HOMESTAKE MINING COMPANY

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Received 8/13/96
KRH
Orig to Fridley/CF
Copy to Elaine

CERTIFIED MAIL NO.: P 369 600 945

August 6, 1996

U.S. Nuclear Regulatory Commission
Division of Waste Management, MST7J9
Attn. Mr. Joseph J. Holonich, Chief
High Level Waste and Uranium Recovery Projects Branch
11555 Rockville Pike
Rockville, MD 20852

Re: Docket No. 40-8903
License No. SUA-1471 License Amendment- Final Radon Barrier Design for Small Tailings Pile

Dear Mr. Holonich:

Homestake Mining Company of California has reviewed the current radon barrier design in the October 1993 Reclamation Plan. We are now in the position to more accurately estimate remaining quantity of byproduct material that will be placed into the small tailing pile, thus allowing a more detailed characterization of the small pile. Attached is the Final Radon Barrier Design for the Small Tailing Pile. I request a license amendment to license condition number 37 B reflecting the redesign.

The same time I recommend a general license housekeeping. These would include the following recommended changes:

License Condition Number	Recommended Changes
13	Remove, same as L.C.# 10
18	Remove, current and future activities are for total site reclamation following the approved Oct. 1993 Reclamation Plan, no changes to tailings retention system
21	Replace the word "mill" with site.
23	Replace "operational process" and "operation" with reclamation
31	DP-339 has been incorporated into DP-200. So replace DP-339 with DP-200.
32 A.	Remove, since the mill buildings have been fully reclaimed
39	Remove " The NRC shall be notified by the license of any changes or revisions to the design. The license shall notify the NRC 30 days prior to start of filling the pond, at which time the NRC may choose to inspect the pond and construction records."

I request that the license be amended to reflect the above changes. Should you have any questions please call me at the Grants office.

Sincerely,

HOMESTAKE MINING COMPANY
OF CALIFORNIA

F. R. Craft
Resident Manager

Enclosures

xc: H. Barnes
R. A. Scarano(NRC) (CERTIFIED MAIL NO. P 369 600 946)

Final Radon Barrier Design for the Small Tailings Pile
Homestake Mining Company of California

Grants Project

License No. SUA-1471

April 1996

Prepared for:

Homestake Mining Company of California
Grants Project
P. O. Box 98
Grants, NM 87020

Prepared by:

Environmental Restoration Group, Inc.
and
AK GeoConsult Inc.

Contents

Executive Summary

Final Radon Barrier Design for the Small Tailings Pile
Homestake Mining Company of California

Homestake Mining Company of California (HMC) has completed reclamation of most of its Grants Project site in accordance with requirements of its license with the U.S. Nuclear Regulatory Commission (NRC). However, the small tailing pile, which contains Evaporation Pond #1 (EP1), will not be reclaimed until the ground water restoration program is finished and EP1 is no longer needed. Therefore, the design for the final radon barrier has been prepared on the basis of assumed conditions at the time of pond decommissioning and using methodologies and cover materials previously approved for the large tailing pile radon barrier design.

The small tailing pile, pentagonal in shape, holds EP1 and a contaminated soil disposal site, both of which sit atop tailings. EP1 occupies approximately the northern two-thirds of the pile, and the contaminated soil disposal area occupies the southern one-third of the pile. At decommissioning the EP1 basin will be the disposal location for pond residues and liners from other ponds, pipe from the ground water collection system, and other debris. After these materials have been placed, contaminated soil from the south end of the pile and sand tailings from the EP1 dikes will be used to fill the pond basin to the design grades.

The recontoured pile will then consist of two distinctly different parts - the filled EP1 basin and the southern contaminated soil area. The final recontoured pile will have the materials with the highest radium concentrations buried in the lowest levels of both parts of the pile. The southern part will be prepared for radon barrier placement by excavation of contaminated soil to create a surface that slopes to the northwest and northeast from a roughly north-south ridge line. The northern part will be prepared by fill placement, as described above, until the fill surface reaches the same planes as the final excavated surfaces of the southern part. The excavation-fill plan has been designed to result in not more than 20 pCi/m^2s radon flux from all surfaces of the recontoured top of the small pile. The radon barrier will be placed on these surfaces.

The radon barrier will be constructed of clay soil from the North Borrow Area, as defined in the 1993 revision of the reclamation plan and the large pile radon barrier design report. The barrier will consist of a lower layer of clay placed at 100% maximum Standard Proctor dry density, from 0.5 feet thick over the southern part of the pile to 1.7 feet thick over the EP1 area and 3.0 feet thick over the outslopes. The upper layer will be the same clay soil compacted to 95 % maximum dry density and 1.5 feet thick over all pile surfaces. Freeze-thaw action is expected to expand the 1.5 foot top layer to 1.6 feet. The two-layer barrier is designed to limit radon flux to about 8.5 pCi/m^2s from the radon barrier on the southern part of the pile and about 20 pCi/m^2s from all other radon barrier surfaces.

The RAECOM model predictions of radon flux from the bare surface of the pile are very close to the actual radon flux measurements made on the pile surface. These results lend support to the values of parameters selected to characterize the tailings and contaminated soil and add confidence to the radon barrier design.

Final Radon Barrier Design for the Small Tailings Pile
Homestake Mining Company of California

1.0 Introduction

Homestake Mining Company of California (HMC) is currently decommissioning their Grants Uranium Mill site near Grants, New Mexico. The mill structures have been demolished and the mill area reclaimed according to the NRC-approved Reclamation Plan (HMC, 1993). A Uranium Mill Decommissioning Report (HMC, 1996) has been submitted to the U. S. Nuclear Regulatory Commission (NRC).

The final design for the Large Tailings Pile (LTP) was approved by the NRC (NRC, 1995) based on a new radon barrier design submitted by HMC in June 1995 (HMC, 1995). The data and approach that led to the final design of the LTP has been used in this report to prepare a new design for the Small Tailings Pile (STP).

Windblown contaminated soils have been removed and incorporated in the LTP and the STP. Much of the work in remediating the LTP has been completed.

Figure 1-1 shows the mill site, including the STP, as it is in early 1996. The Large Tailings Pile currently has radon barrier and an erosion protection layer placed on the side slopes according to the NRC-approved reclamation plan. The top of the pile has an interim cover and is awaiting final settlement before radon barrier placement. Evaporation Pond No. 1 (EP1) was built on the small tailings pile. The new Evaporation Pond No. 2 (EP2) was constructed in the spring of 1995 in native soil adjacent to the STP.

