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40-8903/DLJ/87/06/12/0

JUN 18 1987

URFO:DLJ
Docket No. 40-8903
040089031405

Homestake Mining Company
ATTN: Edward Kennedy
P.O. Box 98
Grants, New Mexico 87020

Gentlemen:

Enclosed is a copy of the report on your tailings retention system's stability prepared for us by Goodson and Associates of Denver, Colorado. Their analysis was based on the information you made available and on an inspection of the site on March 10, 1987. Their conclusions are that the tailings retention system meets the stability requirements of NRC Regulatory Guide 3.11 in its present configuration and my staff is in concurrence. The NRC staff concurs in the report, and a copy of our evaluation is also enclosed.

The report recommends that the quarterly assessments be continued and that additional analyses be conducted if the embankment slopes are steepened, the embankment is raised, or the phreatic surface within the embankment rises appreciably.

License Condition No. 18 prohibits any changes to the approved tailings retention system without amendment of the license. This requires that specific engineering plans be submitted to the NRC for review and approval prior to increasing the embankment height or modifying the embankment configuration such as by steepening embankment slopes. Further, any appreciable increase in the phreatic surface as described in the report will require re-evaluation for conformance with NRC Regulatory Guide 3.11.

OFC						
NAME						
DATE	87/06/17					

Should you have any questions regarding this situation, please contact me on (303) 236-2805 or Ms. Dawn Jacoby on (303) 236-2814.

Sincerely,

/S/

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Enclosure: As stated

OFC	URFO	URFO	URFO
NAME	DJacoby/lv	PGarcia	EHawkins
DATE	87/06/17	6/17/87	6/18/87

40-8903/DLJ/87/05/15/0

JUN 10 1987

URFO:DLJ
Docket No. 40-8903
040089031405

MEMORANDUM FOR: Docket File No. 40-8903

FROM: Dawn L. Jacoby, Project Manager
Licensing Branch 1
Uranium Recovery Field Office, Region IV

SUBJECT: STABILITY ANALYSIS - TAILINGS EMBANKMENT AT MILAN MILL, HOMESTAKE MINING COMPANY

Background

An announced radiation safety inspection of Homestake Mining Company's Milan Mill was conducted on June 9-13, 1986 (see NRC Inspection Report 40-8903/86-001). Due to the centerline method used to construct the tailings embankment, Homestake Mining Company was requested during the inspection to substantiate the tailings strength parameters utilized in the previous stability analyses. By letters dated October 13, 1986, and January 12, 1987, Homestake Mining Company submitted stability analyses of the embankment and a discussion of the sensitivity of the stability factors on the stability model. The technical review of these analyses and supporting information was performed by Goodson and Associates (G&AI) and documented in their report dated April 30, 1987.

Discussion

The materials reviewed by Goodson and Associates were:

1. "Stability Assessment," prepared by D'Appolonia Consulting Engineers, Inc., dated November 1980.

2. Quarterly stability reports, dated March 7, 1984, to September 5, 1986, submitted by Homestake Mining Company to the State Engineer of New Mexico.

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3. "Reevaluation of Friction Angle of Sand Tailings" report, dated December 30, 1986, prepared by Dr. Alan Kuhn, P.E.

The Goodson and Associates review concluded that the tailings embankment is "stable and satisfies the stability requirements of NRC Regulatory Guide 3.11." Their report addressed the appropriateness of the shear strength, density, acceleration and moisture parameters used in the stability models based on observations, review of the available data and on engineering judgment.

The slope stability analyses utilized a friction angle of 29 degrees for tailings material. This friction angle resulted in factors of safety for static and pseudo-static conditions greater than those required by NRC Regulatory Guide 3.11 for all sections modeled. G&AI found the 29 degree friction angle to be "reasonable and on the conservation side," based on the 10 CU triaxial tests that were reviewed. They concluded that the other tailings soil parameters utilized in the stability model such as density and moisture content had been obtained by appropriate methods and that the values were reasonable and resulted in "reasonably accurate factors of slope stability."

The phreatic surfaces of the stability models were based on piezometric measurements and are kept current by the licensee's consultant. The 1980 D'Appolonia report concluded that the phreatic surface within the tailings embankment did not significantly affect the factor of safety until it increased by 50 percent above the 1980 phreatic surface. Based upon this conclusion, the piezometric surfaces utilized in the stability analyses were determined by G&AI to be reasonable. The liquifaction study performed by D'Appolonia was found acceptable by G&AI based on observations at the site and a review of the available data.

