to the 900 Level. Practically all of this production came from areas developed north of the main shaft crosscuts.

On only one level (the 500) has any exploratory work been performed south of the shaft crosscuts. On the 500 Level, 200 ft. of narrow vein has been opened up, with ore still present in the south face.

The entire Project remained in the granite-gneiss complex. The shear zone is fairly strong for the first 350 ft. of drifting in the Project, consisting of numerous lenses of quartz along with some sericitization and evidence of shearing. The strike is about S 40 W and dip about 70° to the southeast.

Beyond this point, the structure has not been definitely identified, although several segments may have been opened up by later drifting, in the vicinity of survey station 1430, and between survey stations 1447 and 1458. The shear zone evidently weakens and is difficult to identify in the drifts and diamond-drill holes. There is a possibility the structure may yet be in the footwall of the drifts. Further drilling is justified to determine this. The importance of diamond drilling is shown by the discovery of the small ore lense in the vicinity of survey station 1440 where the junction of two zones resulted in a small ore body.

Docket No. DMEA 4216
Contract No. E-1032

Final Report - Project B

Narrative Summary of Work

Crosscutting westward to No. 3 Vein was started on December 1, 1956. At a point about 38 ft. from the starting point a narrow vein was encountered. The crosscut was continued to the expected location of No. 3 Vein but no structure was located. It then became apparent that the vein previously cut was No. 3 Vein and that the No. 3 Vein structure had made a rather sudden change in strike. Drifting was then started on this narrow vein to the southwest on this structure for about 380 ft. encountering sporadic mineralization. One short lens of ore about 45 ft. long immediately north of survey station 1419 was opened up. Four samples on this lens of ore averaged 5.2 ft. wide and assayed 0.63% WO_3.

During the month of March 1957, 165 wet tons of ore was produced from this lens. Grab samples of this ore assayed 0.39% WO_3.

At a point 20 ft. north of survey station 1420 an intersecting structure was encountered. This was a comparatively strong structure and was followed westward to survey station 1429 at which point it became evident that this was not No. 3 Vein.

Two drill holes U1269 and U1270 indicated the presence of No. 3 Vein structure in the hanging wall. A crosscut was driven on the line of Drill Hole U1269 and encountered two narrow veins, one at the location of survey point 1434 and one at the location of survey point 1430.

The latter appeared to have the proper strike and dip for No. 3 Vein and drifting was started to the southwest on this narrow vein. However within a few feet this vein and structure pinched out completely.

A few crosscut rounds were taken in the vicinity of survey station TP 26 to explore scattered narrow veins in this area, but none proved to be very promising.

The drift was continued on the general strike of No. 3 Vein while two drill holes U1283 and U1284 were drilled to test the foot wall area.

Drill Hole U1283 encountered vein from 22-1/2 ft. to 48 ft.:

Assays as follows:

22-1/2'-30'	0.36% WO_3
30' - 40'	NIL
40' - 48'	0.75% WO_3

Drill Hole U-1284 encountered vein from 17 ft. to 20 ft.

Assay:

17' - 20'	0.02% WO_3

As a result of this drilling it was decided to drop back to survey point 1434 and drift westward on the first of the two veins cut in the crosscut. This work opened up some ore in a narrow vein striking approximately eastwest and dipping at about 50 degrees to the south. This vein junctioned with another vein striking about N 25 E and dipping to the southeast at about 75 degrees.

The first vein mentioned above is mineralized for a length of about 73 ft; the latter for about 45 ft.

As a result of the development work in this area 276 net tons of ore were produced. Grab samples of this ore assayed 0.74% WO3. This production came in July, August, and November of 1957.

Five samples taken on the narrow westerly vein averaged 3.2 ft. wide and assayed 0.46% WO3. Four samples on the N 25 E vein averaged 6.8 ft. wide and assayed 0.46% WO3.

While this work was in progress two drill holes U1289 and U 1290 were drilled from the main drift into the hanging wall. These failed to indicate any structures.

When the major portion of the work in this area (described above) was completed, the drift to the southwest was continued again and soon encountered a small diabase dike. When this dike was crosscut, the drift was turned to the west and another structure was encountered at the location of survey station 1447.

One sample taken here across a width of 2.4 ft. assayed 0.05% WO3.