Areas of the site currently used for activities associated with the groundwater restoration project include the collection ponds and evaporation ponds. EP2 was placed on an area that had been decontaminated to meet the cleanup criteria. This pond along with the older collection ponds and EP1 will be decommissioned after the groundwater restoration project has been completed. All liners and contaminated residues and soils will be placed in EP1 on the small tailings pile. Upon decommissioning,

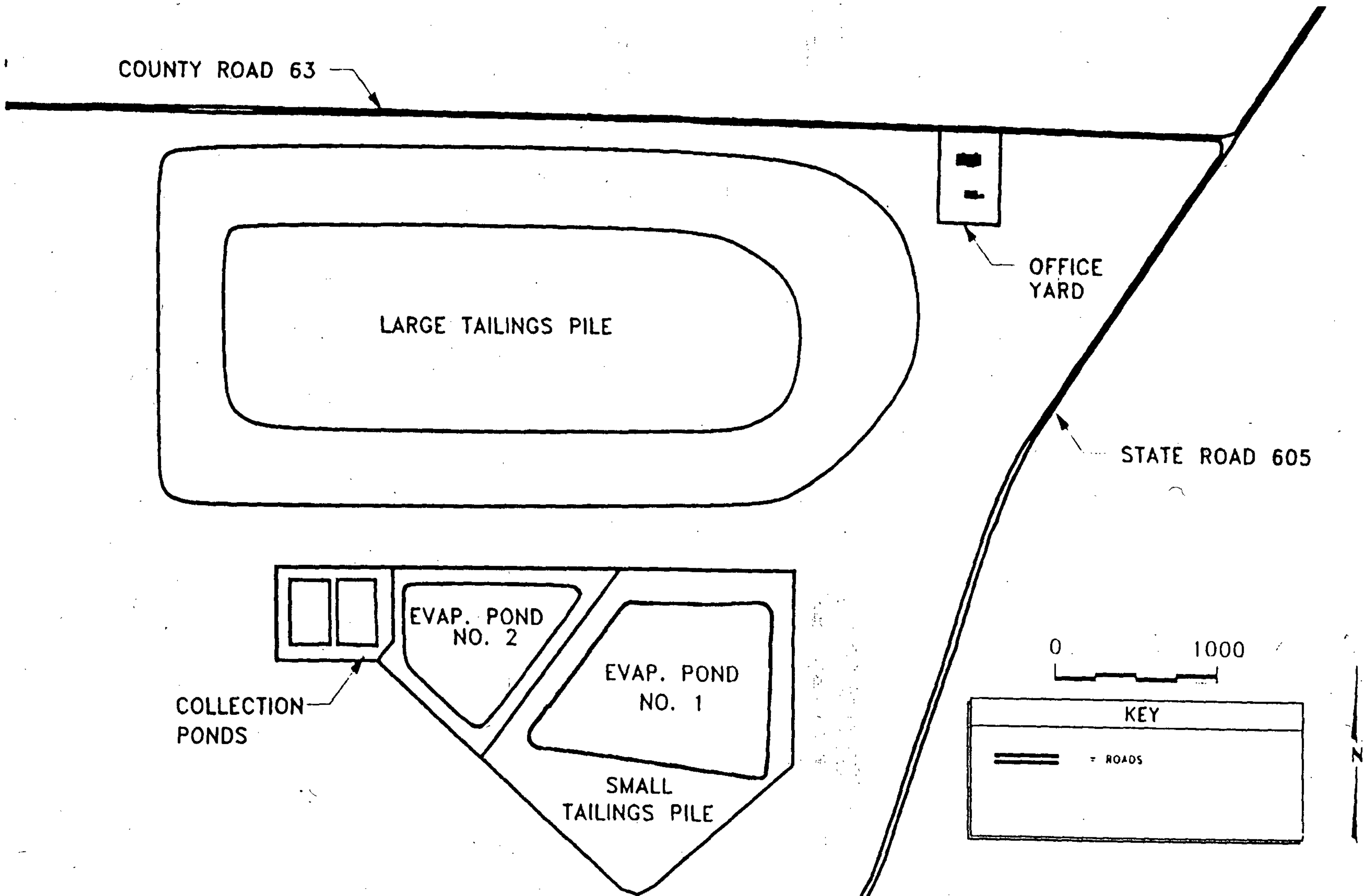

Figure 1-1 Homestake Mining Company Grants Project

Prepared By:
Anderson Engineering Co., Inc.
01-04-96 FIG1-1C.DWG

these off-pile areas will be resurveyed and verified as meeting the soil cleanup criteria. The STP will then be reclaimed according to 10 CFR Part 40, Appendix A.

2.0 Tailings and Radon Barrier Characterization

The STP was created by constructing a clay starter impoundment dike on the perimeter of the pile to contain the liquids. The height of this dike is approximately 12 feet on the south side and somewhat less on the northern portion of the pile. Tailings were discharged from the north end of the pile, where the larger particles (sands) were deposited. The slimes and liquids flowed to the south.

The tailings pile was characterized in 1989 prior to the construction of EP1 on the top of the pile. During the construction of the evaporation pond, some of the tailings sands were excavated from the north portion of the STP and used to construct containment dikes for the lined evaporation pond. All excess tailings sands were placed on the southern end of the STP. A plan view of the existing STP is shown in Figure 2-1.

2.1 Tailings Characterization

In 1989, the pile was characterized by pushing continuous sampling tubes at five locations. Lithologic logs were made and gravimetric and volumetric moisture contents and dry bulk densities were measured. Five composite samples of slimes and five composite samples of tailings sands were prepared for analysis for their radiological properties. The field logs, sampling locations, and laboratory data are included in Appendix A.

The measured Ra-226 concentrations and radon emanation coefficients are presented in Table 2-1. These and the other input parameters for the RAECOM model are listed in Table 2-2. The Ra-226 concentration averaged 408 pCi/g for the sand tailings and 732 pCi/g for the slime tailings. The measured radon emanation coefficients are somewhat troubling in that three out of the ten measurements exceed the theoretical maximum of 0.5 with the averages higher than typical default values. While probably conservative, HMC will use the values of 0.39 for the tailings sands and 0.47 for the tailings slimes.