Conclusion

The purpose of this memorandum is to review the conclusions reached by Goodson and Associates regarding the ability of the tailings to achieve strength values which will result in the embankment meeting the minimum factors of safety of 1.5 for the static case and 1.0 for the psuedo-static case as recommended in Regualtory Guide 3.11.

Based on a review of the Goodson and Associates report and a visit to the site by the author, the staff concludes that Homestake Mining Company has satisfactorily addressed the concerns regarding the slope stability of the tailings embankment in its present configuration. The G&AI report

recommends that the quarterly stability assessment by the licensee's consultant be continued. Additional analyses are recommended if the embankment slopes steepen, the embankment is raised, or a phreatic surface higher than 150 percent of the 1980 phreatic surface is reached. The staff agrees with the concultant's recommendations. The licensee should be apprised of the results of this review and directed to follow the recommendations.

/S/

Dawn L. Jacoby, Project Manager
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Approved by: /S/

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office, Region IV

Case Closed: 040087031405

cc: Goodson & Associates

FINAL REPORT

LICENSING ASSISTANCE/

GEOTECHNICAL AND HYDROLOGICAL

EVALUATIONS/URFO

TASK ORDER NO. 2

REVIEW OF

HOMESTAKE MINING COMPANY
SUBMITTAL

MILAN MILL

APRIL 30, 1987

(5603.01)

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PURPOSE

The purpose of this geotechnical evaluation is to determine the adequacy of the information submitted by Homestake Mining Company regarding the stability of the uranium mine tailings embankment at the Milan Mill site. This work was performed in accordance with Contract No. NRC-31-85-377 between the Nuclear Regulatory Commission (NRC) and Goodson & Associates, Inc. (G&AI).

SCOPE OF WORK

The scope of work performed by G&AI for this study consisted of the following:

1. Conduct a site visit on March 10, 1987, to observe the condition of the tailings ponds and embankment.

2. Review the following reports:

   a) "Stability Assessment," prepared by D'Appolonia Consulting Engineers, Inc., dated November 1980.

   b) Quarterly stability reports, dated March 7, 1984, to September 5, 1986, submitted by Homestake Mining Company to the State Engineer of New Mexico.

   c) "Reevaluation of Friction Angle of Sand Tailings" report, dated December 30, 1986, and prepared by Dr. Alan Kuhn, P.E.

3. Evaluate the adequacy of the stability analyses performed and prepare a safety evaluation report. This evaluation is based upon a review of data obtained by others and the results of the onsite examinations. No independent field investigations, laboratory testing, nor stability analyses were performed by G&AI.

DESCRIPTION

The Milan Mill is located in Valencia County, north of Grants, New Mexico. Based upon data furnished by the Homestake Company, the east tailings pond was formed by construction of a 10-foot-high starter dam composed of native sandy clay. There was no starter dam for the west pond, which is contiguous to the east pond. Tailings were reportedly hydraulically disposed in a center-line method of construction with cyclones. In general, coarser fractions of the tailings were placed on the downstream side of the crest and finer fractions were placed on the upstream side. A total of approximately 20 million tons of tailings were deposited in the east and west tailings ponds.

According to surveys dated December 20, 1986, the tailings embankment has a maximum crest elevation of 6680 feet at section 6-6' (Figure 1), a maximum height of approximately 100 feet, and downstream side slopes ranging from 2:1 to 2.3:1. Since operations have been severely curtailed, tailings are presently being deposited in the ponds at a low rate of approximately 2,000 tons per month, according to officials of Homestake Mining Company.

SITE EXAMINATION

A site visit was made on March 10, 1987, to the Milan Mill, located near Grants, New Mexico. Ray Gonzales and Dawn Jacoby of the NRC, Denver office, accompanied Ralph Rabus and Al Zlaten of G&AI on the field trip.

There was water in the east and west ponds. Seepage through the tailings embankment was visible along the downstream toe. The observed seepage does not adversely affect the safety of the embankment.

A visual examination of the tailings embankment disclosed no areas of structural distress.

ADEQUACY OF STABILITY ANALYSIS

In a letter from the U.S. Nuclear Regulatory Commission (NRC), dated October 9, 1986, to Homestake Mining Company, the appropriateness of using 29° as the friction angle for the strength value of the uranium mill tailings in stability analyses of the tailings embankment was questioned. In response, Dr. Alan K. Kuhn prepared a report entitled "Reevaluation of Friction Angle of Sand Tailings, Homestake Mill, Grants, New Mexico," dated December 30, 1986, (Kuhn Report) in which the basis for selection of a friction angle of 29° is documented and evaluated. The materials test data used in the Kuhn Report were originally developed for a report entitled "Engineer's Report, Stability Analysis, Uranium Mill Tailings Pond, United Nuclear-Homestake Partners, Grants, New

Mexico," dated November 1980, prepared by D'Appolonia Consulting Engineers, Inc. (D'Appolonia Report).

