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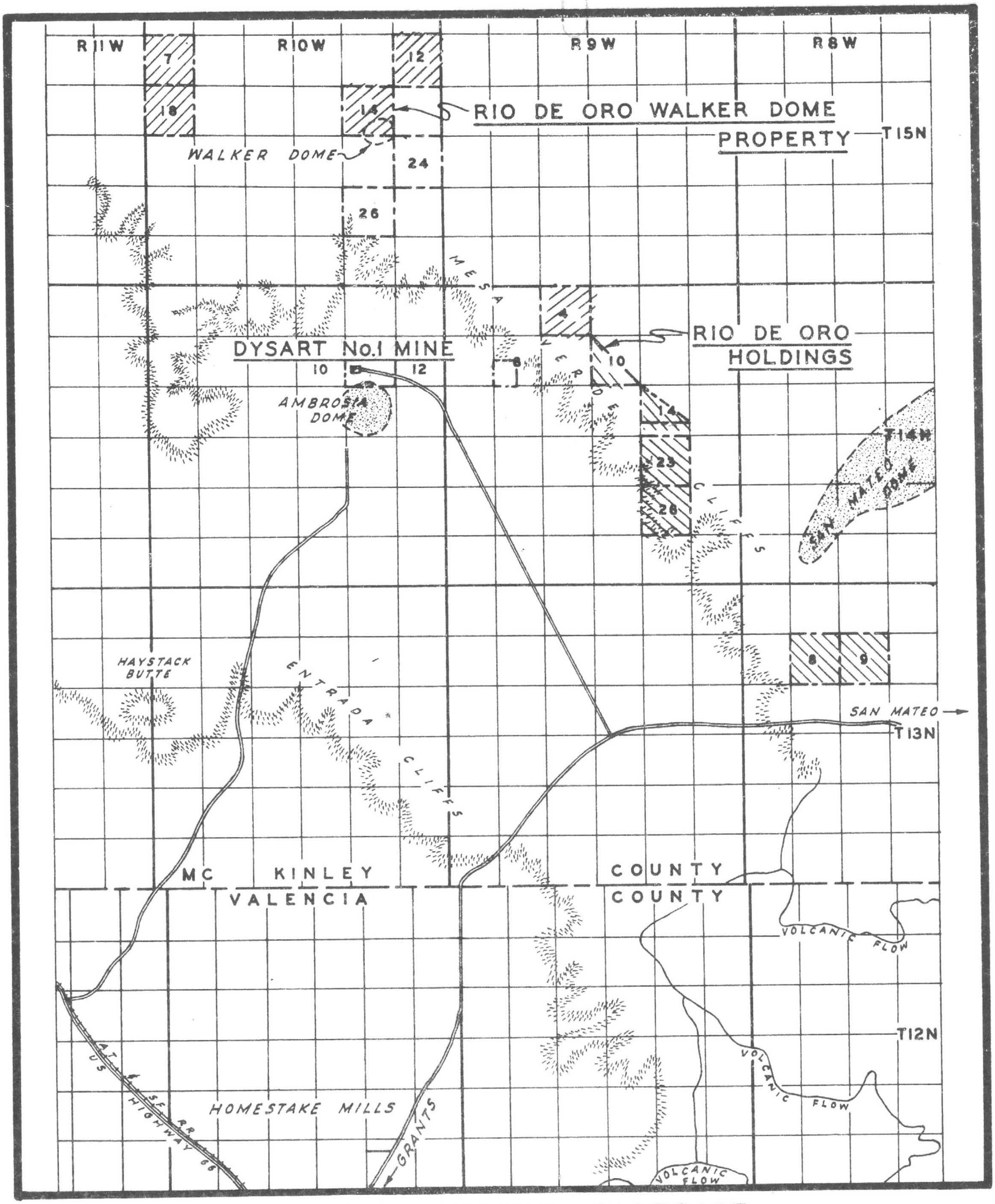
# EXPLORATION REVIEW

# RIO DE ORO URANIUM MINES, INC.

McKinley County, New Mexico

To September 1, 1957

Prepared for E. J. Longyear Company
October 10, 1957




# AMBROSIA MINING DISTRICT

MC KINLEY & VALENCIA Co.'S, NEW MEXICO

— LOCATION MAP —

FIGURE 1

MILES 0 1 2

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## SUMMARY

1. The report covers reserves and exploration possibilities in the holdings of Rio de Oro Uranium Mines, Inc., Ambrosia Mining District, McKinley County, New Mexico as of September 1, 1957. Uranium ore occurs as elongate, sometimes stringlike runs at several horizons within the Westwater Canyon member of the Jurassic Morrison formation. The ores lie from 300 to more than 1500 feet below the land surface. As hereinafter detailed, certain special and several usual exploration techniques, not all in use by Rio de Oro, could be applied to decrease the cost of exploration.

2. At Dysart Mine No. 1, section 11 (14N-10W) there has been shipped to A.E.C. or Homestake-New Mexico Partners, or stockpiled, a total of 63,380 tons averaging 0.233% $U_3O_8$. Indicated reserves in place before dilution and without regard to minability, total 664,640 tons grading 0.251% $U_3O_8$.

3. Low grade mineralization occurs peripheral to the known commercial ore in 5 distinct horizons. Total indicated low grade reserves are estimated as 162,390 tons grading 0.09% $U_3O_8$, without regard to minability or dilution. A substantial portion will be taken as dilution in mining Dysart ores.

4. Comparison or production by headings (April thru August 1957) with drill hole intercepts suggests a higher ore grade than indicated by drilling. Comparison of total area mined, tons produced and uranium yield with drill hole reserve estimates suggests a substantially greater mining yield. However, the basic data are inaccurate both as to weights and grade and these conclusions are thus only indicative. We believe, on balance, that reserves indicated by drilling will be found to be conservative for rock in place.

5. Section 11 offers attractive exploration targets as herein outlined.

6. Drilling on section 26 (14N-9W) outlines two overlapping ore runs that contain a total indicated reserve in place of 293,000 tons grading 0.295% $U_3O_8$, without regard to minability or dilution. The ore bodies lie 1200 feet or more below the land surface, and have no possible extensions within Rio holdings. Other targets of lesser interest present themselves in this section.

7. No mineralization has been found to date on other Rio holdings in the township (14N-9W) although 20 scattered holes have been drilled in 5 sections. These lands offer only wildcat exploration chances without good geologic guides.

8. Mineralization of commercial thickness and grade has been intercepted in a graben block on section 9 (13N-8W) but at depths in excess of 1500 feet. The area merits substantial drilling. We recommend further geologic work to assist in guiding exploration.

9. No work has been done on the Walker Dome holdings, T15N, R10W. We suggest a "unitized" project could profitably by set up here. Failing unitization, we recommend adherence to exploration techniques herein outlined.

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## Bound Into Report



## In Accompanying Folio

## SCOPE OF REPORT

1. This report covers certain work assigned to us by E. J. Longyear Company on the properties of Rio de Oro Uranium Mines, Inc. McKinley County, New Mexico, as follows:

a. Estimation of low grade reserves at the operating Dysart Mine No. 1, S½ section 11, T14N, R10W, NMPM.
b. Investigation of and recommendations for additional prospecting on that half section.
c. Study of drill results to date and recommendations for additional drilling on Section 26, T14N, R9W.
d. Review of drill results on other Rio holdings in the Ambrosia Lake District and recommendations for further exploration.

2. In order intelligently to accomplish these objectives, we found it necessary to restudy all the data available at Dysart Mine No. 1, to map this mine, and to prepare detailed plans and sections thereof. To determine what should be considered as low grade mineralization, it was necessary to study what constituted ore and to develop cutoff limits for ore and for low grade. We consulted with local management and with Mr. Roland Erickson for Longyear Company, but made no independent study of what might be termed the minimum threshold of economic value. Cutoff grades and other parameters for ore-in-place, and low-grade-in-place seem different for each area involved.

3. At the request of management, we have prepared an analysis of production results compared to drill hole estimates, using underground cut sampling and radiometric "sampling".

4. A necessary by-product of the above work was a re-estimate of ore reserves made for management and for the use of Erickson of the Longyear Company.

5. We took none of our own samples. Our investigation of basic data was confined to restudy of A.E.C. and Century Geophysical logs. We have perforce accepted as correct, chemical assays and weights estimates from company records. To the extent that these data are inaccurate, our conclusions and recommendations are equally false. In most cases, however, cross checks were available so that conclusions herein presented have an order of reliability commensurate with the use to which this information may reasonably be put.

## GENERAL STATEMENT

### Location and Access

6. Rio de Oro holdings which are the subject of this report, are located in the Ambrosia Mining District, McKinley County, New Mexico. The principal holdings lie 25 to 30 miles north and west of the town of

Grants, New Mexico. Grants is located on U.S. Highway #66, and the Atcheson-Topeka and Santa Fe Railroad, in Valencia County, New Mexico. All properties can be reached by automobile. An improved road leads to Dysart Mine No. 1; unimproved truck trails lead to most of the other properties. The area is shown by the attached Index Map, Figure 1.

7. The area is gently rolling country but there are some cliffs formed on resistant members of the Mesaverde formation that make access difficult into east and north holdings. By use of a bulldozer, however, it is possible to make access into all Rio holdings for exploration purposes.

Property Studied

8. Holdings of Rio de Oro Uranium Mines, Inc. are as follows:

T 14 N, R10 W - S½ section 11
T 14 N, R 9 W - Section 4; SW¼ section 8; SW½ section 10
SW½ section 14; section 23, section 26.
T 13 N, R 8 W - Sections 8 and 9
T 15 N, R 10 W - Believed to include sections 7, 12, 14, 18, 24, 26.

Geologic Factors Affecting Exploration

9. Uranium deposits in the Ambrosia Mining District, with a few minor exceptions, are confined to the Jurassic Morrison formation. Members of that formation of interest to uranium seekers are the Recapture shale, overlain by the Westwater Canyon sandstone, and in turn overlain by the Brushy Basin shale. Brushy Basin shale may in certain areas contain a high percentage of sandstone, locally known as the Poison Canyon sandstone tongue. As determined from outcrop, viewed underground, or interpreted by drill logs, these divisions are neither sharp, nor have they been consistently placed at the same point by geologists in different parts of the area. For practical use, however, the noteworthy fact is that major uranium mineralization occurs mainly in the coarse sandstones. These rocks are lithified sands, waterlain, probably fluvial in origin. They show the usual characteristics of cross-bedding, channel scour and fill, minor shale lenses, and local conglomerates, etc. In certain areas the sandstones are gypsiferous. Certain sections contain a high percentage of clastic fledspar and clastic (?) clay minerals. Pyrits is commonly present.

10. As seen in outcrop, the greater part of the Westwater is a brick red color. However, near ore deposits the formation is usually pale grey to buff colored and is said to be "bleached". Hydrocarbons, apparently asphaltic, are found near and in uranium bearing sandstones. But not all asphaltic rocks are uranium bearing, hence this feature is indicative rather than definitive of uranium occurrence. As of this date the mineralogic nature of "primary" uranium mineralization is not determined. Brightly colored secondary uranium minerals may be seen in outcrop, underground along old water courses, and, after a few months, on mine working faces.