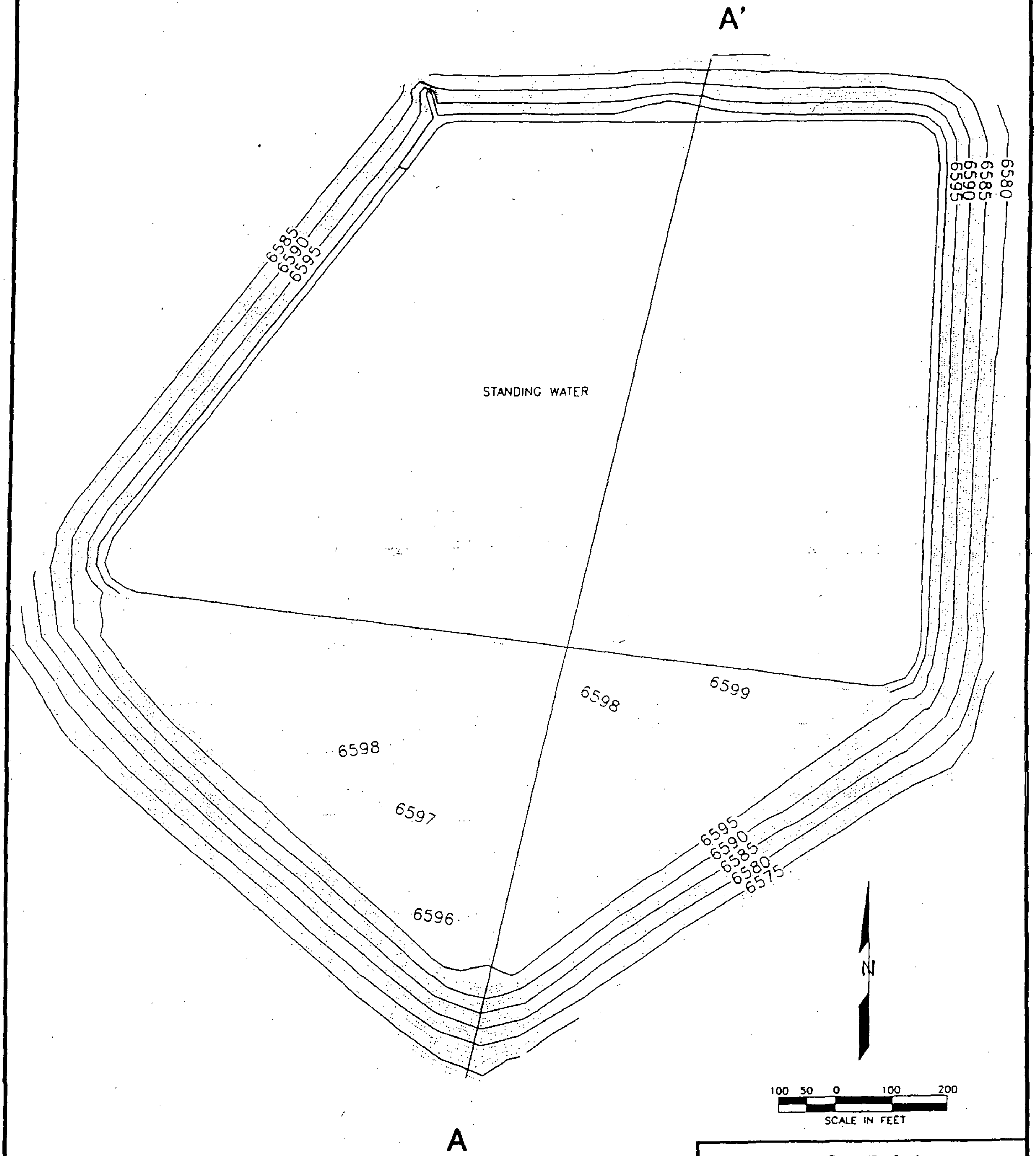

FIGURE 2-1

PLAN VIEW OF EXISTING SMALL TAILING PILE

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OF CALIFORNIA
GRANTS PROJECT

4/30/96

Table 2-1 Properties of Tailings in Small Tailings Pile

Sample I. D.	Ra-226 (pCi/g)	Rn Emanation Coeff.
Inactive Sand #1	455	0.52
Inactive Sand #2	557	0.31
Inactive Sand #3	419	0.36
Inactive Sand #4	250	0.38
Inactive Sand #5	359	0.40
Average	408	0.39
Standard Error	23	0.02

Sample I. D.	Ra-226 (pCi/g)	Rn Emanation Coeff.
Inactive Slime #1	602	0.56
Inactive Slime #2	545	0.48
Inactive Slime #3	776	0.48
Inactive Slime #4	767	0.51
Inactive Slime #5	969	0.32
Average	732	0.47
Standard Error	33	0.02

TABLE 2-2

SMALL TAILING PILE, HOMESTAKE GRANTS PROJECT -- COVER DESIGN MODEL INPUT PARAMETERS

MATERIAL	LOCATION OF SECTION								PROPERTIES					
	SOUTH TRIANGLE		SOUTH SIDE OF POND		NORTH SIDE OF POND		POND AREA OUTSLOPES			DRY DENSITY	ACTIVITY	E	MOISTURE	DIFFUSION
	LAYER #	THICKNESS cm	LAYER #	THICKNESS cm	LAYER #	THICKNESS cm	LAYER #	THICKNESS cm	POROSITY	g/cc	pCi/g		w%	COEFFICIENT cm^2/s
RADON BARRIER, 95% MDD	5	48.5	6	48.5	6	48.5	4	48.5	0.475	1.42	0	0.35	15.5	0.0138
RADON BARRIER, 100% MDD	4	15	5	51.2	5	51.2	3	88.9	0.412	1.59	0	0.35	15.5	0.006
INTERIM COVER							2	45.7	0.32	1.80	0	0.35	8	0.0129
CONTAMINATED SOIL	3	366	4	152	4	152			0.40	1.60	6	0.34	8	0.0236
EP2 AND COLLECTION POND LINERS														
TAILING SAND			3	152	3	152			0.40	1.60	408	0.39	8	0.03
PIPE, POND SLUDGE,TAILING SLURRY			2	44	2	44			0.3	1.75	55	0.35	11	0.0083
EP1 LINER														
TAILING SAND	2	122	1	274	1	152	1	305	0.44	1.49	408	0.39	8	0.03
TAILING SLIMES	1	213							0.55	1.19	732	0.47	13	0.0317
NATURAL GROUND	0		0		0									
EXIT FLUX FROM RADON BARRIER, pCi/m^2 s		**8.52**		**20**		**20**		**20**						

The measured physical parameters for the sands in the Large Tailings Pile were adopted for the STP since the ore and milling techniques were identical and a larger data base exists for the LTP. A density of 1.49 g/cc, porosity of 0.44, long-term moisture of 8 percent, and a diffusion coefficient of 0.03 cm^2/s were used in the radon flux calculational model. The density of 1.49 g/cc compares well to the density derived from sampling the small pile. In the previous STP design (HMC, 1993), a density of 1.54 g/cc was used based on the measurements.

For the slimes portion of the STP, the data shown in Appendix A support the density of 1.19 g/cc and porosity of 0.55 as previously used in HMC, 1993. A more conservative long-term moisture content of 13 percent was used in these calculations. The diffusion coefficient of 0.0317 cm^2/g was calculated using the empirical relationship in NUREG/CR-3533 (NRC,1994). Since the slimes are deeply placed in the STP, these parameters are not of great significance in modeling the flux from the pile.

Upon decommissioning of EP1, the pipe, pumps and other solid debris as well as pond residues will be placed on top of the EP1 liner for burial. In order to estimate the radon source term for the debris layer, a study was done to determine the current residues in EP1 after five years operation. The residues are a mixture of carbonate and sulfate salt precipitates from the pond water, windblown sediment, and remains of algae and other flora that grow in the pond. It was discovered that less than 0.25 feet of residues currently exist. Five samples were taken and analyzed for Ra-226 using HMC's on-site gamma-ray spectrometer. The samples averaged 55 pCi/g Ra-226. Based on this rate of residue accumulation, the total thickness of the residue layer in each pond will be 1.0 to 1.5 feet, as shown in Table 2-3. As part of decommissioning and reclamation of the ponds, the residues of the collection ponds and EP2 will be placed in EP1. Calculations summarized on Table 2-3 show that the total thickness of these dewatered and compacted residues is expected to be about 1.5 feet.

Table 2-3 also includes the calculation of volumes of pipe to be placed in EP1 for burial as part of the debris layer. The solid volume of the pipe is very small compared to the total volume of the debris layer and can be conservatively disregarded in the radon flux calculations. The amount of tailing sand/ cement slurry needed to fill the pipe voids will also be small. Therefore, an assumed Ra-226 concentration of 55 pCi/g for the debris layer is conservative.

TABLE 2-3

PROPERTIES, VOLUMES, AND THICKNESSES OF POND RESIDUES AND PIPE DEBRIS

ESTIMATED PROPERTIES OF POND RESIDUE

Specific Gravity, g/cc	2.5
Porosity, Wet	0.40
Unit Weight, Dry, pcf	93.6
Unit Weight, Wet, pcf	118.6
Moisture Content, W%	27

POND RESIDUE AND THICKNESS	YRS.	RATE/YR ft/yr deposited	AREA acres	THICKNESS ft	VOLUME cy
EP1	20	0.05	23	1	37107
EP2	20	0.05	10	1	16152
COLLECTION PONDS	30	0.05	4	1.5	9722
		TOTAL WET VOLUME IN PLACE, CY =			62981

POND RESIDUE, REWORKED AND COMPACTED

Porosity	0.30
Unit Weight, Dry, pcf	109.2
Unit Weight, Moist, pcf	121.7
Moisture Content, W%	11
TOTAL COMPACTED VOLUME, CY =	53983
THICKNESS OF COMPACTED RESIDUE, FT =	1.45

VOLUME OF PIPE PLACED IN EP1

ASSUME 8" HDPE SDR 15.5 PIPE	OD, IN.	8.625
	ID, IN	7.513
	WALL, IN	0.556
	AREA, SF	0.10
	VOL/ FT	0.10

ESTIMATED TOTAL LENGTH OF PIPE	FT	52800	
ESTIMATED TOTAL VOLUME OF PIPE	CY	191	
CAPACITY/ ACRE, FT OF PIPE		60605	
CAPACITY /ACRE, CF PER 8.6 25" LAYER		31309 CF OR	1160 CY
VOL OF PIPE, ONE LAYER/ACRE		5932 CF OR	220 CY
VOL. OF VOID/ACRE IN ONE LAYER		25377 CF OR	940 CY

VOLUME OF PIPE IS SMALL FRACTION OF TOTAL RESIDUE LAYER ,
CAN BE DISREGARDED IN CALCULATION OF LAYER THICKNESS OR RADON FLUX.