Drifting was then undertaken to the southwest on this structure, but the structure tightened up almost immediately. This drift on this structure accounted for about 183 ft. of advance.

When very little quartz remained, two holes U1296 and U1297, were drilled into the footwall, Each encountered narrow veins with some mineralization.

A crosscut was driven to this structure and about 30 ft. of drifting to the southwest followed. This structure showed a few inches of quartz with traces of mineralization.

Inasmuch as only a few feet of the alloted 1300 ft. for this Project remained, the last few rounds of advance were taken in the "room area" in the vicinity of survey station 1462. Advance was both to the northeast and to the southwest. The vein to the southwest pinched rapidly. The advance to the northeast exposed some scattered mineralized quarts.

One additional drill hole U1298 was drilled at +33 degrees to test the N25°E structure above the level indicating 1-1/2 ft. vein which assayed 1.35% WO3.

Drifting and crosscutting advance was completed in Project B on November 26, 1957.

In June 1958, one drill hole (U1318) was drilled to check the intersection of the structure which is in the drift between survey stations 1429 and 1420, and the schist contact. No encouraging results were obtained. Drilling was completed on June 16, 1958 which marked the completion of all DMEA work under the Contract.

The following tabulations show the units of each type of work performed in Project B in chronological sequence as well as a summary of the costs involved.

Docket No. DMEA No. 4216
Contract No. E-1032

SUMMARY OF PROGRESS FOR PROJECT B

	Drifts (Bare) Ft.	Drifts Timbered Ft.	X-Cuts Bare Ft.	X-Cuts Timbered Ft.	Timber Ft.	Diamond Drilling Ft.	Assays No.	Ore Production Wet Tons	Grade % WO_3
November 1956	-	-	-	-	-	-	-	-	-
December 1956	42	-	80	-	-	-	-	-	-
January 1957	137	-	-	-	-	-	-	-	-
February 1957	36	-	-	-	-	-	-	-	-
March 1957	126	-	-	-	-	-	4	165	0.39
April 1957	135	-	19	-	-	189	-	-	-
May 1957	102	-	85	-	-	-	-	-	-
June 1957	42	-	-	-	-	162	4	-	-
July 1957	120	20	-	-	20	149	9	264	0.75
August 1957	141	15	-	-	15	-	-	3	0.75
September 1957	51	5	6	-	5	312	1	-	-
October 1957	53	-	-	-	-	-	1	9	0.35
November 1957	-	-	-	-	-	-	-	-	-
December 1957	-	-	-	-	-	-	-	-	-
January 1958	-	-	-	-	-	-	-	-	-
February 1958	-	-	-	-	-	-	-	-	-
March 1958	-	-	-	-	-	-	-	-	-
April 1958	-	-	-	-	-	-	-	-	-
May 1958	-	-	-	-	-	-	-	-	-
June 1958	-	-	-	-	-	229	-	-	-
TOTAL	1015	40	245	-	40	1041 (10 holes)	19*	441	0.61%

* 5 Drill Hole Assays
14 Chip Sample Assays

TOTAL EXPLORATION AND COST, PROJECT B

Drifting, bare @ $35.00	1015 ft.	$35,525.00
Drifting, timbered @ $32.40	40 ft.	1,296.00
Crosscutting, bare @ $35.00	245 ft.	8,575.00
Crosscutting, timbered @ $32.40	--	--
Timbering @ $6.00	40 ft.	240.00
Diamond Drilling @ $1.65	1041 ft.	1,717.65
Number of Assays @ $3.00	19	57.00
	Total	$47,410.65

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Contract No. E-1032

Ore Reserves Project B

There are two areas in which ore reserves may be calculated.

One of these is the ore in the vicinity of survey station 1419. (Lens No.1)

The other is in the area in the vicinity of survey stations 1440 and 1462. (Lens No. 2)

The reserves are calculated in the same manner that reserves are figured for the rest of the mine. Normally the first 25 ft. above and below the level are classed as Proven Ore. The next 25 ft. above and below are classed as Probable Ore. Since no raising, winzing, or diamond drilling was done on any of these ore lenses, no additional ore above or below the 50 ft. mark is included.

The tonnage factor used for ore in place is 12.00 cu. ft. per ton.