As noted in the D'Appolonia Report, stability analyses were performed on embankment cross sections taken at eight different locations (1-1' through 8-8', shown on Figure 1). Factors of safety at three locations, 1-1', 4-4', and 5-5' (Figure 1) did not meet the requirement of a 1.5 safety factor as specified in the NRC Regulatory Guide 3.11.

Three remedial procedures for stabilizing the tailings embankment were proposed in the D'Appolonia Report. All three options would result in a general flattening of the slopes. According to Homestake officials, slopes were flattened by moving upper slope material towards the toe and by moving the crest inward towards the pond.

The phreatic level used in the stability analyses for the D'Appolonia Report was based upon piezometric measurements obtained in 1980. To monitor the phreatic surface, piezometers were installed in 1977 and in 1980 by D'Appolonia (Figure 1). The D'Appolonia Report noted that the phreatic surface within the tailings embankment did not significantly affect the safety factor until it became 50 percent greater than the piezometric level that existed in 1980. Assessments of the location of the phreatic surface have been made periodically and are kept current by Dr. Kuhn. Based upon the stability results presented in the quarterly stability report dated September 5,

1986, the existing phreatic level has not increased 50 percent over the 1980 level.

Our review of available data indicates that the selection of the friction angle of 29° for the uranium mill tailings at the Milan Mill tailings pond is based on 10 consolidated-undrained (CU) triaxial shear test made on representative samples that were remolded to approximate the in situ densities encountered in the embankment. Based on our judgment and experience, a friction angle of 29° for the type of tailings material produced by the Milan Mill is reasonable and on the conservative side.

According to the available data, the following safety factors are the most recent for the eight cross sections for which stability analyses are performed:

Section	SF Static	SF Psuedo-static	Date
1-1'	1.88	1.23	May 86
2-2'	1.87	1.19	Aug 85
3-3'	1.56	1.07	Sep 86
4-4'	2.08	1.32	Aug 85
5-5'	1.76	1.09	Sep 86
6-6'	1.66	1.09	Sep 86
7-7'	2.05	1.32	Aug 85
8-8'	1.69	1.12	Sep 86

Sections with a more recent date (May and September 1986) for the safety factors had a relatively low safety factor value in the past and additional stabilizing work, such as flattening slopes, was performed at the location of these cross sections, resulting in an increase of the factors of safety to the current adequate values. Stability analyses have not been

performed on Sections 2-2', 4-4', and 7-7' since August 1985, because the conditions affecting stability on these sections have not changed significantly and the sections have high factors of safety.

Additional slope stabilization was being performed at the time of the onsite examination in the area of Section 3-3' (Figure 1), which has a relatively low factor of safety as indicated in the table above. The slope stabilization consisted of moving the crest of the embankment towards the pond, resulting in a general flattening of the slope. Based upon the stability analyses performed, this procedure does increase the factor of safety of the slope.

Results of potential for liquefaction studies contained in the D'Appolonia Report indicate that the potential for liquefaction under earthquake loading does not endanger the stability of the embankment. Due to the relatively low phreatic surface, the potential for liquefaction is low except at the toe of the dam where seepage from tailings ponds tends to saturate the sand tailings. In this restricted area, minor surficial sloughing of the embankment can occur. This minor sloughing should not endanger the stability of the embankment. Based on our observations of the site and a review of available data, failure of the tailings embankment due to liquefaction is unlikely.

CONCLUSIONS

Based on a review of available data and on an onsite examination of the tailings embankment, the shear strength, density and moisture values of the tailings materials used in the stability analyses of the Milan Mill tailings embankment have been obtained by generally recognized and approved methods in the geotechnical profession, are judged to be reasonable, and result in reasonably accurate factors of slope stability.

The stability of the Milan Mill tailings embankment is being monitored on a periodic (quarterly) basis and remedial work is being done to increase the stability in the area where the safety factor values become marginal due to changes in the slope from placement of tailings from mill operation, wind blown movement of tailings, and change in phreatic surface. Continued monitoring is warranted as long as tailings are being deposited and changes in conditions affecting stability are occurring.

Based on a review of available data and on an onsite examination, the Milan Mill tailings embankment is considered to be stable and satisfies the stability requirements of NRC Regulatory Guide 3.11.