2.2 Radon Barrier Characterization

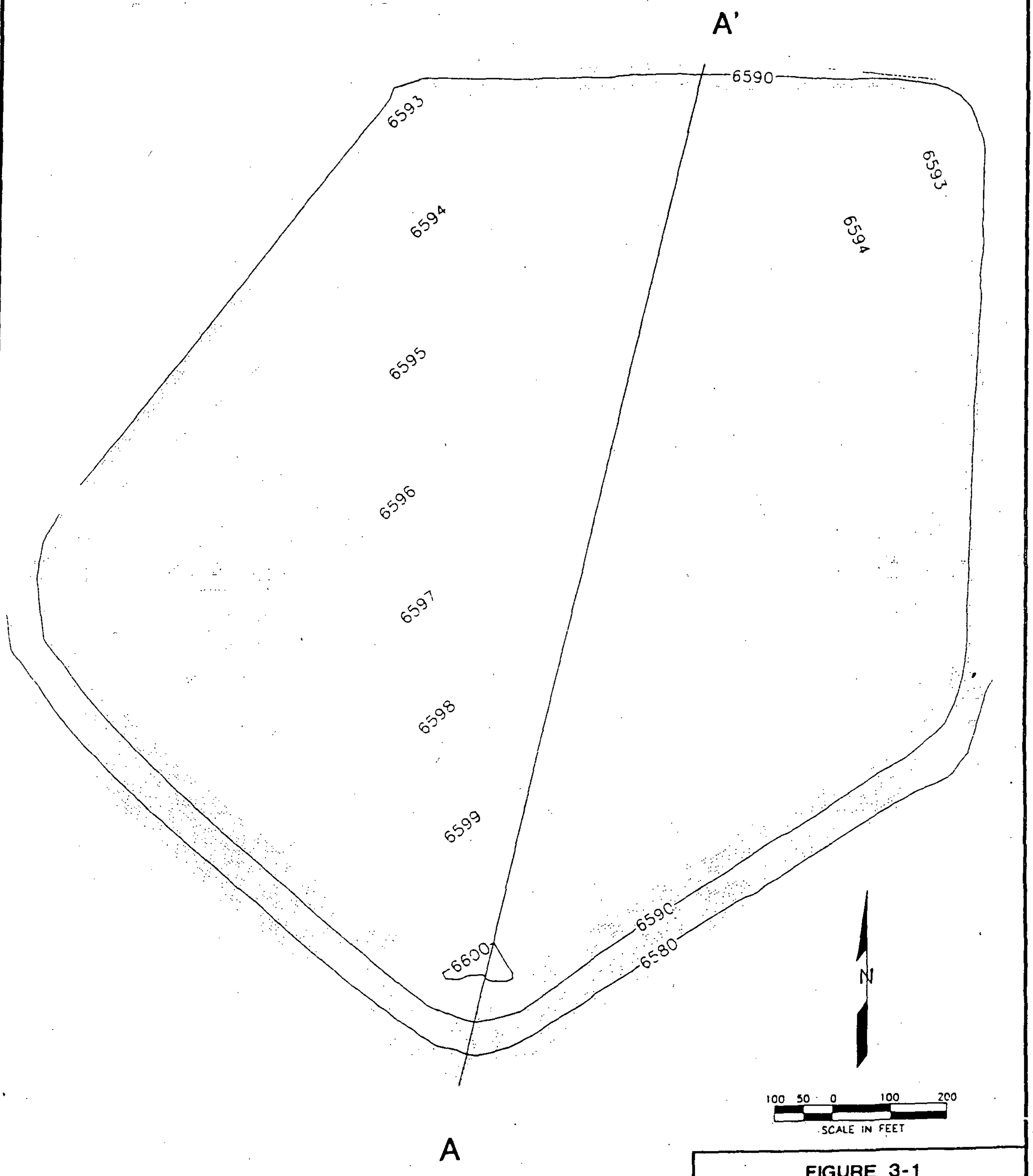
Extensive radon barrier studies were conducted to characterize the quantity and quality of local borrow materials for use as radon barrier. These materials have been used on the side slopes of the LTP. Additional borrow material has been identified for use in completing the reclamation of the LTP as well as to provide the radon barrier for the STP. The report, "Borrow Investigation" (HMC, 1994) has been submitted to the NRC. Samples of the materials taken in the borrow studies were submitted to Rogers and Associates Engineering Company for diffusion coefficient measurements. Measurements were made at densities and long-term moistures representative of the design conditions for the LTP. The data and further discussions can be found in the report, "Final Radon Barrier Design for the Large Tailings Pile" (HMC, 1995).

All borrow materials for constructing the radon barrier for the STP will come from the North Borrow Area. As indicated above, the North Borrow material has been extensively characterized. North Borrow parameters used in the LTP radon barrier design will be used in the calculations for the STP. The reader is directed to HMC, 1995 for additional information on the North Borrow parameters. A summary of the parameters used in the radon model code are presented in Table 2-2.

3.0 Final Radon Barrier Design for Small Tailings Pile

The final configuration of the STP will be established after the groundwater restoration is complete and the residues from the evaporation and collection ponds, the piping, and the other debris have been placed in EP1. The EP1 containment berms will then be excavated to the elevations shown on Figure 3-1 and placed within the evaporation pond directly over the pond residues and debris. Any additional off-pile contaminated soils discovered at that time will then be placed on the top of the debris. Final contouring will be achieved by moving the contaminated soil from the south triangle of the small pile and placing it in the EP1 pond basin until the desired slope, shown in Figure 3-1, is attained.

Figure 3-1 shows the plan view of the final configuration of the STP. A typical north-south cross section is shown in Figure 3-2. The northern portion of the pile shows the absence of tailings slimes since they naturally drained to the south end of the pile. All visible slimes were excavated and placed in the south portion of the pile at the time that EP1 was constructed. The layer of debris will be made up



NOTES

1. CONTOURS DEPICT FINAL COVERED PILE SURFACE INCLUDING RADON BARRIER, BEDDING, AND ROCK.

2. CONTOURS MAY VARY DEPENDING ON ACTUAL EARTHWORK VOLUMES.

4/30/96

FIGURE 3-1

PLAN VIEW DESIGN OF RECONTOURED SURFACE SMALL TAILING PILE

HOMESTAKE MINING COMPANY OF CALIFORNIA GRANTS PROJECT of a mixture of evaporation pond residues, pipe and other debris, and the excess evaporation pond berm material which is assumed to be tailings sands. The layer above this is made up of any additional off-pile windblown and contaminated soils moved from the top surface of the southern portion of the STP.