Grades are based on cut samples taken and given as per cent WO_3.

Following is a Summary of Calculated Ore Reserves in Project B:

	Tons, Proven	Tons, Probable	Tons, Total	Grade, %WO_3
Lens No. 1	874	874	1748	0.63%
Lens No. 2	2330	2330	4660	0.46%
Total	3204	3204	6408	0.51%

The total reserves in Project B are thus:

3204 tons	Proven	@	0.51% WO_3
3204 tons	Probable	@	0.51% WO_3
6408 tons	Total	@	0.51% WO_3

Due to the method of calculation 50% of this ore is above the 900 Level and 50% is below the 900 Level.

Lens No. 1 is in the vicinity of survey station 1419
Lens No. 2 is in the "Room area" in the vicinity of survey station 1440

Docket No. DMEA 4216
Contract E-1032

Evaluation of Project C

1199 lineal feet of drifting and crosscutting, and 487 ft. of diamond drilling were expended in Project C. 59 lineal feet of timber was installed.

One lens of mineralized vein about 166 ft. long was opened up. This vein varies in width from 1 ft. to 3-1/2 ft., the average being about 2.4 ft. Mineralization in this vein is very irregular and spotty. Five cut samples taken averaged 0.46% for an average width of 1.9 ft. Tonnage mined as a result of this exploration work amounted to 157 wet tons at 0.27% WO_3.

No Ore Reserve Tonnage can be calculated in this Project.

The results of the exploration in this Project were very discouraging, especially so after the first 500 ft. of drift had been driven. Up to that point the structure was quite strong and contained vein quartz for much of this distance, approximately 200 ft. of which contained some mineralization. However, beyond this point the structure is very tight and unimpressive.

It appears that any hope for ore is largely centered in the first 200 ft. of drift in the Project, either upwards or downwards. Additional exploration work in the form of raising and winzing is necessary to more fully evaluate this prospect. It is certainly quite possible that the drift may be either at the top or the bottom of an ore lens. This remains to be determined by further exploratory work.

General Geology of Project C

Exploration in Project C was performed on No. 28 Vein. No. 28 Vein was encountered in sinking the Sneed Shaft at about the 1320 ft. level. Subsequently a small amount of exploratory work was done on this vein on the 900, 1100, 1300 and 1500 Levels in the immediate shaft area. This proved the vertical continuity of the vein, but little was known about the continuity or character of this vein along its strike. Project C was designed to determine this.

The Project originated on the 900 Level on a very narrow vein in the schist. Within approximately 10 ft., the drift crossed from the schist into the granite-gneiss complex and remained in it to the end. The granite schist contact strikes about N20E and dips at about 80° to the south.

The vein widened out almost immediately and attained a true thickness of approximately 2 to 2-1/2 ft. The strike of the vein is about N33E. The dip is rather flat at about 50° to the south. The first 190 ft. of the Project is on mineralized vein. The next 250 ft. is also on narrow vein but very little mineralization is present. The following 100 ft. was on a fairly strong shear with little or no quartz.

In the area in the vicinity of the lamprophyre dike near survey station 1421, the shear zone split up into several weak branches and there after no strong shear was encountered.

A short crosscut was driven into the footwall in order to pick up this shearing, but failed to encounter it. Drifting was pursued on a rather weak structure and when this feathered out a longer crosscut was driven to the projected location of the main shear in the footwall. A very tight structure with a few inches of quartz was drifted upon to the completion of the Project.

Several pre-mineral lamprophyre dikes were encountered in this Project.

Docket No. DMEA 4216
Contract No. E-1032

Final Report - Project C

Narrative Summary of Work

Drifting was started on December 3, 1956 in Project C. The first 25 ft. of this drift was on tight structure with traces of mineralization, but very little vein. At this point a narrow vein was encountered. For the next 166 ft. or so drifting was on vein varying in width from 1 ft. to 3-1/2 ft. wide, averaging about 2.4 ft. wide. Mineralization was very irregular and spotty.

Five cut samples taken averaged 1.9 ft. wide (true width) and assayed 0.46% WO_3.

As a result of the drifting on this vein 157 tons of ore were produced. Grab samples of this ore assayed 0.27% WO_3.