11. Structurally the district is a region of gently tilted sedimentary strata having a regional dip to the northeast of a few feet per mile to 15 degrees or more. Superimposed on or part of the regional structure, which is the southwest flank of the San Juan petroliferous basin, are three or more weak anticlinal structures. These are the Ambrosia Dome, site of the original uranium discovery of the camp, the San Mateo Dome, Walker Dome and an un-named nose near Calumet and Hecla mine 23. Although the original Dysart No. 1 discovery appeared to be related to ancient hydrologic levels such as may localize petroleum accumulations, continued exploration seems to indicate such association to be fortuitous. The domes do have the practical effect of bringing the Morrison host formations closer to the land surface. Depth to the uranium bearing zones of the Morrison ranges from a few hundred to more than 2000 feet in the area thus far explored. Formations exposed at surface are various rock units of Cretaceous age.

12. Ambrosia District is broken by numerous minor faults. The most common strike is northeast and thus there are formed small horsts and grabens having their long axis parallel to the regional dip. Because there is essentially no stratigraphic disconformity between Jurassic and younger rocks in the district, it was possible for A.E.C. and other geologists to prepare structure contour maps reliably reflecting the configuration of the uranium bearing host rocks. Such a map, taken in conjunction with surface contours, affords a quick guide to exploration depths.

13. In the lithified Cretaceous rocks cropping out over most of the district, fractures of all degrees of intensity are formed. It is possible to map these fractures by photogeologic methods from large scale photographs. Where this has been done, principally by T. W. Mitcham, there is at least an empirical relationship between certain groups of locally anomalous fractures, faults or fissures, and ore. Such a correlation is as yet unproven genetically, but may be considered a useful tool for prospecting.

14. A noteworthy feature of known deposits is their disproportion of length to breadth to thickness. In general, the greatest dimension is in a northwest-southeast direction and may be several thousand feet. Several horizons within a sandstone member may be mineralized or mineralization may coalesce into nearly vertical runs, probably fissure controlled. The most common form for deposits is however stringlike; but several strings or runs may be vertically superimposed or lie closely en echelon one to the other.

15. Two main district wide trends, or belts, containing most of the many known ore bodies exist. The most continuous lies south of Ambrosia Dome and includes Hecla's section 32 mine and Rio's section 26 (14N, 9W) holdings; the other, north of the Dome, includes Dysart Mine No. 1

## Suggested Exploration Techniques

16. The geologic features of Ambrosia district uranium deposits, the special features of uranium mineralization in general, and accepted drilling practice may be combined to develop optimum exploration methods for this area. Depending upon the current stage of exploration at each Rio property, some part of these suggestions will apply:

a. Secure low level, large sacle, controlled photography of area, with normal 2/3 stereo overlap. Black and white pictures are adequate.

b. Prepare surface photogeologic map by standard techniques.
c. Prepare surface detailed fracture pattern map, by Mitcham's methods.
d. Determine sufficient key surface elevations to permit construction of structure contour map on a key horizon near or in host rock.
e. In new areas begin drill pattern in anomalously fractured areas; in old areas place drill pattern such as to cross-section known trends, if any. Drill pattern should be closely spaced across trend, widely spaced along trend.
f. Drill at least 20% of holes by coring methods from top of Dakota formation in order to establish correlation factor between chemical assays and radiometric determinations.
g. Drill at least ten holes on each tract well into Recapture shale despite results. First holes to be drilled by standard open hole wet or dry rotary methods such that down-the-hole geophysical measurements can be conveniently made.
h. Run drift surveys on all holes more than 500 feet deep in order to determine location of ores when found.
i. Run gamma logs, resistivity and self-potential logs on all holes.
j. Consult with E. J. Longyear field personnel to establish consistent nomenclature and correlation of lithologic logs. Carry working sections of each hole graphically as well as by written log, showing shale and sand layers, mineralization, water and ground conditions.
k. Have every open hole observed in the field from the top of Dakota through the Morrison. Record type of sand, shale, gypsum, asphalt, etc. from cuttings. Record water and ground conditions as encountered.
l. Carry working structure contour map and working cross section for layout and correlation purposes of each plat. Revise continuously. For this purpose, 200-scale is adequate.
m. Construct in cooperation with other projects cross sections from detailed graphic logs for several sections in order to determine distribution of favorable sands, trends of structure and mineralization.
n. Finally in estimating reserves, take into full account correlation of various horizons into continuous (geometrically) masses of potential mining interest.

Geologic Factors Affecting Mining

17. Dysart Mine No. 1 produces ore from three or more horizons lying close together and 350 feet or more below land surface. The ore zones are well above the water table; moisture content in the ore is less than 3%. Here the Westwater sandstone, the host rock, is without important shaley partings. It seems everywhere to be a nearly homogeneous mass of lithified coarse sand. Flat-backed rooms as much as 40 feet across have been opened without appreciable pillar or roof failure. The host rock is quite porous but has a high percentage of clay.

18. One northeast trending fault zone with minor displacement has been found by underground workings. Correlation of drill logs strongly suggests other and more powerful faults may be expected east of present workings. Jointing, although well developed, is discontinuous and no areas made weak by jointing have yet been encountered. Most joints are sealed by calcite, gypsum or hydrocarbons. There is evidence of leaching of uranium and oxidation of pyrite along the one open fault zone.

19. The main factor affecting mining at Dysart No. 1 and probably other Rio holdings is the general thinness of uranium bearing horizons and the tendency for mineralization to occur in several superimposed layers separated only by thin barren sandstone. These ore runs are elongated many tens of times in an east-west direction over their north-south dimension. Mining to date indicated that much of the material shown barren or very low grade by drill holes in fact contains enough uranium to somewhat compensate for this otherwise unfortunate multiplicity of mining horizons.

20. In section 26 and other deeper potential mining areas the increase in depth adds factors to complicate mining. One is the presence of ground water. The second is the expectable difference in physical behavior of the Westwater sandstone where water saturated. Experience at Homestake Section 32 shaft indicates to date these problems may not be severe, for the host rock appears to drain well and to stand well. However, somewhat higher cutoff parameters are required in estimating ore or outcome for these more deeply buried deposits.

SECTION 11, T14N, R10W

Operating Maps

21. In order to determine geologic control, if possible, and to set forth natural limits of mineralization, we prepared maps and cross sections, Figures 2 to 19, incl. attached hereto and made a part hereof. Two base maps show all basic data, such as drill holes, ore intercepts, workings, elevations and location of sections. As overlays there are attached transparencies outlining mineralization, ore reserves, and low grade. Basic data for this presentation were derived solely from company records. The most significant disclosure resulting from this analysis seems to be recognition of persistent mineralization at four stratigraphic horizons. The horizons overlap like shingles on a roof, lower horizons being displaced to the south from upper horizons.

Basis of Estimates

22. To determine limits of low grade mineralization, it was necessary to determine limits of commercial reserves. Having prepared base maps and sections, Wisser then reviewed the basic geophysical logs of all Dysart drilling and recalculated all low grade intercepts. Chemical assays were perforce accepted as correct. A total of 156 holes on Rio holdings and 16 Kermac holes were restudied. For 30 holes, cores and chemical analyses were available. Thus 15% of the data is confirmed by chemical analyses. Study of company underground sampling and radiometric muckpile readings was made. Because these data appear to check within themselves and against shipment records, we can accept the data as sufficiently reliable to warrant conclusions drawn hereinafter.

23. Mine operating records substantiated by Longyear engineers indicate that 4' mining height and .13% $U_3O_8$ grade are acceptable cutoff limits. We have used these parameters to determine outside cutoff; where lower grade material occurs within otherwise mining grade reserves, such low grade is included in ore reserves. Low grade outside of ore blocks, either peripheral or above and below is included in low grade blocks. Up to 2 feet of low grade is included in ore intercepts where such inclusion does not reduce intercept grade below cutoff. Ore and low grade limits are extended a maximum of 50 feet beyond isolated or outside drill holes, except where geologic trends dictate more scientific interpretation of occurrence. Where mine workings yield information supplementary to drill holes, such information has been used to modify outline, thickness or grade. The average of several Homestake specific gravity determinations, 15.8 cu. ft/ton, is used to estimate ore and low grade reserves.

24. Ore reserves or low grade thus estimated fall in the category of indicated reserves in place. No consideration is made of minability of reserves. Reserves are not split into measured and indicated categories since no purpose is served by such a split at this property. Because mineralization occurs at three principal and several minor horizons (or splits from the main horizons), reserves are in each case estimated by horizons.

25. To study continuity of mineralization and as a check on ore and low grade outlines, a map of each horizon showing foot-percent contours was prepared. Where modification in shape was apparent, the contour basis has been used to outline ore or low grade.

26. Studies hereinafter described of production and mine sampling compared to drill hole estimates seem to suggest that dilution into these reserves will not be barren. Because the data available to date are somewhat contradictory, we report reserves without regard to dilution.

Ore Reserve

27. An estimate of reserves at Dysart Mine No. 1 is given in Appendix 1. It is summarized by Table 1.

# TABLE 1

## Dysart Mine No. 1
## SUMMARY OF ORE RESERVES
## 9-1-57

WEST AREA

| Horizon | Tons | Grade | T x G |
|---|---|---|---|
| 0 | 17,260 | .171 | 2,952 |
| 1 | 58,300 | .306 | 17,870 |
| 2 | 109,550 | .237 | 25,957 |
| 2A | 24,700 | .283 | 6,999 |
| 3 | 129,780 | . 285 | 36,973 |
| Sub-total | 345,030 | .266 | 91,785 |
| Net depletion reserve to date; 1,2,3 only | - 37,380 | .296 | - 11,072 |
| Net Total Reserve | 307,650 | .262 | 80,713 |

EAST AREA

| Horizon | Tons | Grade | T x G |
|---|---|---|---|
| 1 | 3,280 | .310 | 1,017 |
| 2A | 4,050 | .310 | 1,256 |
| 3 | 350,680 | .239 | 83,912 |
| Sub-total (no mining to date) | ~~356,990~~ 357,010 EHW | .241 | 86,185 |
| TOTAL RESERVE | ~~664,640~~ 664,660 EHW | .251 | 166,898 |

Low Grade Mineralization

28. Minimum parameters for low grade mineralization are arbitrarily assumed at 5 foot minimum thickness and 0.06% minimum grade. As a test of what increase might result from dropping these parameters to 4 feet and 0.4%, for example, we re-estimated several larger low grade blocks. Lower cutoff apparently results in, at most, a 5% increase in tonnage. Low grade mineralization is divided among the same three principal and several minor horizons as is commercial ore. It is principally the fringe and tops and bottoms of ore. Table 2 summarizes total "reserves" without regard to minability or dilution. Details of the estimate are given by Appendix 2. By reference to the attached map folio and cross section the isolated nature of much of these reserves will be clear.