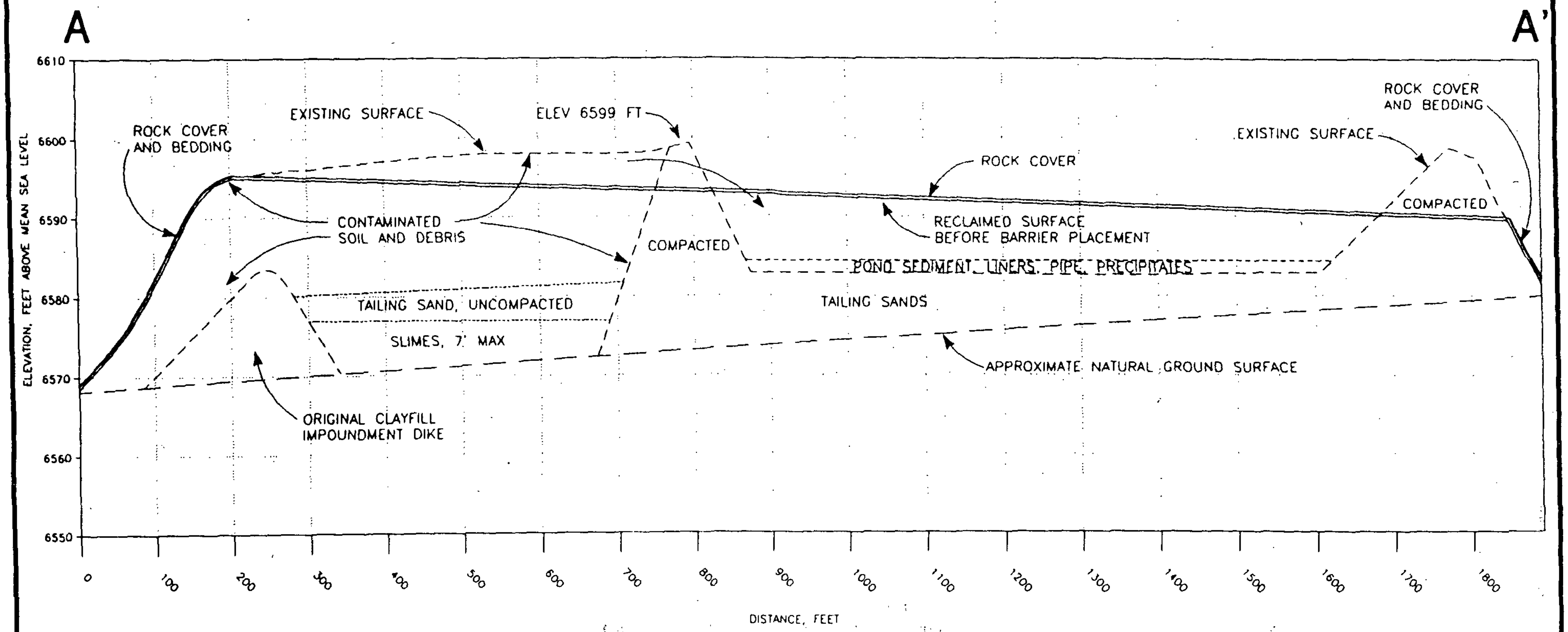
The southern portion of the STP consists of a slimes tailings layer, a sands tailings layer, and a thick layer of windblown contaminated soils. This windblown contaminated material currently exists and resulted from the cleanup of the off-pile windblown contaminated areas. The average Ra-226 concentration for the windblown contaminated soils was measured to be 6 pCi/g. The data have been presented in HMC, 1995. The clay starter dike is shown on the southern portion of the cross section. Historical photos show a dike around the entire STP. The height of the dike generally decreases as the dike runs north.

Three radon flux models have been used to model the flux from the final configuration of the STP. The input parameters and results of these models are listed in Table 2-2. Models for the northern portion of the pile consist of the south side of the pond and the north side of the evaporation pond area and the associated side slopes. The triangular southern portion of the pile was modeled as one unit.

3.1 Northern Portion

The largest area of the northern portion of the STP will consist of the decommissioned EP1 which will have been filled with residues, debris, tailings sands and contaminated soil. This area has been calculated to be 1,331,000 square feet, exclusive of outslopes. The model for this area consists of a bottom tailings sands layer with maximum thickness of 9.0 feet. The next layer is 1.5 feet of a mixture of pond residue, pipe and other debris as well as tailings/cement slurry filling pipe voids. The third layer is tailing sand up to 5.0 feet thick ; derived from lowering the west, north and east dikes of EP1. The fourth layer is approximately 5.0 feet thick and is made up of off-pile contaminated soils and soils moved from the southern portion of the STP.

In order to reduce the flux to 20 pCi/m^2s, a two-layer radon barrier will be placed. Layer #5 will be a 1.7 foot (51.2 cm) layer of North Borrow material compacted to 100 percent Standard Proctor MDD will be applied. The top layer will be a 1.5 foot layer of North Borrow material placed at a compaction



10X VERTICAL EXAGGERATION

NOTE

SEE FIGURE 3-1 FOR LOCATION OF CROSS SECTION

FIGURE 3-2

CROSS SECTION DESIGN
OF RECONTOURED
SMALL TAILING PILE

HOMESTAKE MINING COMPANY
OF CALIFORNIA
GRANTS PROJECT

4/30/96

of 95 percent of MDD. The model predicts that at the long-term moisture content of 15.5 percent (dry weight basis), the flux will be 20 pCi/m^{2}s.

The side slopes of the northern portion of the STP have been constructed of a small clay containment dike followed by tailings sands. An interim cover averaging 1.5 feet thick currently exists to stabilize the tailings. No logs are available to better define the location or height of the clay starter dikes. Therefore, the existence of this dike has been ignored in the model. The area of the side slopes for the northern portion of the remediated pile has been estimated as 137,000 square feet. The model assumes the same properties for the interim cover as that approved by the NRC for the top of the LTP (HMC, 1995). This model shows that in order to reduce the flux on the side slopes to 20 pCi/m^{2}s, a 3.0 foot thick layer (89 cm) of North Borrow material compacted to 100 percent MDD, followed by a 1.5 foot layer of the same material placed at 95 percent MDD is required.

For the two models discussed above, an approach identical to that used in the LTP design was used where the top 1.5 feet of radon barrier were assumed to be degraded (expanded to 1.6 feet thickness) by freeze-thaw conditions. The results of the RAECOM models are contained in Appendix B.

3.2 Southern Portion

The southern portion of the pile is triangular in shape and has a top surface of 574,000 square feet and 300,000 square feet of side slopes. The cross section shows that the proximity of the tailings sands to the surface of the side slopes is similar to that of the top surface. Therefore this area was modeled as one area whose total surface area is 874,000 square feet.

The model consists of a bottom 7.0-foot thick layer of slimes followed by an average 4.0 foot thick layer of sands tailings. Currently, there are at least 16 feet of contaminated windblown material on the southern portion of the pile. After recontouring, 15 feet (south end) to 12 feet (north end) of contaminated soil will be left in place as the third layer. A highly compacted 0.5 foot layer of North Borrow radon barrier will be placed above the contaminated soil layer as the fourth layer. The properties at 100 percent maximum dry density have been used in the model. In order to protect this layer from freeze-thaw degradation, a 1.5 foot thick layer of North Borrow at 95 percent MDD will be placed as the fifth layer. The properties for the degraded material have been used in the model, including a slight increase (+0.1 feet) in thickness above the original 1.5 feet of clay actually placed.

The result of the model shows that under long-term moisture conditions, the radon flux from the southern portion of the STP will be 8.5 pCi/m^{2}s. The RAECOM run for this model is provided in Appendix B.