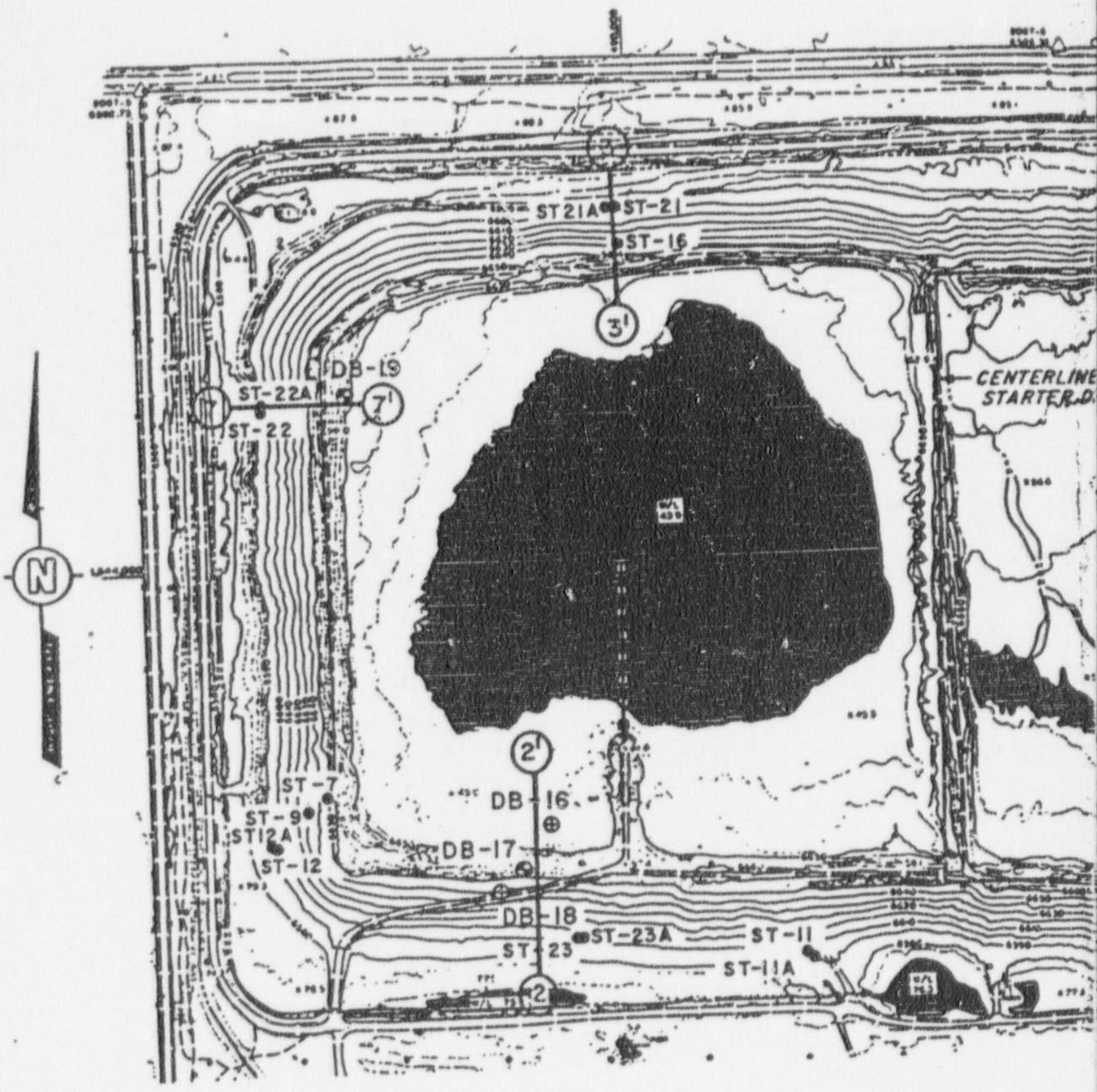
RECOMMENDATIONS

Additional stability analysis, to verify the stability of the tailings embankment, will be required if changes in existing conditions steepen existing slopes, raise the embankment

height, or produce a higher phreatic surface than what was measured for the most recent stability analyses.

In the event that topsoil and seeding is used during final reclamation of the tailings embankment, flattening of the existing slopes for greater erosional stability should be considered. Final grading of the slopes should also remove all windblown sand that may have been deposited tending to oversteepen the existing slopes.