TABLE 2

Dysart Mine No. 1
LOW GRADE ESTIMATE
9-1-57

WEST AREA

| Horizon | Tons | Grade | T x G |
|---|---|---|---|
| 0 | 23,580 | .079 | 1,861 |
| 1 | 13,580 | .089 | 1,230 |
| 2 | 20,600 | .097 | 2,001 |
| 2A | 3,980 | .085 | 338 |
| 3 | 29,280 | .086 | 2,509 |
| Sub-total | 91,260 | .087 | 7,939 |
| Mined to 9/1/57 (approx.) | - 2,260 | .13 | - 294 |
| TOTAL WEST AREA | 89,000 | .086 | 7,645 |

EAST AREA

| Horizon | Tons | Grade | T x G |
|---|---|---|---|
| 1 | 10,660 | .091 | 967 |
| 2 | 21,470 | .084 | 1,814 |
| 2A | 14,400 | .099 | 1,430 |
| above 3 | 2,860 | .110 | 273 |
| 3 | 26,860 | .090 | 2,425 |
| TOTAL EAST AREA | 73,390 | .094 | 6,909 |
| TOTAL LOW GRADE | 162,390 | .090 | |

29. The total reserve of 162,390 tons grading 0.90% $U_3O_8$ contains 292,302 pounds $U_3O_8$. We estimate that perhaps 20-30% of this material will be normally mined as "dilution" in the course of extracting the commercial reserves; some 2,200 tons have been mined to date. Thus the total tonnage or poundage available to any special low grade mining project will be substantially less than the "reserves" above stated.

30. Reference to equal value contour maps attached will indicate the striking lack of large, low grade fringes to the main uranium ore bodies. Were all the low grade mineralization to be mined with commercial ores, the total increased recovery of uranium would be less than 9%. Obviously careful economic study must be made prior to attempting extraction of this low grade material.

## MINE PRODUCTION COMPARED TO RESERVE ESTIMATES

31. Analysis of production from the West Area, Dysart Mine No. 1, suggests that the ore reserve estimates made herein, as well as previous estimates, are safely conservative. However, this analysis also points up the inadequacies of previous operators' records and highlights the weaknesses of current practice. Production from Dysart Mine No. 1 is given by Table 3. Underground results (April to August 1957) are given by Table 4. Two methods are adopted to compare production to drill hole estimates.

32. First, a comparison is made by horizon and working place between five months (April-August 1957) production and an adjusted estimate of grade from drill holes within fifty feet of each working place. Figure 30 shows the areas thus compared; results of the comparison are given in Table 5, attached. Direct comparison between average grade of ore extracted for a given place in a given horizon, with average of ore in drill holes exploring that place is impossible, because the height of workings in every case exceeds the vertical thickness of ore, resulting in considerable dilution with expected consequent lowering of grade. For each area, the average total height of workings was estimated; this, subtracted from the average vertical thickness of ore estimated from drill holes, gave the amount of waste to be included in the drill hole grade.

Example:

Horizon 1, area d

Average grade, ore mined - - - - - 0.245% $U_3O_8$
Average height of workings- 9.35'
Average grade of drill holes - - - 0.350%
Average thickness ore - - - 6.9'

| | Thickness | % | T x % |
|---|---|---|---|
| Waste | 2.45' | -- | -- |
| Ore | 6.90' | .350 | 2.42 |
| Drill grade | 9.35' | .260 | |

33. The comparison is inaccurate for many reasons: (1) Local pinches and swells between drill holes, or changes in grade, will invalidate the drill hole estimate where only a few intercepts are available; (2) The average height of workings is determined from only a few measurements. Were it too high or too low by, for example, 0.75' the corrected drill hole grade would be changed by 0.02% $U_3O_8$; (3) Grade of ore mined is determined by radiometric probe readings in the muckpile, adjusted by an empirical factor selected to correlate muckpile readings with shipments and surface probe readings. Certainly the probe factor varies from place to place and from time to time, despite obvious care in manipulation of these operators; (4) Mined tonnage is based on skip and truck count, adjusted periodically against shipment scale records. However, the scales up to September 1, 1957 had never been calibrated so that weights are also open to question.

## TABLE 5

### Dysart Mine No. 1

### GRADE MINED vs DRILLED GRADE
### Comparison by Working Place

| Area | Place | Mined Tons | Grade[1] | T x G | Drilled Grade[2] | T x G | Diff.[3] $U_3O_8$ | % change Mine/drill hole |
|---|---|---|---|---|---|---|---|---|
| Horizon 1 | | | | | | | | |
| a | 101,67 | 1,705 | .233 | 397 | .20 | 341 | 0.66+ | |
| b | 101,36 | 5,326 | .364 | 1,938 | .22 | 1,170 | 2.84+ | |
| c | 38,62,70 | 3,636 | .540 | 1,969 | .34 | 843 | 4.00+ | |
| d | 22,36,38,70 | 7,121 | .245 | 1,743 | .26 | 1,855 | 0.30 - | |
| Sub Total #1 | | 17,788 | .340 | 6,047 | .232 | 4,259 | 2.16 | +48% |
| Horizon 2 | | | | | | | | |
| a | 76,18 | 2,807 | .27 | 759 | .24 | 673 | 0.60+ | |
| b | 27,76 | 2,291 | .234 | 532 | .11 | 252 | 2.48+ | |
| c | 71 | 1,811 | .13 | 230 | .16 | 290 | 0.60- | |
| d | 549 | 1,006 | .27 | 272 | .29 | 292 | 0.44- | |
| e | 60 | 504 | .09 | 45 | .09 | 45 | 0.00 = | |
| Sub Total #2 | | 8,419 | .218 | 1,838 | .184 | 1,552 | 0.68+ | +18% |
| Horizon 3 | | | | | | | | |
| a | 28 | 1,275 | .18 | 230 | .23 | 294 | 1.00- | |
| b | 30 | 1,590 | .14 | 222 | .10 | 159 | 0.80+ | |
| c | 29 | 923 | .09 | 83 | .074 | 68 | 0.32+ | |
| d | 520 | 1,569 | .15 | 234 | .115 | 180 | 0.70+ | |
| e | 99 | 785 | .12 | 94 | .13 | 102 | 0.20- | |
| Sub Total #3 | | 6,142 | .140 | 863 | .131 | 803 | 0.18+ | + 7% |
| TOTAL | | 32,349 | .270 | 8,748 | .204 | 6,614 | 1.32+ | +33% |

1. Grade derived by weighted average of radiometric muck pile probe x.70 factor

2. Grade derived by weighting drill hole intercept x grade with barren waste to equal mining thickness.

3. Plus equal mining grade greater than drill hole estimate

TABLE 5

Dysart Mine No. 1

GRADE MINED vs DRILLED GRADE
Comparison by Working Place

| Area | Place | Mined Tons | Grade [1] | T x G | Drilled Grade [2] | T x G | Diff. [3] $U_3O_8$ | % change Mine/drill hole |
|---|---|---|---|---|---|---|---|---|
| Horizon 1 | | | | | | | | |
| a | 101,67 | 1,705 | .233 | 397 | .20 | 341 | 0.66+ | |
| b | 101,36 | 5,326 | .364 | 1,938 | .22 | 1,170 | 2.84+ | |
| c | 38,62,70 | 3,636 | .540 | 1,969 | .34 | 843 | 4.00+ | |
| d | 22,36,38,70 | 7,121 | .245 | 1,743 | .26 | 1,855 | 0.30 - | |
| Sub Total #1 | | 17,788 | .340 | 6,047 | .232 | 4,259 | 2.16 + | +48% |
| Horizon 2 | | | | | | | | |
| a | 76,18 | 2,007 | .27 | 759 | .24 | 673 | 0.60+ | |
| b | 27,76 | 2,291 | .234 | 532 | .11 | 252 | 2.48+ | |
| c | 71 | 1,811 | .13 | 230 | .16 | 290 | 0.60- | |
| d | 549 | 1,006 | .27 | 272 | .29 | 292 | 0.44- | |
| e | 60 | 504 | .09 | 45 | .09 | 45 | 0.00 = | |
| Sub Total #2 | | 8,419 | .218 | 1,838 | .184 | 1,552 | 0.68+ | +18% |
| Horizon 3 | | | | | | | | |
| a | 28 | 1,275 | .18 | 230 | .23 | 294 | 1.00- | |
| b | 30 | 1,590 | .14 | 222 | .10 | 159 | 0.80+ | |
| c | 29 | 923 | .09 | 83 | .074 | 68 | 0.32+ | |
| d | 520 | 1,569 | .15 | 234 | .115 | 180 | 0.70+ | |
| e | 99 | 785 | .12 | 94 | .13 | 102 | 0.20- | |
| Sub Total #3 | | 6,142 | .140 | 863 | .131 | 803 | 0.18+ | + 7% |
| TOTAL | | 32,349 | .270 | 8,748 | .204 | 6,614 | 1.32+ | +33% |

1. Grade derived by weighted average of radiometric muck pile probe x.70 factor

2. Grade derived by weighting drill hole intercept x grade with barren waste to equal mining thickness.

3. Plus equal mining grade greater than drill hole estimate

34. Table 5 summarizes results of such a comparison for 14 areas, distributed among 3 ore horizons. The overall check, for 32,349 tons is a poor one; .270% mined against .204 estimated from drilling. Grade of ore mined exceeds drill hole estimates by 33%. For individual areas discrepancies ranged from a plus 60% to a minus 22%. The differences exceeded one pound per ton contained uranium oxide in four out of fourteen cases.

35. What conclusions may be drawn from such data?

a. The data are incorrect: knowing that the data used are in every case approximations, we still believe them sufficiently accurate to be indicative of trends for reasons explained in paragraph 36;

b. Reserve estimates are faulty: our estimates based on drill results are consistent with those results and check previous estimates made by other persons;

c. The ore is thicker or better grade, or "dilution" introduced in mining is far from barren: These factors, or some combination of them, we believe, are responsible for the apparent nearly 1/3 greater yield to date suggested by the data analyzed.

36. The second method used was to attempt an overall metallurgical accounting for the entire mine excavation as to tons, contained uranium, and to balance such accounting against shipment and stockpile records. Obviously without precise records the method has its faults. However, having calculated by area and volume the entire underground excavation exclusive of shaft and air raise (assumed to be wholly barren), and knowing the hoisting record for five months we could allocate waste and ore mined to working places with good accuracy. We then calculated or took from monthly records production from our reserve blocks, and compared such estimates with the known probable total production. Finally being satisfied that the data check within themselves within limits needed for this study, we calculated production by horizons and compared those estimates to total reserve blocks thus far penetrated by workings.

37. Adjustment of underground sampling to mill results is a problem in every operating mine; this is no special case but merely one complicated by lack of precise records. As records accumulate and better weights, actual mill heads, etc. are received over periods of several months; we would expect the balance to become better and better. We believe, all things considered, that the data thus derived, tabulated in Appendix 3 as (a) "Probable Allocation of Total Production", (b)"Comparison of Yield to Reserve Estimate", (c) "West Area Production/Reserve Comparison" are self balancing and quite accurate enough for these purposes.