At a point about 26 ft. northeast of survey station 1380, a small diabase dike about 2 ft. wide was encountered. For practical purposes the mineralization ended at this point. For approximately the next 250 ft. northeast of the dike drifting was continued on a narrow vein 1 to 2 ft. wide. This section of the vein does not appear very lively and no mineralization is present.

At a location about 20 ft. northeast of survey station 1398 the vein pinched out but the shear continued fairly strong, requiring timber to support the slabby back. About 25 ft. northeast of survey station 1409 a lamprophyre dike came into the drift on the east side. The drift cut across this dike and picked up a shear on the north side of the dike; however this shear did not appear very lively, and diamond drilling was undertaken to test both walls. Drill hole U1265 was drilled into the footwall and drill holes U1264, U1266, and U1267 were drilled into the hanging wall. The only possible shear indicated by this drilling which might correlate with the vein previously drifted upon was in the footwall. A short crosscut was driven into the footwall crosscutting the dike but this failed to indicate any structure.

Drifting was again resumed on the general strike of the vein, about N30E, on a tight structure (from survey station 1436 to the northeast). This structure pinched out and two drill holes, U1292 and U1293 were drilled to test both walls. Shearing was indicated in both holes, but no well defined veins were cut.

At this time it was deemed advisable to further advance the short crosscut previously driven to the northwest in the vicinity of survey station 1436. Although some shearing was exposed, none tied in with the expected strike and dip of the structure, except one very tight seam in the granite.

Inasmuch as all indications were that the structure should be to the northwest of the drift face (in the area of survey station 1448), a cross cut was started on the line of Drill Hole U1292 to the northwest. This crosscut exposed only one narrow vein which correlated fairly well with the strike and dip expected of No. 28 Vein.

Drifting on this structure was undertaken to the northeast (from survey station 1453). The advance, about 193 ft. was on a narrow vein 3 to 6 inches wide to a point where 1199 ft. of the contracted 1200 ft. had been completed.

Work was terminated at this point on October 10, 1957.

The following tabulation shows the units of each type of work performed in Project C in chronological sequence, as well as a summary of the cost involved.

Docket No. DMEA 4216
Contract No. E-1032

SUMMARY OF PROGRESS FOR PROJECT C

	Drifts (bare) Ft.	Drifts Timbered Ft.	X-Cuts Bare Ft.	X-Cuts Timbered Ft.	Timber Ft.	Diamond Drilling Ft.	Assays No.	Ore Production Wet Tons	Grade % WO_3
November 1956	-	-	-	-	-	-	-	-	-
December 1956	191	-	-	-	-	-	-	140	0.27
January 1957	186	-	-	-	-	-	-	17	0.27
February 1957	127	-	-	-	-	-	-	-	-
March 1957	24	59	-	-	59	-	-	-	-
April 1957	58	-	-	-	-	200	-	-	-
May 1957	14	-	43	-	-	30	-	-	-
June 1957	43	-	-	-	-	-	-	-	-
July 1957	89	-	26	-	-	257	-	-	-
August 1957	-	-	142	-	-	-	-	-	-
September 1957	134	-	-	-	-	-	5	-	-
October 1957	63	-	-	-	-	-	-	-	-
November 1957	-	-	-	-	-	-	-	-	-
December 1957	-	-	-	-	-	-	-	-	-
January 1958	-	-	-	-	-	-	-	-	-
February 1958	-	-	-	-	-	-	-	-	-
March 1958	-	-	-	-	-	-	-	-	-
April 1958	-	-	-	-	-	-	-	-	-
May 1958	-	-	-	-	-	-	-	-	-
June 1958	-	-	-	-	-	-	-	-	-
Totals	929	59	211	-	59	487 (6 holes)	5	157	0.27

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TOTAL EXPLORATION AND COST — PROJECT C

Drifting, Bare	@	$35.00	929 ft.	$ 32,515.00
Drifting, Timbered	@	$32.40	59 ft.	1,911.60
Crosscutting, Bare	@	$35.00	211 ft.	7,385.00
Crosscutting, Timbered	@	$32.40	--	--
Timbering	@	$ 6.00	59 ft.	354.00
Diamond Drilling	@	$ 1.65	487 ft.	803.55
Number of Assays	@	$ 3.00	5	15.00
				$ 42,984.15

Ore Reserves

No ore reserves in Project C are calculated.