3.3 Conservatism in Design

The radon barrier design presented above limits each of the portions of the STP to the flux limit of 20 pCi/m^{2}s or below. The area-weighted-average flux for the pile is calculated as 15.7 pCi/m^{2}s which provides an additional margin of safety of 22 percent.

An indication of the accuracy of the model has been obtained from radon flux measurements made on the STP in August 1995 (Table 3-1 and Figure 3-3). Ten measurements were made on the outslopes of the northern portion of the pile which averaged 122 pCi/m^{2}s. The RAECOM code, when run without the two proposed radon barrier layers, predicted that the flux would be 218 pCi/m^{2}s. This, of course, assumed that the interim cover and tailings had a moisture of 8 percent. While HMC has no moisture data for the dike materials at that time, it is reasonable to assume that the moisture was near 8 percent. One explanation for the difference may have been the influence of the clay starter dike. While the difference cannot be explained with certainty, it is probable that the radon barrier design is overly conservative for this portion of the pile.

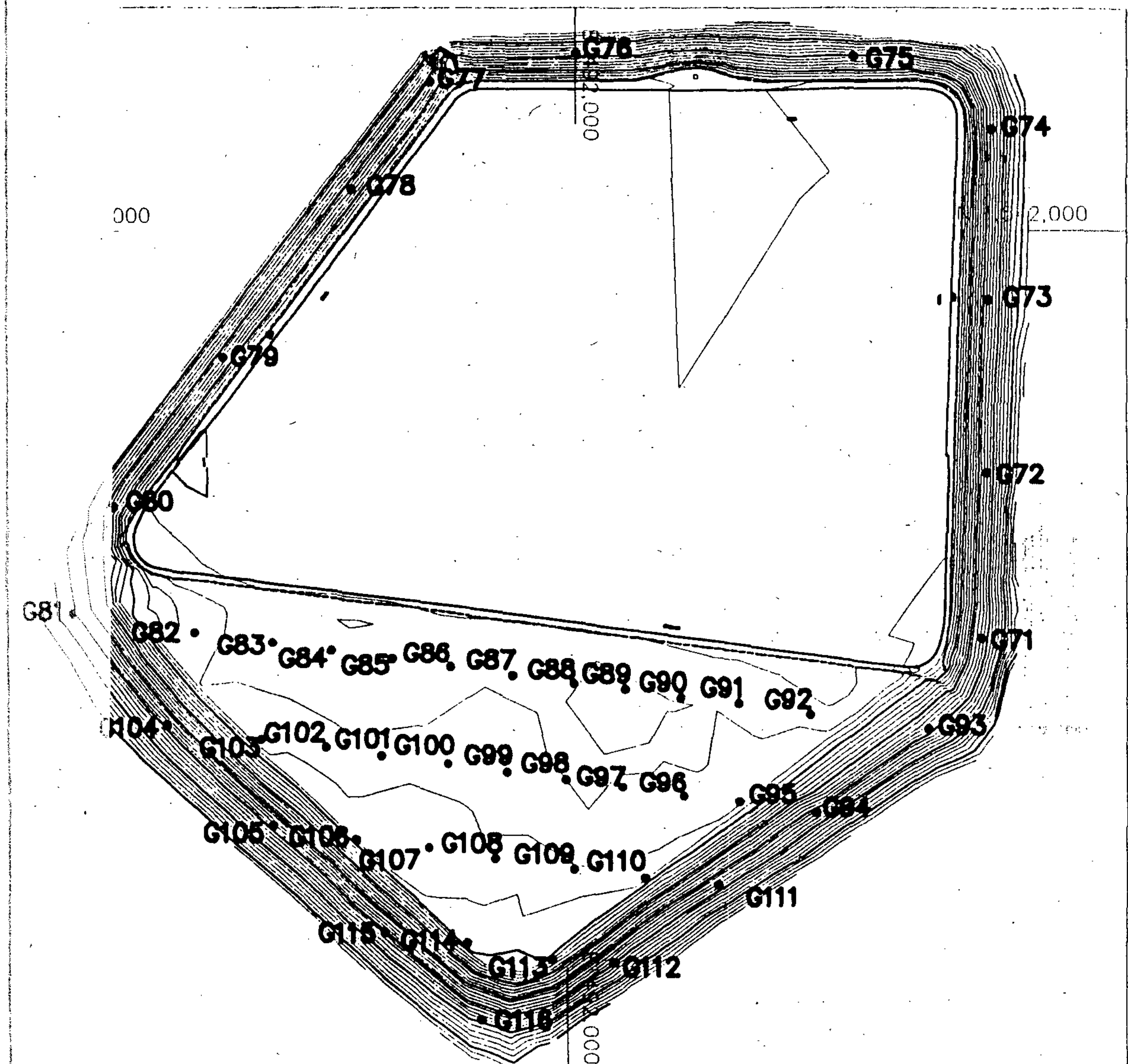
Thirty-six radon flux measurements were made at evenly spaced locations on the southern portion of the STP. The average measured radon flux was 8.6 pCi/m^{2}s. A RAECOM run for the model without radon barrier resulted in a calculated flux of 18 pCi/m^{2}s. Since the pile should be near long-term moisture conditions at the present time, the fact that these two numbers compare well indicates that the source term is fairly accurate and probably conservative. See Table 3-1, Radon Flux Measurements on Small Tailing Pile.

NOTES

1) The monument locations represent data points set in the field 9/93
2) Elevations on baselines are unadjusted, 3rd order (use for general reference only)

LEGEND

- Control Point
- Measurement monument (Cap with number)
- Monument Index Number (see coordinates)



Control Point Locations

	N	E	Elev
NW	1545137.3	488909.4	6587.67
NE	1545633.8	493107.5	6586.01
SE	1542710.6	493067.2	6581.57
SW	1542724.7	488800.4	6577.11
TC	1543925.8	490816.3	6675.09

NORTHING	EASTING	CAN#
1541275 000000	492730 000000	G71
1541570 000000	492740 000000	G72
1541880 000000	492745.000000	G73
1542180 000000	492750 000000	G74
1542310 000000	492500 000000	G75
1542315 000000	492000 000000	G76
1542265 000000	491740 000000	G77
1542075 000000	491600 000000	G78
1541780 000000	491370 000000	G79
1541510 000000	491170 000000	G80
1541320 000000	491095 000000	G81
1541288 000000	491315 000000	G82
1541270 000000	491455.000000	G83
1541255 000000	491560 000000	G84
1541240 000000	491670 000000	G85
1541225 000000	491775 000000	G86
1541210 000000	491885.000000	G87
1541195.000000	491995 000000	G88
1541185 000000	492085.000000	G89
1541170 000000	492185 000000	G90
1541160.000000	492290 000000	G91
1541140 000000	492420.000000	G92
1541115.000000	492635 000000	G93
1540965 000000	492430 000000	G94
1540985 000000	492290 000000	G95
1540995.000000	492190 000000	G96
1541012 000000	492080.000000	G97
1541025 000000	491980 000000	G98
1541040 000000	491875 000000	G99
1541055 000000	491770 000000	G100
1541070 000000	491650 000000	G101
1541085 000000	491550 000000	G102
1541100 000000	491435 000000	G103
1541125 000000	491265 000000	G104
1540945 000000	491455 000000	G105
1540920 000000	491605 000000	G106
1540905 000000	491735 000000	G107
1540885 000000	491855 000000	G108
1540865 000000	491995 000000	G109
1540850 000000	492120 000000	G110
1540837 000000	492252 000000	G111
1540700 000000	492065 000000	G112
1540705 000000	491955 000000	G113
1540735.000000	491805 000000	G114
1540755 000000	491655.000000	G115
1540600 000000	491830 000000	G116

N
NTS

RAD-FLUX.DWG 1/5/95

ISSUED FOR	REV. NO.	DATE	SIGNATURE
Review			
Approval			
Bid			
Construction			

COMMUNITY SCIENCES CORPORATION

LOCATION OF RADON FLUX CANISTERS

HOMESTAKE MINING COMPANY OF CALIFORNIA GRANTS OPERATION

Based on data (dwg 4152-3) prepared by: AA GeoConsult, Inc.