38. Therefore we draw these conclusions:

a. Yield to date as compared with drill hole estimates is about 30% greater in pounds uranium and nearly 50% greater in tonnage.

b. Dilution to date is not barren. In horizon 1, ore thicknesses are somewhat greater than drilling indicated and tops and bottoms are mineralized. In horizon 2 data suggest ore is thinner and walls may be barren. In horizon 3 the suggestion is that wall material is very low grade, but mineralized.

c. On balance, the estimates made from radiometric readings and chemical assays in drill holes will be found to be safely conservative.

39. To sum up, we find that 71,000 tons (in round figures) had been mined from Dysart Mine No. 1. Of this amount, 64,000 tons grading 0.233% $U_3O_8$ has been shipped or remained in stockpiles. The difference of 7,000 tons being presumed to be in the waste dumps. Some 56,000 tons of ore came from our reserve blocks, and graded 0.259% $U_3O_8$, but this mining did not deplete these blocks by such an amount due to the greater thickness mined than considered in estimates. We find ore reserves to be depleted by 38,000 tons grading 0.296% $U_3O_8$. However the greater part of this increased yield comes from horizon 1. Because horizon 3 contains the greatest reserve, we doubt that such yields will be attained in the future.

SUGGESTIONS FOR ADDITIONAL EXPLORATION

40. Drilling within areal limits of the indicated ore bodies does not in many cases penetrate far below #3 horizon. Figure 6,plan of #4 horizon, West Area, graphically illustrates this situation. Some test drilling is warranted below mine workings. Future drilling should penetrate the full thickness of the Westwater member. The chances of encountering new major ore bodies in this developed area are few, but probably some additions to reserved may be expected.

41. Although Company records indicate at least 160 core and plug big holes have been drilled in the $S\frac{1}{2}$ of Section 11, almost all of this drilling is restricted to the vicinity of the known ore body. Information furnished tous indicates that no more than 10 holes are drilled farther than 250 feet beyond the limits of commercial ore. Geometrically, then, there is certainly room for additional exploration. Suggested exploration targets and methods of attack do not take into account any property difficulties which may exist and are based solely upon engineering and geological considerations. They are shown by Figure 29, Proposed Exploration.

42. We recommend that drilling technique in this area wherein the holes will not be more than 500 feet deep, be limited to open hole dry rotary work. All holes should be surveyed with self-potential and resistivity as well as gamma ray logs. No resistivity or self-potential logs are now available for Section 11. From comparison with other drill logs, it would appear that the No. 3 ore horizon in Section 11 is close to the base of the Westwater. The contours shown on the attached proposal for exploration are based upon this assumption. One or two early holes should be drilled well into the Recapture shale so that the characteristics of these various formations can be identified if at all possible from resistivity and self-potential work. Moisture content of Rio de Oro is about 3% which is probably enough to permit diagnostic self-potential and resistivity work.

43. Layout of exploration should take advantage of the obvious trends visible underground and from previous Section 11 drilling. There is one main ore zone crossing diagonally from the northwest corner of the $S\frac{1}{2}$ of Section 11, which appears to extend through the section and probably joins with known ore in the adjoining Section 12. With this trend in mind, drill holes should be laidout to cross section the prolongation of the known ore. In the $E\frac{1}{2}$ of Section 11, this trend includes a graben depressed 100 feet or more. It is probable, therefore, that the easternmost Section 11 holes (804, Z8+400, Z6+400 and 806) did not penetrate deep enough to encounter all of the mineralization which could be present. There is a suggestion in other parts of the Ambrosia district that better ore is found in graben structures.

44. We recommend that drilling in this area, shown as Target C on the attached map, should be laid out so that the holes give a 100 foot covering in cross section of the area. The holes may be 200 feet apart in a north-south direction and 400 feet apart in east-west direction, provided that the grid is so staggered that the projected position of the holes encompasses no more than 100-foot spacing north-south. Figure 29 shows this scheme graphically.

45. Another open trend, shown as Target A on the attached map, and still a third, shown as Target B on the attached map, are based upon known intercepts. Therefore, these targets should be reasonably closely spaced. The spacing of the holes recommended is shown on the map, the exact location depending in each case upon the geometry involved. A continuation of project B to the south, and the addition of project D, to the north, on the east end of the known ore, will effectively cross section the entire potential mineralized ground of Section 11.

46. The holes shown by this layout are, of course, a minimum. If they are drilled completely unsuccessfully, the chances of finding important concentrations of ore on Section 11 will have been so far reduced as to make further exploration considerably less attractive. However, if mineralization is encountered in any group of these holes, expanded drilling will be necessary. Such expanded drilling should take the form of exploring the obvious strike direction east-west, once an ore intercept or a near commercial intercept is found. Expectation of discovery of substantial new ore bodies can be considered good.

## SECTION 26, T 14 N, R 9 W

### Geologic Conditions

47. Surface elevations in Section 26 range from 7,050 to 7,200 feet. The rocks exposed at the surface are the Mancos shale, first Gallup sandstone and other lower beds of the Mesaverde formation. Strong northeast trending faults break these rocks into several major blocks. Throws of up to 200 feet are measurable on the Gallup sandstone. In general, the beds dip nearly due east, somewhat more steeply inclined than at Section 11. The average dip is approximately 500 feet per mile. On the attached map, Figure 31, the structure in the southern part of the section is portrayed by contours on the top of the Westwater member.

48. To date 63 holes have been drilled on the section, of which 17 intercept strong uranium mineralization and an additional 12 intercept trace mineralization. So far, the only substantially mineralized zone discovered is near the southwest section corner where more or less east-west trending stringlike runs similar in size, shape and grade to those at Section 11, are found at several horizons in the Westwater. The mineralized area is portrayed by the attached plans and sections, figures 32 to 45.

Operating Conditions

49. The depth to the base of the Westwater (and the deepest mineralization) on the eastern side of known ore is approximately 1,280 feet. It is reasonable to assume that at such depths the Westwater will be water saturated and there will be a static head of 500-600 feet. The average slope of the ore zones from west to east is 9%.

Ore Reserves

50. Because of the more difficult operating conditions we haveuused a higher cut off for Section 26 ores than for section 11 ores. Six feet minimum mining thickness and minimum grade of 0.15% $U_3O_8$ is used. On the basis of cross sections and stratigraphic relations, four mineralized horizons are indicated but only two, B and C, contain commercial ores. Chemical assays were available for 9 out of 17 ore holes. In Section 26, radiometric equivalents are taken at 75% of Century Geophysical Company formula. Note that chemical determinations are still lower than the radiometric equivalent used. Thus the true grade of section 26 reserves is open to some question.

51. Calculations of thickness and grade for each horizon are shown by Appendix 4. Planimetric measurements of the total mineralized area in each horizon yield total volume. 15.6 cu.ft. per ton was used to estimate tonnage. We believe this factor to be conservative since these ores will be water saturated and hence should have a somewhat greater weight than the dry rock of Section 11.

52. With these qualifications, indicated ore reserves in place are estimated as follows:

TABLE 6 - Section 26 (14N-9W) Reserves

| | | |
|---|---|---|
| Horizon B | 125,346 tons | 0.369% $U_3O_8$ |
| Horizon C | 168,046 tons | 0.239% $U_3O_8$ |
| Total | 293,000 tons | 0.295% $U_3O_8$ |
| Dilution 1' | 29,000 " | 0.040% $U_3O_8$ |
| TOTAL | 322,000 tons | 0.276% $U_3O_8$ |

Future Exploration

53. The trend of mineralization across the southwest corner of Section 26 certainly suggests that ore occurs in the adjacent sections. Because the tonnage available in this one part of section 26 is seemingly

small on which to predicate a deep mining venture, consideration is warranted of extending Rio interests to these other ground. The known ore zones are well defined by a number of barren holes on the north side. Should other ores be found in the section, almost certainly they will not be physically continuous with the two shoots located to date.

54. East of known ore, one hole (32) encountered near-commercial mineralization. Although additional drilling has been done, both by Rio and competing companies, this drilling is not conclusive. Until a north-south cross-sectioning pattern is attempted from the section lines northward near hole 32, the ground remains untested.

55. There is no indication of mineralization in the other holes drilled on the section. Most of the section lies outside the district's so-called main trend of mineralization. Study of the drill logs, however, shows no particular change in the Westwater formation. Unfortunately, no direct observational data has been kept to determine the nature of the sand, presence or absence of asphalt, etc. No drilling lies close to this area on ground held by others, as least as far as could be easily determined by field reconnaissance.

56. Thus drilling northward on Section 26 is entirely in the nature of wildcatting. Because a number of blank holes have been drilled, the attractiveness of such wildcatting is lessened. We recommend, however, that at least one or two lines of closely spaced north-south holes be put in, if wildcatting is resumed. However, general exploration procedures not yet done should certainly precede further drilling.

## OTHER HOLDINGS IN T 14 N, R 9 W

### Exploration to September 1, 1957

57. A number of holes, all barren, have been drilled in the holdings of Rio de Oro in T14N, R9W, other than Section 26. No work was in progress. Inspection of the logs of these holes seems to indicate a northward decrease in sand content of the Westwater. Areas with one or more holes are Section 4, SW$\frac{1}{4}$ section 8, SW$\frac{1}{2}$ section 10, SW$\frac{1}{2}$ section 14, section 23. In section 15, Entrada is reported to have encountered low grade mineralization. These areas are illustrated by figure 46.

### Recommendations

58. We recommend this area be included in photogeologic studies, elsewhere herein recommended. The area must all be considered as wildcat exploration, tempered by the fact that at least 20 blank holes have to date been drilled. Unless ore trends from some adjacent area can be projected into such an area (which is not the case) or fracture patterns are encouraging (which is unknown and at best only suggestive) there is no clue geology can give to aid wildcatting. Favorable horizons are deeply buried and ore, to be of strong interest, should be in large quantity and of good grade.

59. We believe, on balance, the chances of Rio de Oro encountering commercial mineralization in these holdings are few.

## SECTIONS 8 AND 9, T 13 N, R 8 W.

### Geologic setting

60. Holdings of Rio de Oro in Sections 8 and 9, T13N, R8W, lie on the south flank of the San Mateo Dome. Here elevations on the top of the Westwater range from 5,400 to 6,000 feet. Northeast trending fault zones rive this area into many splinters jostled up or down from a few feet to a few hundred feet one from the other. These relationships are sketchily shown by the reference map, Figure 47 attached.

61. Topographically, the area is more rugged than Section 11 for the outcropping formations are the cliff-forming members of the Mesaverde group (Dalton sand up to Hosta sand). Elevations range from just below 7,300 feet to over 7,800 feet. In general, the beds have anorth-south to northwest strike and dip 3-4 degrees to the northeast. Erosion forms scarp and bench topography on the more resistent members.

62. Surface geology has been roughly mapped by Kelley and Fowler but more detailed work is required. Photogeology from existing low level Longyear photographs should be very useful here because the many sandstone beds will allow fracture pattern and structural studies of some accuracy.

### Exploration to September 1, 1957

63. To date 14 holes on Section 9 and 2 on Section 8 have been completed with drilling still in progress. Layout of the holes was stated to have been largely dictated by property considerations, but some attempt has been made to drill at least one hole in each fault block. A resume of results is given by Appendix 5.