Undoubtedly some ore will be obtained from future exploration work on the mineralized vein exposed in the first 190 ft. of drifting in this Project, but the vein is too narrow and too irregular in value to be classed as mineable ore or to permit calculation of any tonnage.

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Final Report - Project D

Evaluation of Project D

2000 ft. of drifting and crosscutting and 855 ft. of diamond drilling were expended in Project D.

293 lineal feet of timber was installed.

As a result of this exploration work, 1427 tons of ore were mined at an average assay of 0.74% WO3. An ore estimate of 15,132 tons @ 0.85% WO3 has been calculated for ore encountered in this Project.

Based on the limited amount of exploratory work performed in the vein area, these results are good. They do not however, accurately reflect the true potential of this ore discovery. It should be noted that of the 2000 lineal ft. of drifts and crosscuts, 793 ft. was drifting and 1207 ft. was crosscutting. For practical purposes, the entire 793 ft. of drifting was on mineralized vein. There are present six major lenses occuring en echelon. Two of these lenses are quite likely of mineable grade and size. The other lenses may be mineable in part, depending upon results of further exploratory work. In the ore estimate for this Project, some tonnage has been calculated for each of the six major lenses in the main vein system. Some of these are of marginal widths and some of marginal grade. It can readily be seen that these conditions may be due to the fact that the drift encountered the top or bottom of an ore lens and that grade and width may improve either up-dip or down-dip. These conditions have been encountered in other parts of the mine. Additional exploratory work in the form of raises and winzes might well disclose additional ore.

It should also be noted that the southwest face of the drift is still in very lively looking structure with some fair mineralization. The northeast face still shows some mineralization although the structure is somewhat tighter, perhaps locally. Both are regarded as having possibilities of encountering additional ore.

Surface drilling performed by the company several years ago indicates some ore over a strike length of about 500 ft. The lowest intersection (in elevation) is about 540 ft. above Project D. The surface is about 900 ft. above Project D. The ore potential between the 900 Level and the surface is sizeable; however on the basis of present drilling and exploratory work it is almost impossible to calculate with any degree of certainty, the ore in this block. Also the ore potential below the 900 Level is sizeable, especially since the lowest working level in the mine is 600 ft. below Project D at the 1500 Level.

Other veins in the schist have shown a marked degree of persistence in depth. It is quite likely that this is also true of the Morton Estate No. 3 Vein.

The ore estimate plus ore mined as a result of work in Project D amounts to 16,559 tons. This covers a maximum height of 100 ft. in the estimate.

Further exploratory work on the level is justified by additional drifting in both directions.

To the northeast, Morton Estate No. 2 Vein, 900 ft. distant, shows some mineralizations on the surface. The possibility of ore between the present northeast face of Project D and Morton Estate No. 2 Vein must be considered. Also as mentioned in the Project B report, the remaining area between Project D and Project B should

be explored.

The southwest face of Project D is still in very lively structure with mineralization and further drifting to the southwest is warranted. Surface mineralization continues 300 ft. south of the south face in the Project D.

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General Geology of Project D

Exploration work in Project D consisted of a crosscut approximately 1200 ft. long to the Morton Estate No. 3 Vein on the 900 Level.

The Morton Extate No. 3 Vein is known on the surface by several scattered outcrops about 1200 ft. northwest of the Sneed Shaft. Surface drilling under this outcrop indicated good mineralization. Vein widths varied considerably from 3 to 40 ft.

No underground work or surface work (other than trenching) has been done on this vein previously.

The Morton Extate No. 3 Vein is entirely within the chlorite schist area west of the main shear zone (No. 2 Vein) which is in the granite-gneiss complex.

The crosscut on a bearing of N65W was started in chlorite schist, considerably baked by the large diabase dike. Within 10 ft., the diabase dike was encountered. This dike proved to be about 200 ft. thick. The crosscut was continued in chlorite schist to the vein intersection. For about 90 ft. northwest of the dike the schist was baked and contained a few seams of dike.

Several narrow barren quartz veins which contained mica on the outer borders of the veins were intersected but none contained any tungsten mineralization. Several shear zones were also encountered, but these do no appear to be of any importance, although they should be tested by drilling.