DRAWN BY	MJG	CHECKED BY	TJH	10-27-80	DRAWING NUMBER	RM80-3118-1
	10/14/80	APPROVED BY	AKK	10-27-80		



LEGEND

⊕ D'APPOLONIA BORINGS WITH SINGLE PIEZOMETERS

⊗ D'APPOLONIA BORINGS WITH DOUBLE PIEZOMETERS

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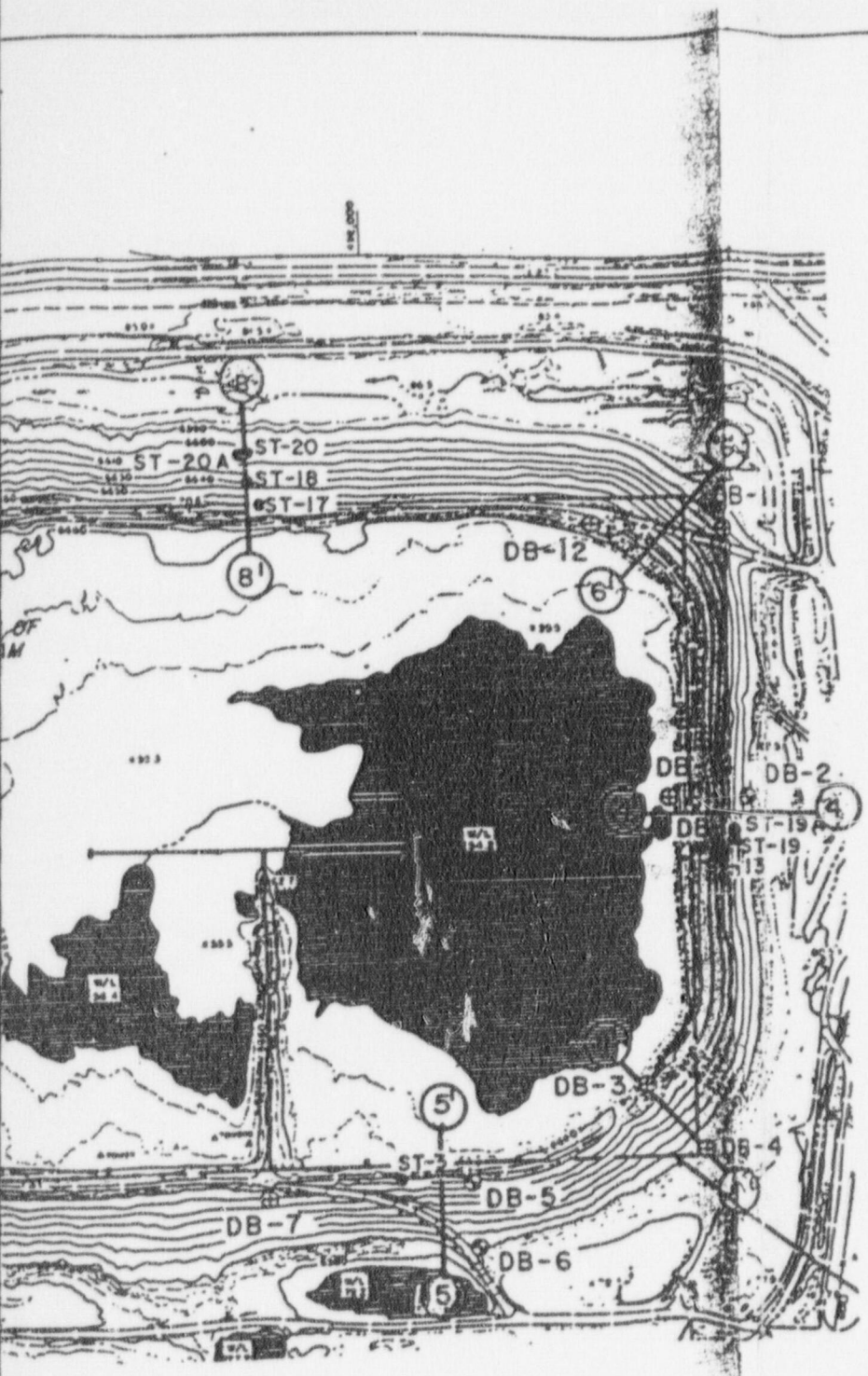

CROSS SECTION	FIGURE NUMBER
1 - 1'	3
2 - 2'	4
3 - 3'	5
4 - 4'	6
5 - 5'	7
6 - 6'	8
7 - 7'	9
8 - 8'	10

400 0 400

SCALE IN FEET

EZOMETER FROM 1977
ELD INVESTIGATIONS

YPICAL CROSS SECTION

BORING AND PIEZOMETER
LOCATION PLAN

PREPARED FOR

UNITED NUCLEAR-HOMESTAKE PARTNERS
GRANTS, NEW MEXICO

D'APPOLONIA

Figure 1