64. Two holes, 5 and 6, in Block B of the reference map, each show two ore intercepts (for purposes of a standard, we have used feet x % $U_3O_8$ x 100 = 90 as cutoff). Low grade mineralization is present in holes 3 and 8, and trace mineralization in all other holes except 11 and 14. Because survey data are not available for the holes, no cross sections are submitted. There is some suggestion that mineralization is stronger within the graben block B than elsewhere. However, hole spacing to date ranges from 400 to more than 1,500 feet and obviously closer drilling is required before trends can become obvious. To the northwest in horst block A, all holes contain trace mineralization. No mineralization has been found to the southeast in horst block C.

### Recommendations

65. Uranium mineralization is present but very deeply buried. In this area each drill hole is very costly; a very large number of holes might well exhaust the profit possibilities of all but the largest of ore bodies. Here, then, in a place where any aids to minimize drilling should be used, we recommend the following steps:

a. Prepare a photogeologic map with attention to fracture pattern Perhaps all work can be done by Dr. T. W. Mitcham

b. Have a geologist at the rig from the time the top of the Dakota is reached to completion of the hole.

c. Concentrate first drilling to cross section, then grid drill graben block B, follow by structural drilling from geologic study.

d. Run drift surveys on all holes.

e. Set up cross sections and a structure contour map and revise as new data come in.

f. Keep hole spacing greater than 300 feet, at least until the presence or absence of important mineralization has been discovered.

The cost of such preparation, largely by on the spot company personnel will not exceed that of one or two barren holes in this section.

## T 15 N, R 10 W (WALKER DOME)

66. Rio de Oro holdings in the Walker Dome area are scattered. As reported to us, they comprise all or part of sections 7, 12, 14, 18, 24, and 26. To date this entire area is in the nature of an intriguing speculation that uranium may occur on this structure. Obviously, "unitizing" into a project such as the San Mateo Dome project would have many a dvantages.

67. If unitization is not feasible, we would strongly urge detailed geologic work, aerial photography at no more than 1:12000 scale of such accuracy that with ground control and photogrammetric methods, good base maps can be prepared. Then the entire sequence of study suggested under exploration technique should be brought to bear.

68. Failure to find mineralization by such methods may not prove that none exists. However, it should so increase the odds against finding ore as to make questionable the commercial merit of further work.

Respectfully submitted,

Edward Wisser

Edward H. Wisser

Manning W. Cox

Manning W. Cox

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TABLE 3

## Production from Dysart Mine No. 1

| Time Interval | Shipments Wet Tons | Shipments $\#U_3O_8$ | Rock Tons | Hoisted % $U_3O_8$ | Waste Tons | Shipping Ore Hoisted Tons | Shipping Ore Hoisted % $U_3O_8$ | Low Grade Hoisted Tons | Low Grade Hoisted % $U_3O_8$ | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 1955 thru Feb. 1957 | 20,574 | 99,096 | | | | | | | | A.E.C. purchases |
| March | | | 4,394 | .18? | ? | 4,394 | .180? | combined ore-low grade | | |
| April | | | 5,443 | .156? | 516 | 2,346 | .220 | 2,581 | .130? ) | |
| May | | | 4,628 | .219? | 528 | 3,245 | .289 | 855 | .092 ) | |
| June | 2,194 | 11,527 | 6,329 | .301? | 653 | 4,850 | .378 | 826 | .084 ) | Hom. Nu Mex purchases |
| July | 14,944 | 74,049 | 9,279 | .225? | 146 | 9,132 | .229 | - | - ) | |
| August | 17,816 | 81,606 | 12,174 | .2114 | - | 9,774 | .232 | 2,400 | .118 ) | |
| Sub-Total-Hidden Splendor operations | 34,954 | 167,182# | 42,246T | .221 | 1,843T | 33,741T | .250 | 6,662 | .114 | |
| Total Shipments | 55,528 | 266,279 | | | | | | | | |

Notes:
(?) 100% probe factor, probably too high, all others .70 probe factor
Shipment weights based on uncalibrated truck scales at Homnumex mill
All other "weights" by skip or truck count only
Moisture factor - ignored except in A.E.C. settlements
A.E.C. shipments chemical assays - Homnumex shipments probed and roughly checked against Homestake grab sampling

### Stockpile Record

| Date Estimated | Ore Tons | Ore % $U_3O_8$ | Low Grade Tons | Low Grade % $U_3O_8$ | |
|---|---|---|---|---|---|
| 3- 1-57 | 818 | - | none | | |
| 4- 1-57 | 5,212 | ? | none | | |
| 4-30-57 | 8,141 | .2000 | 2,059 | .1300 | |
| 5-31-57 | 11,386 | .2254 | 2,944 | .1188 | |
| 6-30-57 | 13,898 | .2579 | 3,754 | .1108 | |
| 7-31-57 | 8,086 | .2430 | 3,693 | .1120 | |
| 8-30-57 | 2,849 | .2360 | 5,004 | .1230 | 7853 tons stockpile. |

| | |
|---|---|
| Addition to stockpile by difference | |
| Ore hoisted | |
| ore shipped | 5,549 tons |
| Addition to stockpile by measurement | -7,035 |
| Difference | 1,486 |

| | |
|---|---|
| $\#U_3O_8$ shipped | 167,182 |
| " stockpile | 27,216 |
| | 195,398 |
| - " hoisted | -186,787 |
| Difference | 8,611# |
| less initial pile | - 3,272 |
| Net Difference | 5,339# or about 1500 tons @.175 |

TABLE 4
Dysart Mine No. 1
MUCK PILE PROBE RESULTS

| Month | #18 Tons | #18 Probe @.70 | #18 Tons x Probe | #22 Tons | #22 Probe @.70 | #22 Tons x Probe |
|---|---|---|---|---|---|---|
| April | - | - | - | - | - | - |
| May | 599 | .27 | 161.73 | - | - | - |
| June | - | - | - | - | - | - |
| July | - | - | - | - | - | - |
| August | 437 | .24 | 104.88 | 813 | .18 | 146.34 |
| Total | 1036 | | 266.61 | 813 | | 146.34 |
| Wtd.Avg. | | .26 | | | .18 | |

| Month | #27 | | | #28 | | |
|---|---|---|---|---|---|---|
| April | - | - | - | - | - | - |
| May | - | - | - | - | - | - |
| June | 863 | .29 | 250.27 | - | - | - |
| July | 109 | .25 | 27.25 | 215 | .16 | 34.40 |
| August | - | - | - | 1060 | .18 | 190.80 |
| Total | 972 | | 277.52 | 1275 | | 225.20 |
| Wtd.Avg. | | .28 | | | .18 | |

| Month | #29 | | | #30 | | |
|---|---|---|---|---|---|---|
| April | - | - | - | 308 | .18 | 55.44 |
| May | - | - | - | 144 | - | - |
| June | - | - | - | - | not worked | - |
| July | - | Start | - | 288 | .24 | 69.12 |
| August | 923 | .09 | 83.07 | 850 | .13 | 110.50 |
| Total | 923 | | 83.07 | 1590 | | 225.06 |
| Wtd.Avg. | | .09 | | | .14 | |

| Month | #36 | | | #38 | | |
|---|---|---|---|---|---|---|
| April | - | - | - | - | - | - |
| May | - | - | - | 433 | .16 | 69.28 |
| June | 793 | .47 | 372.71 | 1163 | .51 | 593.13 |
| July | 2063 | .34 | 701.42 | 865 | .51 | 441.15 |
| August | 3388 | .21 | 711.48 | 1950 | .26 | 507.00 |
| Total | 6244 | | 1785.61 | 4411 | | 1610.56 |
| Wtd.Avg. | | .29 | | | .36 | |

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TABLE 4 - Sheet 2

| Month | #60 Tons | #60 Probe @.70 | #60 Tons x Probe | #62 Tons | #62 Probe @.70 | #62 Tons x Probe |
|---|---|---|---|---|---|---|
| April | 197 | .14 | 27.58 | - | - | - |
| May | 180 | .05 | 9.00 | - | - | - |
| June | 53 | .08 | 4.24 | - | - | - |
| July | - | - | - | 1281 | .63 | 807.03 |
| August | 74 | .09 | 6.66 | 115 | .46 | 52.90 |
| Total | 504 | | 47.48 | 1396 | | 859.93 |
| Wtd.Avg. | | .09 | | | .61 | |

| Month | #70 | | | #71 | | |
|---|---|---|---|---|---|---|
| April | - | - | - | - | - | - |
| May | - | - | - | - | - | - |
| June | - | - | - | - | - | - |
| July | 969 | .39 | 377.91 | 1269 | .13 | 164.97 |
| August | - | - | - | 542 | .12 | 65.04 |
| Total | 969 | | 377.91 | 1811 | | 230.01 |
| Wtd.Avg. | | .39 | | | .13 | |

| Month | #76 | | | #80 | | |
|---|---|---|---|---|---|---|
| April | 1745 | .08 | 139.60 | - | - | - |
| May | 1026 | .27 | 277.02 | - | - | - |
| June | 635 | .11 | 69.85 | - | - | - |
| July | - | - | - | - | - | - |
| August | - | - | - | 123 | .08 | 9.84 |
| Total | 3406 | | 486.47 | 123 | | 9.84 |
| Wtd.Avg. | | .14 | | | .08 | |

| Month | #99 | | | #101 | | |
|---|---|---|---|---|---|---|
| April | - | - | - | 1333 | .16 | 213.28 |
| May | 323 | .12 | 38.76 | 1481 | .33 | 488.73 |
| June | - | - | - | 1551 | .38 | 589.38 |
| July | 231 | .16 | 36.96 | 1142 | .16 | 182.72 |
| August | 231 | .11 | 25.41 | - | - | - |
| Total | 785 | | 87.78 | 5508 | | 1474.11 |
| Wtd.Avg. | | .12 | | | .26 | |

TABLE 4 - Sheet 3

| Month | #520 Tons | #520 Probe @.70 | #520 Tons x Probe | #549 Tons | #549 Probe @.70 | #549 Tons x Probe |
|---|---|---|---|---|---|---|
| April | 1569 | .15 | 235.35 | 124 | .23 | 28.52 |
| May | - | - | - | 266 | .25 | 39.90 |
| June | - | - | - | 317 | .28 | 88.76 |
| July | - | - | - | 299 | .38 | 113.62 |
| August | - | - | - | - | - | - |
| Total | 1569 | | 235.35 | 1006 | | 270.80 |
| Wtd. Avg. | | .15 | | | .27 | |

| Month | #558 | | |
|---|---|---|---|
| April | - | - | - |
| May | - | - | - |
| June | - | - | - |
| July | - | - | - |
| August | 700 | .09 | 63.00 |
| Total | 700 | | 63.00 |
| Wtd. Avg. | | .09 | |