3-3 FLUX MEASUREMENT LOCATIONS ON THE SMALL TAILING PILE.

TABLE 3-1

RADON FLUX MEASUREMENTS ON SMALL TAILING PILE

OUTSLOPES OF NORTH PART OF SMALL TAILING PILE

LOCATION		FLUX pCi/m^2s
95 G	71	198.4
95 G	72	81.6
95 G	73	101.0
95 G	74	65.2
95 G	75	110.5
95 G	76	191.5
95 G	77	122.0
95 G	78	34.7
95 G	79	167.4
95 G	80	146.0
	AVERAGE	121.8

SOUTH PART OF SMALL TAILING PILE

LOCATION		FLUX pCi/m^2s
95 G	81	11.1
95 G	82	2.8
95 G	83	7.7
95 G	84	8.8
95 G	85	22.9
95 G	86	5.2
95 G	87	3.2
95 G	88	14.1
95 G	89	6.8
95 G	90	10.7
95 G	91	15.9
95 G	92	2.1
95 G	93	19.9
95 G	94	15.0
95 G	95	7.0
95 G	96	8.8
95 G	97	3.7
95 G	98	6.1
95 G	99	10.6
95 G	100	14.7
95 G	101	8.6
95 G	102	4.9
95 G	103	2.6
95 G	104	11.4
95 G	105	9.3
95 G	106	10.1
95 G	107	3.5
95 G	108	4.0
95 G	109	3.1
95 G	110	3.2
95 G	111	13.1
95 G	112	17.6
95 G	113	10.7
95 G	114	5.5
95 G	115	2.6
95 G	116	1.1
	AVERAGE	8.6

4.0 Environmental Influences on Radon Barrier

4.1 Freeze-Thaw Effects

The design for the LTP (HMC, 1995) addressed the freeze-thaw effects of radon barrier used from the North Borrow Area. The depth of frost penetration in the area has been estimated at 1.83 feet. Since at least 0.5 feet of rock will be applied to the top of the pile, HMC considered the top 1.5 foot layer of North Borrow radon barrier subject to degradation (volumetric expansion) from freeze-thaw effects. The NRC agreed with this approach where the porosity was increased by 8.0 percent. This resulted in an increase in the diffusion coefficient. A slight increase in the cover layer thickness was also calculated (45.7 cm to 48.6 cm) and used. HMC, however, did not take advantage of a small projected increase in the long-term moisture (15.5 percent to 17.2 percent). Further discussion of the freeze-thaw effects are presented in Section 6.0 of HMC, 1995.

4.2 Intrusion of Radon Barrier by Plants and Animals

Intrusion of the radon barrier by plants and animals is not considered to be a major concern for the HMC piles. This is discussed further in Section 6.0 of HMC, 1995.

5.0 References

HMC,1993 Reclamation Plan, Revision October 1993, Homestake Mining Company of California, Grants Operation, P. O. Box 98, Grants, New Mexico 87020. Prepared by AK GeoConsult., Inc. with Jenkins Environmental, Inc.

HMC,1994 Borrow Investigation, Homestake Mining Company of California, Grants Operation, P. O. Box 98, Grants, NM 87020. Prepared by Knight Piesold and Company.

HMC,1995 Final Radon Barrier Design for the Large Tailings Pile, June 1995, Homestake Mining Company of California, Grants Operation, P. O. Box 98, Grants, New Mexico 87020

HMC,1996 Uranium Mill Decommissioning Report, Homestake Mining Company of California, Grants Operation, P. O. Box 98, Grants, New Mexico 87020.

NRC, 1984 Radon Attenuation Handbook for Uranium Mill Tailings Cover Design, NUREG/CR-3533, 1984. U. S. Nuclear Regulatory Commission, Washington D.C. 20555

NRC,1995 License Amendment No. 22 to Radioactive Materials License SUA-1471, October 10, 1995, U. S. Nuclear Regulatory Commission, Washington D. C.

Appendix A

Small Tailings Pile Characterization Data

DANIEL B. STEPHENS & ASSOCIATES, INC.

CONSULTANTS IN GROUND-WATER HYDROLOGY ALBUQUERQUE, NEW MEXICO

LABORATORY ANALYSIS

OF

HYDRAULIC PROPERTIES OF

URANIUM MILL TAILINGS

FROM THE HOMESTAKE MINE

IN

GRANTS, NEW MEXICO

PREPARED FOR

AK GEOCONSULT, INC.

ALBUQUERQUE, NEW MEXICO

SEPTEMBER, 1989

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INTRODUCTION

Daniel B. Stephens & Associates, Inc. (DBS&A) was requested by Dr. Alan Kuhn of AK GeoConsult, Inc. to perform laboratory analysis for physical and hydraulic properties of tailing samples. The scope of work included conducting the following tasks:

1. Sample Preparation
2. Initial moisture content, dry bulk density and porosity
3. Moisture characteristics

SUMMARY

Tailings cores were collected by Dr. Allen Kuhn of AK Geoconsult, Inc. from the Homestake tailing pile in Grants, New Mexico. The tailings cores consisted of interbedded layers of sand, silts and slimes. The tailings were visually inspected through the 2.5 inch acrylic tubes, and sections of the core were selected for consolidation and/or moisture characteristics testing. Consolidation tests were performed by Vineyard and Associates, Inc. (V&A), whereas moisture retention characteristics were analyzed by DBS&A. Five of the consolidated samples were also analyzed for moisture characteristics.

The tailings cores were generally well intact upon arrival to the DBS&A laboratory; however, the tailings core diameter was slightly less than the inside diameter of the acrylic tubing. Due to the slight gap between the tailings core and tubing wall, the tailings were subsampled into 5.4 cm diameter by 3 cm brass cores. These tailings cores trimmed and weighed to obtain the initial moisture content. After weighing, the samples were placed into a water bath to satiate the samples. Satiation of the samples was deemed necessary to eliminate hysteresis of the moisture characteristics curve. During wetting, lead weights (approximately 200 grams each) were placed on the top of the sampling ring to prevent swelling of the tailings core samples.

The moisture characteristic data were generated using a ceramic pressure plate extractor. Pressures of 0, 0.33, and 15 bars were requested. Due to a pressure regulator malfunction during the first batch of samples testing, the actual pressure was slightly higher (0.48 bar) than the requested third of a bar pressure. Table 4 lists the applied pressure and the corresponding moisture contents for each sample.

The results were evaluated subjectively for consistency and reasonableness. Please note that in some cases the initial (field) moisture is greater than the moisture content at 0 bars (satiated moisture content). This is likely due to slight consolidation of the tailings sample by the lead weight overburden pressure during satiation. After the moisture characteristic analysis was complete, some samples decreased in height by as much as 0.5 cm. Laboratory data shown in Appendix B contains consolidation comments.