The chlorite schist is generally dark colored, rather massive in areas and foliated in others. Epidote is quite common. The attitude of the foliation is about N10E, dip about 70 degrees to the northwest.

The first mineralization was encountered about 50 ft. southeast of the main vein where a small amount of drifting indicated the presence of a narrow vein striking about S70 W and dipping at 74 degrees to southeast.

The main vein was encountered in the crosscut and subsequent drifting to the southwest and to the northeast opened up six major lenses of ore. These lenses occur en echelon and cover a strike length of about 740 ft. Practically all of this length contains mineralization.

Vein widths vary from a few inches up to 9-1/2 ft.

The general strike is about N40E and the dip is about 82 degrees to the northwest.

Both the south face and the north face still contain mineralization and offer excellent opportunities for further exploration.

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Final Report - Project D

Narrative Summary Work

Crosscutting in Project D was started on November 26, 1956 on a bearing of N65W toward the Morton Estate No. 3 Vein.

The first seven feet of crosscut were in chloritic schist. The next 200 ft. were in diabase dike which had to be timbered.

For the next 895 ft. to the vicinity of survey station 1455, the crosscut was in schist. This is chlortie schist with varying amounts of epidote. Adjacent to the dike the schist was considerably baked and contained seams of dike for a distance of about 90 ft.

Three fairly lively shears were encountered in the 895 ft. of crosscut mentioned above, but no mineralization was present. These are located as follows:

A - 108 ft.	northwest	of survey	station	1437
B - 177 ft.	"	"	"	1437
C - 25 ft.	"	"	"	1449

At a point about 87 ft. northwest of survey station 1449, a rather lively structure was encountered. Branching off from this structure to the southwest was a narrow quartz vein with some fair mineralization. This mineralization was drifted upon to the southwest for a distance of about 52 ft. The vein varied in width from a few inches to about 2-1/2 or 3 ft. Two samples were taken on this vein and assayed 0.03% WO3 for a width of 2.7 ft. and 0.07% WO3 for a width of 2.5 ft.

Inasmuch as this vein did not appear to improve in width and grade, the crosscut was again advanced and at a point about 53 ft. northwest of survey station 1455, a well mineralized vein about 9 ft. wide was encountered. This vein and structure was crosscut and drifting to the southwest was started.

At various intervals drifting was performed both to the southwest and to the northwest on this structure. The advance in the south drift amounted to 579 ft. of drift and 6 ft. of crosscut. In the north drift, the advance was 162 ft. of drift and 5 ft. of crosscut. The structure has an average strike of S40°E, and dips at about 82 degrees to the northwest.

As a result of this drift work, 1427 wet tons of ore were produced. Grab samples of this ore assayed 0.74% WO3.

Of academic interest only, it should be mentioned that molybdenite mineralization is present in this area, usually in very narrow veins striking a few degrees off the general strike of the main vein. Two samples assayed for Molybdenum ran 0.19% Mo and 0.10% Mo.

Following is a tabulation of assay results for the several lenses, starting at the one furthest north and going southward to the face of the southwest drift:

Lens	Number of Samples	Average Width	Length Represented by Sample	Grade % WO_3
No. 1	3	4.8	20 ft.	0.88%
No. 2	14	6.9	120 ft.	1.08%
No. 3	15	2.9	138 ft.	0.76%
No. 3A	2	2.7	7 ft.	1.27%
No. 4	7	7.9	60 ft.	0.72%
No. 5	12	3.0	120 ft.	0.42%
No. 6	7	4.5	60 ft.	0.36%

The above results indicate that Lens No. 2 and Lens No. 4 are of mineable grade and width.

Lens No. 1 is of good grade but is only 20 ft. long.

Lens No. 3 is of good grade and length but the average width is low. It is interesting to note that a portion of this vein is occupied by a diabase dike averaging about 1 ft. wide. A section of this lens may be mineable.

Lens No. 3A is not of any importance being very short and narrow.

Lens No. 5 is narrow and grade is rather low; however the southern end of this lens may be mineable.

Lens No. 6 is of mineable width but the indicated grade is low.

Seven diamond drill holes were drilled in Project D. Four of these were drilled into the hanging wall of three into the footwall. No mineralized veins were encountered.