APPENDIX 1

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APPENDIX 1

## Section 11 - ORE RESERVE ESTIMATE

## WEST AREA

### HORIZON 0

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 7,600 | 4.0 | 30,400 | 1,920 | .16 | 307 |
| Hole: 54 | | | | | | |
| 2 | 5,100 | 4.0 | 20,400 | 1,290 | .13 | 168 |
| Hole: 57 | | | | | | |
| 3 | 9,000 | 4.0 | 36,000 | 2,280 | .185 | 422 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 518 | 4.0 | .22 | .88 |
| 14 | 4.0 | .15 | .60 |
| | 8.0 | .185 | 1.48 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 4 | 6,000 | 4.0 | 24,000 | 1,520 | .14 | 213 |
| Hole: 18 | | | | | | |
| 5 | 7,850 | 4.0 | 31,400 | 1,990 | .22 | 438 |
| Hole: 21 | | | | | | |
| 6 | 9,000 | 14.5 | 130,500 | 8,260 | .17 | 1,404 |
| Hole: 10 | | | | | | |
| Sub-total 0 Horizon | | | | 17,260 | .171 | (2,952) |

### HORIZON 1

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 15,400 | 8.4 | 129,360 | 8,190 | .235 | 2,006 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 33 | 7.7 | .23 | 1.77 |
| 548 | 13.6 | .25 | 3.40 |
| 32 | 4.0 | .26 | 1.04 |
| | 25.3 | .245 | 6.21 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 8,200 | 5.0 | 41,000 | 2,600 | .15 | 390 |
| Hole: 561 | | | | | | |
| 3 | 13,600 | 9.1 | 123,760 | 7,830 | .154 | 1,206 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 20 | 4.0 | .17 | .68 |
| 22 | 14.2 | .15 | 2.13 |
| | 18.2 | .154 | 2.81 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 4 | 31,200 | 5.4 | 168,480 | 10,660 | .436 | 4,648 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 35 | 8.5 | .64 | 5.44 |
| 81 | 8.0 | .67 | 5.36 |
| 39 | 4.0 | .18 | 0.72 |
| 40 | 4.0 | .15 | 0.60 |
| 36 | 4.0 | .18 | 0.72 |
| 61 | 4.1 | .34 | 1.39 |
| | 32.6 | .44 | 14.23 |

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Horizon 1 (Cont.)

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 5 | 28,500 | 6.2 | 176,700 | 11,180 | .481 | 5,379 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 544 | 4.0 | .24 | .96 |
| 31 | 10.5 | .21 | 2.21 |
| 37 | 6.9 | 1.07 | 7.38 |
| 23 | 4.0 | .29 | 1.16 |
| 38 | 5.7 | .57 | 3.25 |
| | 31.1 | .481 | 14.96 |

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 6 | 24,600 | 8.9 | 218,940 | 13,860 | .24 | 3,326 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 26 | 14.0 | 2.80 | 39.2 |
| 70 | 7.2 | 2.52 | 18.1 |
| 18 | 5.5 | 1.10 | 6.0 |
| | 26.7 | .24 | 63.3 |

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 7 | 7,850 | 4.0 | 31,400 | 1,990 | .28 | 557 |
| Hole: 51 | | | | | | |
| 8 | 7,850 | 4.0 | 31,400 | 1,990 | .18 | 358 |
| Hole: 54 | | | | | | |
| | Sub-Total | 1 Horizon | | 58,300 | .306 | 17,870 |

HORIZON 2

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 23,500 | 16.8 | 394,800 | 24,990 | .265 | 6,622 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 50 | 16.6 | .20 | 3.32 |
| 549 | 32.1 | .33 | 10.59 |
| 51 | 7.0 | .28 | 1.96 |
| 543 | 11.5 | .17 | 1.95 |
| | 67.2 | .265 | 17.82 |

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 25,200 | 9.6 | 241,920 | 15,310 | .188 | 2,878 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 62 | 4.0 | .17 | .68 |
| 53 | 4.0 | .12 | .48 |
| 537 | 4.7 | .42 | 1.97 |
| 55 | 25.9 | .16 | 4.14 |
| | 38.6 | .188 | 7.27 |

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 | 29,400 | 10.0 | 294,000 | 18,610 | .270 | 5,025 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 70 | 19.2 | .25 | 4.8 |
| 24 | 9.9 | .17 | 1.7 |
| 18 | 4.0 | .58 | 2.3 |
| 532 | 8.5 | .30 | 2.6 |
| 76 | 8.3 | .25 | 2.1 |
| | 49.9 | .27 | 13.5 |

## Horizon 2 (Cont.)

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 4 | 27,500 | 9.1 | 250,250 | 15,840 | .133 | 2,103 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 27 | 12.0 | .19 | 2.28 |
| 518 | 4.0 | .18 | .72 |
| 71 | 4.0 | .13 | .52 |
| 72 | 16.5 | .08 | 1.32 |
| | 36.5 | .13 | 4.84 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 5 | 45,000 | 8.9 | 400,500 | 25,350 | .291 | 7,377 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 559 | 5.3 | .49 | 2.54 |
| 3 | 14.2 | .21 | 3.00 |
| 557 | 6.9 | .43 | 2.96 |
| 520 | 5.0 | .32 | 1.60 |
| 558 | 4.0 | .37 | 1.48 |
| 517 | 21.5 | .25 | 5.37 |
| 9 | 5.4 | .22 | 1.18 |
| | 62.3 | .291 | 18.13 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 6 | 7,200 | 5.9 | 42,480 | 2,690 | .23 | 618 |

Hole: 64

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 7 | 20,000 | 4.0 | 80,000 | 5,060 | .22 | 1,113 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 66 | 4.0 | .13 | .52 |
| 57 | 4.0 | .32 | 1.28 |
| | 8.0 | .22 | 1.80 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 8 | 6,700 | 4.0 | 26,800 | 1,700 | .13 | 221 |

Hole: 526

| | | | | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| Sub-Total | 2 Horizon | | | 109,550 | .237 | 25,957 |

## HORIZON 2-A

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 19,000 | 5.5 | 104,500 | 6,610 | .257 | 1,699 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 76 | 4.0 | .25 | 1.00 |
| 27 | 6.2 | .26 | 1.61 |
| 518 | 6.2 | .26 | 1.61 |
| | 16.4 | .257 | 4.22 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 18,200 | 6.1 | 111,020 | 6,980 | .269 | 1,878 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 522 | 4.5 | .44 | 1.98 |
| 528 | 4.0 | .15 | .60 |
| 515 | 10.0 | .24 | 2.40 |
| | 18.5 | .270 | 4,98 |

Horizon 2A(cont.)

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 | 27,000 | 6.5 | 175,500 | 11,110 | .308 | 3,422 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 30 | 4.0 | .14 | .56 |
| 43 | 4.0 | .76 | 3.04 |
| 29 | 11.6 | .21 | 2.44 |
| | 19.6 | .308 | 6.04 |

| | Tons | Grade | T x G |
|---|---|---|---|
| Sub-Total 2-A Horizon | 24,700 | .283 | 6,999 |

HORIZON 3

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 28,000 | 4.2 | 117,600 | 7,440 | .373 | 2,775 |

| Hole | Thick | % | T X G |
|---|---|---|---|
| 35 | 4.0 | .49 | 1.96 |
| 40 | 4.0 | .41 | 1.64 |
| 549 | 4.6 | .24 | 1.10 |
| | 12.6 | .373 | 4.70 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 46,000 | 10.0 | 460,000 | 29,110 | .224 | 6,521 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 543 | 11.3 | .21 | 2.37 |
| 53 | 11.8 | .25 | 2.95 |
| 538 | 6.5 | .17 | 1.10 |
| 55 | 15.1 | .26 | 3.93 |
| 537 | 9.0 | .16 | 1.44 |
| 24 | 8.0 | .20 | 1.60 |
| 532 | 7.4 | .26 | 1.92 |
| 16 | 19.1 | .27 | 5.16 |
| 527 | 7.9 | .14 | 1.11 |
| 57 | 4.0 | .22 | 0.88 |
| | 100.1 | .224 | 22.46 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 | 36,600 | 8.0 | 292,800 | 18,530 | .284 | 5,263 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 519 | 4.0 | .24 | .96 |
| 76 | 4.7 | .24 | 1.13 |
| 518 | 9.2 | .24 | 2.21 |
| 14 | 4.0 | .11 | .44 |
| 58 | 15.5 | .47 | 7.20 |
| 72 | 13.6 | .22 | 2.99 |
| 522 | 4.8 | .17 | .82 |
| | 55.8 | .284 | 15.84 |

Horizon 3 (Cont.)

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 4 | 40,000 | 6.44 | 257,600 | 16,300 | .410 | 6,683 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 87 | 4.0 | .17 | .68 |
| 88 | 6.4 | .82 | 5.25 |
| 84 | 7.0 | .22 | 1.54 |
| 80 | 10.0 | .44 | 4.40 |
| 59 | 4.8 | .27 | 1.30 |
| | 52.2 | .41 | 13.17 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 5 | 29,400 | 4.6 | 135,240 | 8,560 | .276 | 2,363 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 525 | 6.3 | .40 | 2.52 |
| 74 | 4.0 | .17 | .68 |
| 41 | 4.5 | .27 | 1.22 |
| 45 | 4.0 | .22 | .88 |
| 44 | 4.0 | .25 | 1.00 |
| | 22.8 | .276 | 6.30 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 6 | 56,400 | 8.4 | 473,760 | 29,980 | .271 | 8,125 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 17 | 4.0 | .41 | 1.64 |
| 516 | 12.1 | .24 | 2.90 |
| 4 | 4.8 | .26 | 1.25 |
| 82 | 7.7 | .27 | 2.08 |
| 7 | 4.0 | .13 | .52 |
| 515 | 10.0 | .24 | 2.40 |
| 25 | 10.3 | .32 | 3.30 |
| 511 | 8.0 | .38 | 3.04 |
| 6 | 14.5 | .23 | 3.33 |
| | 75.4 | .271 | 20.46 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 7 | 74,700 | 4.2 | 313,740 | 19,860 | .264 | 5,243 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 34 | 4.0 | .24 | .96 |
| 514 | 4.0 | .19 | .76 |
| 30 | 4.6 | .23 | 1.06 |
| 28 | 4.0 | .42 | 1.68 |
| 506 | 5.1 | .26 | 1.33 |
| 46 | 4.0 | .16 | .64 |
| 47 | 4.0 | .40 | 1.60 |
| 48 | 4.0 | .28 | 1.12 |
| 5 | 4.0 | .20 | .80 |
| | 37.7 | .264 | 9.95 |

| | Tons | Grade | T x G |
|---|---|---|---|
| Sub-Total 3 Horizon | 129,780 | .285 | (36,973) |

HORIZON 4

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 16,000 | 4.0 | 64,000 | 4,050 | .20 | 810 |
| 2 | 5,500 | 4.0 | 22,000 | 1,390 | .16 | 224 |
| Sub-Total 4 Horizon | | | | 5,440 | .19 | 1,034 |
| TOTAL WEST AREA ORE RESERVE | | | | 345,033 | .266 | 91,785 |

Block 1:

| Hole | Thick | % | T x G |
|---|---|---|---|
| 544 | 4.0 | .10 | .40 |
| 537 | 4.0 | .24 | .96 |
| | 8.0 | .163 | 1.30 |

Block 2: Hole: 520

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## EAST AREA

**HORIZON 1**

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 7,850 | 6.6 | 51,800 | 3,280 | .31 | (1,017) |
| Hole: 565 | | | | | | |

**HORIZON 2-A**

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 7,850 | 4.0 | 31,400 | 1,990 | .36 | 716 |
| Hole: R-6 | | | | | | |
| 2 | 7,850 | 4.1 | 32,185 | 2,040 | .265 | 540 |
| Hole: V-5 | | | | | | |
| Sub-Total 2-A Horizon | | | | 4,030 | .31 | (1,256) |

**HORIZON 3**

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 78,000 | 4.3 | 335,400 | 21,230 | .296 | 628 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| L-8 | 4.0 | .31 | 1.24 |
| 502 | 4.7 | .21 | .99 |
| L-10 | 4.4 | .52 | 2.28 |
| L-11 | 4.0 | .14 | .56 |
| | 17.1 | .296 | 5.07 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 92,000 | 6.9 | 635,000 | 40,190 | .21 | 8,440 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| N-7 | 5.2 | .15 | .77 |
| N-9 | 10.8 | .215 | 2.32 |
| N-8 | 4.0 | .22 | .88 |
| N-10 | 9.0 | .28 | 2.57 |
| N-11 | 5.5 | .13 | .71 |
| | 34.5 | .21 | 7.25 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 | 32,800 | 4.55 | 149,240 | 9,450 | .215 | 2,032 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| P-10 | 4.0 | .21 | .82 |
| R-10 | 5.1 | .223 | 1.14 |
| | 9.1 | .215 | 1.96 |

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 4 | 63,900 | 6.0 | 383,400 | 24,260 | .191 | 4,634 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| P6 + 70 | 10.0 | .15 | 1.50 |
| 565 | 4.0 | .27 | 1.08 |
| R-6 | 4.0 | .216 | .86 |
| | 18.0 | .191 | 3.44 |

Horizon 3 (Cont.)

| Block | Ft$^2$ | Thickness | Ft$^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 5 | 124,000 | 17.7 | 2,194,800 | 138,900 | .26 | 36,114 |
| 6 | 75,000 | 6.3 | 472,500 | 29,900 | .26 | 7,774 |
| 7 | 77,000 | 17.8 | 1,370,600 | 86,750 | .28 | 24,290 |
| | | Sub-Total 3 Horizon | | 350,680 | .246 | (86,185) |

Block 5:

| Hole | Thick | % | T x G |
|---|---|---|---|
| T5 +25 | 24.6 | .217 | 5.35 |
| T-7 | 10.0 | .34 | 3.40 |
| V-5 | 30.0 | .267 | 7.29 |
| V-6 | 19.5 | .30 | 5.85 |
| 563 | 4.5 | .26 | 1.17 |
| | 88.6 | .26 | 23.06 |

Block 6:

| Hole | Thick | % | T x G |
|---|---|---|---|
| X-6 | 8.0 | .29 | 2.32 |
| X-7 | 7.0 | .297 | 2.04 |
| 562 | 4.0 | .154 | .61 |
| | 19.0 | .26 | 4.97 |

Block 7:

| Hole | Thick | % | T x G |
|---|---|---|---|
| Z-6 | 20.1 | .24 | 4.81 |
| 810 | 8.4 | .17 | 1.43 |
| 805 | 25.0 | .35 | 8.75 |
| | 53.5 | .28 | 14.99 |

| | Tons | Grade | T x G |
|---|---|---|---|
| TOTAL EAST AREA ORE RESERVE | 357,990 | .247 | (88,458) |
| TOTAL ORE RESERVE ESTIMATE | 703,023 | .256 | [redacted] |

APPENDIX 2

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## APPENDIX 2

### Section 11 - LOW GRADE ESTIMATE

### WEST AREA

#### HORIZON 0

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 31,500 | 6.9 | 217,350 | 13,750 | .086 | 1,183 |

| Hole | Thick. | % | T x G |
|---|---|---|---|
| 23 | 5.0 | .08 | .40 |
| 70 | 5.0 | .072 | .36 |
| 13 | 4.0 | .20 | .80 |
| 559 | 13.4 | .06 | .81 |
| | 27.4 | .086 | 2.37 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 7,000 | 13.9 | 97,300 | 6,150 | .07 | 431 |
| Hole: 72 | | | | | | |
| 3 | 5,400 | 5.0 | 27,000 | 1,710 | .064 | 109 |
| Hole: 62 | | | | | | |
| 4 | 6,000 | 5.2 | 31,200 | 1,970 | .07 | 138 |
| Hole; 544 | | | | | | |
| Sub-total 0 Horizon | | | | 23,580 | .079 | (1,861) |

#### HORIZON 1

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 15,400 | 5.0 | 77,000 | 4,870 | .083 | 404 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 20 | 5.0 | .065 | .325 |
| 22 | 5.0 | .10 | .500 |
| | 10.0 | .083 | .825 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 28,300 | 5.0 | 141,500 | 8,950 | .093 | 832 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 67 | 5.0 | .07 | .350 |
| 31 | 5.0 | .12 | .600 |
| 38 | 5.0 | .09 | .450 |
| | 15.0 | .093 | 1.400 |

| | | | | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| Sub-total 1 Horizon | | | | 13,820 | .089 | (1,230) |

#### HORIZON 2

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 21,000 | 5.0 | 105,000 | 6,650 | .06 | ( 399) |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 29 | 5.0 | .06 | .300 |
| 47 | 5.0 | .059 | .295 |
| | 10.0 | .059 | .590 |

HORIZON 2 (cont.)

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 | 13,000 | 5.15 | 66,950 | 4,240 | .106 | 449 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 25 | 5.3 | .17 | .90 |
| 511 | 5.0 | .08 | .40 |
| | 10.3 | .106 | 1.30 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 (Hole: 41) | 7,500 | 5.0 | 37,500 | 2,370 | .09 | 213 |
| 4 (Hole: 16) | 5,000 | 5.0 | 25,000 | 1,580 | .07 | 110 |
| 5 | 18,200 | 5.0 | 91,000 | 5,760 | .083 | 830 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 81 | 5.0 | .13 | .65 |
| 35 | 5.0 | .06 | .30 |
| 63 | 5.0 | .06 | .30 |
| | 15.0 | .083 | 1.25 |

| | Tons | Grade | T x G |
|---|---|---|---|
| Sub-total 2 Horizon | 20,600 | 0.97 | 2,001 |

HORIZON 2-A

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 | 7,500 | 5.0 | 37,500 | 2,400 | .075 | 180 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 529 | 5.0 | .07 | .35 |
| 11 | 5.0 | .08 | .40 |
| | 10.0 | .75 | .75 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 2 (Hole: 559) | 5,000 | 5.0 | 25,000 | 1,580 | .10 | 158 |

| | Tons | Grade | T x G |
|---|---|---|---|
| Sub-total 2-A Horizon | 3,980 | .085 | ( 338) |

HORIZON 3

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 1 (Hole: 87) | 7,850 | 5.0 | 39,250 | 2,480 | .10 | 248 |
| 2 | 16,000 | 5.0 | 80,000 | 5,060 | .078 | 395 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 54 | 5.0 | .07 | .35 |
| 56 | 5.0 | .064 | .320 |
| 51 | 5.0 | .09 | .45 |
| | 15.0 | .075 | 1.120 |

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 3 (Hole: 532) | 7,850 | 8.0 | 62,800 | 3,970 | .06 | 238 |
| 4 | 15,600 | 8.0 | 124,800 | 7,900 | .107 | 845 |

| Hole | Thick | % | T x G |
|---|---|---|---|
| 27 | 5.0 | .07 | .350 |
| 559 | 11.5 | .07 | .805 |
| 520 | 8.9 | .16 | 1.424 |
| 71 | 6.4 | .13 | .835 |
| | 31.8 | .107 | 3.414 |

HORIZON 3 (cont.)

| Block | Ft² | Thickness | Ft³ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| 5 | 11,600 | 5.0 | 58,000 | 3,670 | .095 | 349 |
| Hole: 9, 517 | | | | | | |
| 6 | 10,300 | 5.0 | 51,500 | 3,260 | .07 | 228 |
| Hole: 45, 30 | | | | | | |
| 7 | 9,300 | 5.0 | 46,500 | 2,940 | .07 | 206 |
| Hole: 42 | | | | | | |
| Sub-Total 3 Horizon | | | | 29,280 | .086 | (2,509) |
| TOTAL WEST AREA LOW GRADE | | | | 91,260 | .087 | (7,939) |

Block 5:

| Hole | Thick | % | T xG |
|---|---|---|---|
| 9 | 5.0 | .10 | .50 |
| 517 | 5.0 | .09 | .45 |
| | 10.0 | .95 | .95 |

Block 6:

| Hole | Thick | % | T x G |
|---|---|---|---|
| 45 | 5.0 | .07 | .45 |
| 30 | 5.0 | .07 | .45 |
| | 10.0 | .07 | .90 |

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## EAST AREA

| Block | $Ft^2$ | Thickness | $Ft^3$ | Tons | Grade | T x G |
|---|---|---|---|---|---|---|
| **HORIZON 1** | | | | | | |
| 1 | 7,850<br>Hole L-8 | 5.0 | 39,250 | 2,480 | .09 | 223 |
| 2 | 18,000<br>Holes: R-9, R-10 | 5.0 | 90,000 | 5,700 | .10 | 570 |
| 3 | 7,850<br>Hole N-10 | 5.0 | 39,250 | 2,480 | .07 | 174 |
| | Sub-Total 1 Horizon | | | 10,660 | .091 | ( 967 ) |
| **HORIZON 2** | | | | | | |
| 1 | 7,850<br>Hole P-6 + 70 | 5.0 | 39,250 | 2,480 | .14 | 347 |
| 2 | 31,000<br>Holes: P-10, R-9 | 5.0 | 155,000 | 9,810 | .07 | 687 |
| 3 | 29,000<br>Holes: 57, 563 | 5.0 | 145,000 | 9,180 | .085 | 780 |
| | Sub-Total 2 Horizon | | | 21,470 | .084 | (1,814) |
| **HORIZON 2-A** | | | | | | |
| 1 | 7,850<br>Hole L-7 | 5.0 | 39,250 | 2,480 | .10 | 248 |
| 2 | 22,000<br>Holes: N-9, N-10 | 5.0 | 110,000 | 6,960 | .12 | 835 |
| 3 | 7,850<br>Holes P-6 + 70 | 5.0 | 39,250 | 2,480 | .08 | 198 |
| 4 | 7,850<br>Hole: R-5 | 5.0 | 39,250 | 2,480 | .06 | 149 |
| | Sub-Total 2-A Horizon | | | 14,400 | .099 | (1,430) |
| **Above Horizon 3** | | | | | | |
| | 7,850 | 5.0 | 39,250 | 2,480 | .11 | ( 273) |
| **HORIZON 3** | | | | | | |
| 1 | 19,000<br>Holes: R-7, R-8 | 5.0 | 95,000 | 6,010 | .075 | 451 |
| 2 | 45,700<br>Holes: T-9, T10, V-8 | 5.5 | 251,350 | 15,900 | .094 | 1,495 |
| 3 | 7,850<br>Hole: 806 | 5.0 | 39,250 | 2,480 | .083 | 206 |
| 4 | 7,850<br>Hole: Z-6, 400 | 5.0 | 39,250 | 2,480 | .11 | 273 |
| | Sub-Total 3 Horizon | | | 26,860 | .090 | (2,425) |
| TOTAL EAST AREA LOW GRADE | | | | 73,390 | .094 | (6,909) |
| TOTAL LOW GRADE ESTIMATE | | | | 164,650 | .090 | |