293 lineal feet of timbering was installed, most of this was in and adjacent to the main dike near the start of the Project.

The following tabulations show the units of each type of work performed in Project D in chronological sequence, as well as a summary of the costs involved:

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SUMMARY OF PROGRESS FOR PROJECT D

	Drifts (Bare) Ft.	Drifts Timbered Ft.	X-Cuts Bare Ft.	X-Cuts Timbered Ft.	Timber Ft.	Diamond Drilling Ft.	Assays No.	Ore Production Wet Tons	Grade % WO_3
November 1956	-	-	43 -8 *	+8	-	-	-	-	-
December 1956	-	-	13 -13 *	+13	-	-	-	-	-
January 1957	-	-	54 -54 *	+54	-	-	-	-	-
February 1957	-	-	20	61	136	-	-	-	-
March 1957	-	-	73	40	40	-	-	-	-
April 1957	-	-	56	87	87	-	-	-	-
May 1957	-	-	219	-	-	-	-	-	-
June 1957	-	-	100	-	-	-	-	-	-
July 1957	-	-	186	-	-	-	-	-	-
August 1957	-	-	172	-	-	-	-	-	-
September 1957	70	-	42	30	30	-	4	107	1.34
October 1957	209	-	5	-	-	-	18	594	0.81
November 1957	181	-	6	-	-	269	16	283	0.85
December 1957	158	-	-	-	-	375	16	277	0.55
January 1958	175	-	-	-	-	160	11	166	0.25
February 1958	-	-	-	-	-	51	-	-	-
March 1958	-	-	-	-	-	-	-	-	-
April 1958	-	-	-	-	-	-	-	-	-
May 1958	-	-	-	-	-	-	-	-	-
June 1958	-	-	-	-	-	-	-	-	-
Totals	793	-	914	293	293	855 (7holes)	65	1427	0.74 %

* Reported as untimbered, later partially or all timbered as indicated by the negative numbers.

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TOTAL EXPLORATION AND COST, PROJECT D

Drifting, bare @ $35.00	793 ft.	$27,755.00
Drifting, timbered @ $32.40	--	--
Crosscutting, bare @ $35.00	914 ft.	31,990.00
Crosscutting, timbered @ $32.40	293 ft.	9,493.20
Timbering @ $6.00	293 ft.	1,758.00
Diamond Drilling @ $1.65	855 ft.	1,410.75
Number of Assays @ $3.00	65	195.00
		$72,601.95

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Ore Reserves - Project D.

There were six major lenses opened up in the drifting on the vein structure in Project D. On the basis of sampling and indicated widths, two of these are of mineable grade and size.

Referring to the maps, these are lenses No. 2 and No. 4.

Ore reserves are calculated for these two lenses on the same basis that reserves are calculated for the rest of the mine. "Proven Ore" is calculated 25 ft. above and below the level. "Probable Ore" is calculated for the next 25 ft. above and below the level; a total of 50 ft. above, and 50 ft. below the level.

Some ore reserves are also estimated for the other lenses; however due to the small widths or the relatively poorer grades indicated, the reserves are calculated only to a total height of 25 ft. above and 25 ft. below the level. The first 12-1/2 ft. is taken as Proven Ore; the next 12-1/2 ft. as Probable Ore. This also is in line with our normal method of calculating reserves at this mine.

Widths and assays used are based on the samples taken.

Following is a summary of Calculated Ore Reserves for Project D:

	Tons, Proven	Tons, Probable	Tons, Total	Grade, %WO_3
Lens No. 1	200	200	400	0.88%
Lens No. 2	3450	3450	6900	1.08%
Lens No. 3 (Part of)	688	688	1376	0.84%
Lens No. 4	2140	2140	4280	0.72%
Lens No. 5 (Part of)	526	526	1052	0.40%
Lens No. 6	562	562	1124	0.36%
Total	7,566	7,566	15,132	0.85%

The total reserves in Project D are thus:

7566	tons Proven @	0.85% WO_3
7566	tons Probable @	0.85% WO_3
15132	tons Total @	0.85% WO_3

Due to the method of calculation 50% of this ore is above the 900 Level, and 50% is below the 900 Level.