APPENDIX 3

APPENDIX # 3-A

Probable Allocation Total Production
Dysart Mine No. 1

| | Tons | % $U_3O_8$ |
|---|---|---|
| Ore shipped and in stocks to 9/1/57 | 63,380 | .233 |
| Mined From Reserve blocks | 55,800 | .259 |
| Difference* | 7,580 | .042 |

From 520 XC and waste area at main shaft

| | Tons |
|---|---|
| Calculated Total<br>Mine excavation by volume<br>(excluding raises & shaft) | 70,820 |
| Less shipments and stocks | 63,380 |
| Difference* | 7,440 |

Waste from shaft area, 10-P and 24 Waste XC

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APPENDIX # 3-B

Comparison Yield
Reserve Estimate

| | | Tons | # $U_3O_8$ |
|---|---|---|---|
| Mined from reserve | 1. | 17,800 | 121,040 |
| to | 2. | 9,500 | 38,000 |
| September 1, 1957 | 3. | 28,490 | 129,914 |
| | | 55,790 | 288,954# |
| Previously estimated contents | 1. | 9,470 | 72,540 |
| | 2. | 9,000 | 50,580 |
| | 3. | 18,910 | 98,332 |
| | | 37,380 | 221,451# |
| Apparent average to date | | 18,410 | 67,503# |
| Apparent increased yield | | 49.25% | 30.5% |
| Total $U_3O_8$ in shipments and adjusted stockpile | | 63,380 ton | 295,250# |

APPENDIX #3-C

Dysart Mine No. 1
PRODUCTION/RESERVE COMPARISON
West Area

## No. 1 Horizon

| | $Ft^2$ | Height | $Ft^3$ | Tons | % $U_3O_8$ |
|---|---|---|---|---|---|
| Reserve Blocks 1,2,4,5 only | 83,300 | 6.2' | 514,500 | 31,700 | .383 |
| Mined to 9/1/57 | 23,947 | 11.7' | 281,354 | 17,800 | .340 |

(Factors) (28.7% area mined) (88.7% dilution) (56% tonnage mined)

In order to yield above results, there had to be mined 8,330 tons "dilution" grading .29% $U_3O_8$.

(Underground observation indicates ore thicker than drilling indicates)

NET DECREASE IN RESERVES 9,470 tons

## No. 2 Horizon

| | $Ft^2$ | Height | $Ft^3$ | Tons | % $U_3O_8$ |
|---|---|---|---|---|---|
| Reserve Blocks 1,3,4,5 only | 125,400 | 10.7' | 1,339,000 | 84,700 | .281 |
| Mining to 9/1/57 | 13,093 | 11.3' | 148,518 | 9,500 | .200 |

(Factors) (10.4% area mined) (5.6% dilution) (11.2% tonnage mined)

In order to yield above results there would have to be mined 500 tons "dilution" containing a negative quantity of $U_3O_8$ Inasmuch as this is impossible, obviously the data are faulty (probably mined grade is too low)

NET DECREASE IN RESERVES 9,000 tons

## No. 3 Horizon

| | $Ft^2$ | Height | $Ft^3$ | Tons | % $U_3O_8$ |
|---|---|---|---|---|---|
| Reserve Blocks 2,3,5,6,7 only | 243,100 | 6.9' | 1,675,000 | 106,100 | .260 |
| Mining to 9/1/57 | 43,307 | 10.3' | 444,781 | 28,490 | .228 |

(Factors) (17.8% area mined) (49.2% dilution) (26.8% tonnage mined)

In order to yield above results there had to be mined 9,580 tons "dilution" grading .164% $U_3O_8$

NET DECREASE IN RESERVES 18,910 tons

TOTAL DECREASE IN RESERVE 1-3 37,380 tons

APPENDIX 4

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APPENDIX 4

GRADE CALCULATIONS
Section 26 (10N - 9W)

HORIZON B

| Drill Hole | Intercept | % $U_3O_{8e}$* | % $U_3O_{8c}$ | Mining Thickness | % $U_3O_8$ | ft x % | Remarks |
|---|---|---|---|---|---|---|---|
| 3 | 994-1001 | .500 | - | 7' | .500 | 3.50 | |
| 21 | 969-977 | .482 | .233 | 8' | .233 | 1.86 | |
| 18 | 1020-1031 | .450 | .485 | 11' | .485 | 5.34 | |
| 13 | 1028-1033 | .140 | .141 | 6' | .120 | .71 | within mining limit |
| 23 | 1077-1094 | .517 | .386 | 17' | .386 | 6.56 | |
| 22 | 1071-1075 | .179 | .152 | 6' | .115 | .68 | within mining limit |
| 27 | 1119-1124 | .510 | .345 | 6' | .345 | 2.07 | |
| 55 | 1174-1179 | .238 | - | 6' | .197 | 1.19 | |
| 29 | 1177-1188 | .623 | - | 11' | .623 | 6.85 | |
| | | | | 78' | | 28.76 | |

Weighted average 9 holes by intercept only:
8.7' .369 $U_3O_8$

HORIZON C

| Drill Hole | Intercept | % $U_3O_{8e}$* | % $U_3O_{8c}$ | Mining Thickness | % $U_3O_8$ | ft x % | Remarks |
|---|---|---|---|---|---|---|---|
| 16 | 1022-1030 | .180 | - | 8' | .180 | 1.44 | |
| 14 | 1052-1060 | .440 | - | 8' | .440 | 3.42 | |
| 17 | 1080-1084 | .116) | | | | | |
| | 1084-1091 | - ) | - | 15' | .230 | 3.44 | |
| | 1091-1095 | .596) | | | | | |
| 22 | 1097-1117 | - | .279 | 20' | .279 | 5.58 | e - .398 |
| 7 | 1105-1108 | .102 | - | 6' | .051 | .31 | in center ore zone |
| 19A | 1114-1122 | - | .217 | 8' | .217 | 1.74 | e = .274 |
| 25 | 1166-1174 | - | .245 | 8' | .245 | 1.23 | e = .421 |
| 51 | 1192-1198 | .298 | - | 6' | .298 | 1.73 | |
| | | | | 79' | | 18.89 | |

Weighted average 8 holes by intercept only:

9.9' .239% $U_3O_8$ *e=75% of cps formula

APPENDIX 5

# APPENDIX 5

## Drill Log Resume
## SECTION 9 (13N - 8W)

| Hole | Collar | Total Depth | Tops of Formations Kd | Jbb | Jwc | Mineralization Intercept | Feet | $U_3O_8e$ (75% count) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 1905 | 1630 | 1680 | 1730 | 1767-1774 | 7' | trace |
| | | | | | | 1694-1701 | 2' | trace |
| 2 | | 1917 | 1685 | 1735 | 1800 | 1810-1815 | 5' | trace |
| | | | | | | 1865-1875 | 10' | trace |
| 3 | | 1750 | 1630 | 1680 | 1728 | 1728-1730 | 2' | .001 |
| 4 | | 1754 | 1483 | 1538 | 1600 | 1676-1678 | 2' | trace |
| | | | | | | 1709-1710 | 1' | trace |
| 5 | | 1750 | 1395 | 1452 | 1525 | 1565-1596 | 31' | trace |
| | | | | | | 1596-1608 | 6' | .660 |
| | | | | | | 1736-1740 | 6' | .162 |
| | | | | | | 1618-1620 | 2' | trace |
| | | | | | | 1642-1644 | 2' | trace |
| 6 | | 1763 | 1415 | 1472 | 1525 | 1534-1537 | 3' | trace |
| | | | | | | 1560-1562 | 2' | .001 |
| | | | | | | 1569-1574 | 5' | .267 |
| | | | | | | 1626-1633 | 7' | .162 |
| | | | | | | 1712-1716 | 4' | trace |
| 7 | | 1880 | 1492 | 1595 | 1700 | 1593-1595 | 2' | trace |
| | | | | | | 1746-1747 | 1' | .162 |
| | | | | | | 1756-1758 | 2' | trace |
| 8 | | 1826 | 1530 | 1585 | 1660 | 1663-1665 | 2' | trace |
| | | | | | | 1715-1717 | 2' | trace |
| | | | | | | 1758.5-1761 | 2.5' | .151 |
| | | | | | | 1785-1786.5 | 1.5' | .151 |
| | | | | | | 1796-1797 | 1' | trace |
| 9 | | 1726 | 1448 | 1502 | 1550 | 1549-1551 | 2' | .058 |
| | | | | | | 1554-1565 | 11' | trace |
| | | | | | | 1674-1675 | 1' | trace |
| | | | | | | 1687-1689 | 2' | trace |
| 10 | | 1670 | 1350 | 1405 | 1455 | 1452-1454 | 2' | trace |
| | | | | | | 1495-1497 | 2' | trace |
| 11 | | 1693 | 1440 | 1498 | 1545 | 1600-1602 | 2' | .095 |
| | | | | | | 1632-1635 | 3' | .001 |
| | | | | | | 1638-1640 | 2' | trace |
| | | | | | | 1677-1679 | 2' | trace |
| | | | | | | 1686-1689 | 3' | trace |

## APPENDIX 5 - Sheet 2

| Hole | Collar | Total Depth | Kd | Jbb | Jwc | Intercept | Feet | $U_3O_{8e}$ (75% count) |
|---|---|---|---|---|---|---|---|---|
| 12 | | 1962 | 1686 | 1745 | 1806 | 1835-1836 | 1' | trace |
| | | | | | | 1875-1877 | 2' | trace |
| | | | | | | 1920-1921 | 1' | trace |
| | | | | | | 1937-1939 | 2' | .001 |
| 13 | | 1999 | 1630 | 1687 | 1784 | 1825-1855 | 30' | trace |
| | | | | | | 1868-1872 | 4' | trace |
| | | | | | | 1975-1977 | 2' | trace |
| 14 | | 1950 | 1617 | 1695 | 1742 | 1908-1811 | 2' | trace |

SECTION 8

| Hole | Collar | Total Depth | Kd | Jbb | Jwc | Intercept | Feet | $U_3O_{8e}$ (75% count) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 1830 | 1475 | 1527 | 1600 | 1674-1677 | 3' | trace |
| | | | | | | 1715-1719 | 4' | .151 |
| | | | | | | 1729-1731 | 2' | trace |
| 3 | | 1806 | 1510 | 1560 | 1640 | 1568-1571 | 3' | trace |
| | | | | | | 1730-1731.5 | 1.5' | .383 |
| | | | | | | 1768-1775 | 7' | trace |