Two of the five consolidated samples had lower dry bulk densities than nearby unconsolidated samples. DBS&A believes the lower dry bulk densities are due to textural differences. Sample IP-1/T3/8.5-9.0/C and IP-2/T3/10.1-10.5/C bulk densities were calculated to be 1.20 g/cc and 1.08 g/cc, respectively. The adjacent unconsolidated dry bulk densities were both 1.46 g/cc. Visual inspection of these four tailings samples revealed that the unconsolidated samples have a silt/slime texture, whereas the consolidated samples exhibited a finer texture, more characteristic of slimes. Due to the difference in textural characteristics DBS&A

recommends that these samples are not used in the study of the consolidation effect of the moisture characteristic curves. The remaining three consolidated samples exhibited similar texture as the nearby unconsolidated samples.

DBS&A does not assume any responsibility for interpretations or analyses based on these data, nor can we guarantee that these results are representative of the actual materials at the field scale.

Table 1. Summary of Tests Performed

Sample No.	Initial Moisture Content	Dry Bulk Density	Porosity	Moisture Characteristics Pressure Plate
IP-1/T2/5.8-6	X	X	X	X
IP-1/T2/6.0-6.5/C*	X	X	X	X
IP-1/T3/7.6-7.8	X	X	X	X
IP-1/T3/7.8-8.3/C*	X	X	X	X
IP-1/T3/8.3-8.5	X	X	X	X
IP-1/T3/8.5-9.0/C*	X	X	X	X
IP-2/T3/10.1-10.5/C*	X	X	X	X
IP-2/T3/10.8-11.5	X	X	X	X
IP-2/T4/12.2-12.4	X	X	X	X
IP-2/T4/13.0-13.7/C*	X	X	X	X
IP-2/T4/13.7-14	X	X	X	X
IP-3/T2/5.9-6.1	X	X	X	X
IP-3/T3/7.7-7.9	X	X	X	X
IP-3/T5/12.8-13.6	X	X	X	X
IP-4/T2/7.9-8.3	X	X	X	X
IP-4/T3/12.2-12.5	X	X	X	X
IP-4/T4/15.4-15.8	X	X	X	X
IP-4/T5/16.9-17.3	X	X	X	X
IP-5/T2/7.5-7.8	X	X	X	X
IP-5/T3/12.9-13.2	X	X	X	X
IP-5/T6/22.1-22.4	X	X	X	X
IP-5/T7/25.8-26.5	X	X	X	X

/C* = Consolidation sample from Vineyard and Associates, Inc.

DANIEL B. STEPHENS & ASSOCIATES, INC.

Table 2. Summary of Sample Characteristics

Sample No.	Depth (ft)	Color	Texture	Comments
IP-1/T2/5.8-6.0	5.8-6.0	olive green and light olive	slime	saturated, moderately dense compaction
IP-1/T2/6.0-6.5/C	6.0-6.5	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-1/T3/7.6-7.8	7.6-7.8	olive green	slime	saturated, moderately dense compaction
IP-1/T3/7.8-8.3/C	7.8-8.3	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-1/T3/8.3-8.5	8.3-8.5	olive green	slime	saturated, moderately dense compaction
IP-1/T3/8.5-9.0/C	8.5-9.0	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-2/T3/10.1-10.5/C	10.1-10.5	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-2/T3/10.8-11.5	10.8-11.5	olive greenish brown with olive layers	silt	moist, moderately dense compaction
IP-2/T4/12.2-12.4	12.2-12.4	tan	sand	moist, moderately loose compaction, slightly remolded
IP-2/T4/13.0-13.7/C	13.0-13.7	brown	silty sand	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-2/T4/13.7-14.0	13.7-14	olive green	clay	saturated, moderately dense compaction, odor

Table 2. Summary of Sample Characteristics (continued)

Sample No.	Depth (ft)	Color	Texture	Comments
IP-3/T2/5.9-6.1	5.9-6.1	olive green brown mottled	silty sand	moist, moderately loose compaction, silty sand on bottom, sand on top, odor
IP-3/T3/7.7-7.9	7.7-7.9	olive green brown	sand	moist, dense compaction, strong odor
IP-3/T5/12.8-13.6	12.8-13.6	light brown	sand	damp, moderately loose compaction, odor
IP-4/T2/7.9-8.3	7.9-8.3	olive gray	silty sand	saturated, moderately dense compaction
IP-4/T3/12.2-12.5	12.2-12.5	olive gray and dark brown mottled	silty sand	saturated, moderately loose compaction, odor
IP-4/T4/15.4-15.8	15.4-15.8	olive gray	clayey silt	saturated, moderately dense compaction, odor
IP-4/T5/16.9-17.3	16.9-17.3	olive gray	clay w/silt a dark brown mottled	saturated, moderately dense compaction, odor
IP-5/T2/7.5-7.8	7.5-7.8	olive gray	silty sand	saturated, moderately dense compaction
IP-5/T3/12.9-13.2	12.9-13.2	light brown	sand	moist, moderately loose compaction
IP-5/T6/22.1-22.4	22.1-22.4	olive gray and gray mottled	silty sand	moist, moderately loose compaction
IP-5/T7/25.8-26.5	25.8-26.5	dark gray	clayey sand	saturated, moderately loose compaction, odor

Table 3. Summary of Initial Moisture Content, Dry Bulk Density, and Porosity

Sample No.	Initial Moisture Content Gravimetric (%g/g)	Initial Moisture Content Volumetric (%cm³/cm³)	Dry Bulk Density (g/cc)	Calculated Porosity (%)
IP-1/T2/5.8-6.0	60.40	64.21	1.06	59.89
IP-1/T2/6.0-6.5/C*	52.19	61.47	1.18	55.56
IP-1/T3/7.6-7.8	76.12	69.56	0.91	65.52
IP-1/T3/7.8-8.3/C*	59.43	77.72	1.31	50.66
IP-1/T3/8.3-8.5	31.98	46.65	1.46	44.95
IP-1/T3/8.5-9.0/C*	46.93	56.25	1.20	54.78
IP-2/T3/10.1-10.5/C*	54.09	58.58	1.08	59.13
IP-2/T3/10.8-11.5	24.87	36.35	1.46	44.85
IP-2/T4/12.2-12.4	9.76	12.84	1.32	50.33
IP-2/T4/13.0-13.7/C*	33.69	46.52	1.38	47.89
IP-2/T4/13.7-14.0	58.97	64.21	1.09	58.91
IP-3/T2/5.9-6.1	17.76	25.53	1.44	45.75
IP-3/T3/7.7-7.9	10.03	14.02	1.40	47.28
IP-3/T5/12.8-13.6	6.52	7.90	1.21	54.26
IP-4/T2/7.9-8.3	28.32	44.07	1.56	41.28
IP-4/T3/12.2-12.5	30.62	46.82	1.53	42.30
IP-4/T4/15.4-15.8	30.69	47.41	1.54	41.71
IP-4/T5/16.9-17.3	47.62	57.43	1.21	54.49
IP-5/T2/7.5-7.8	24.31	39.60	1.63	38.54
IP-5/T3/12.9-13.2	7.26	9.37	1.29	51.28
IP-5/T6/22.1-22.4	19.89	26.47	1.33	49.77
IP-5/T7/25.8-26.5	32.51	47.86	1.47	44.44

* Initial gravimetric and volumetric moisture contents of the consolidated samples are measured after the consolidated analysis was completed

Table 4. Summary of Moisture Characteristics

Sample No.	Pressure Head (-cm of water)	Moisture Content Gravimetric (% g/g)	Moisture Content Volumetric (% cm³/cm³)
IP-1/T2/5.8-6.0	0.0	58.41	62.09
	489.5	54.21	51.14
	15297.0	48.41	45.67
IP-1/T2/6.0-6.5/C*	0.0	52.19	61.47
	305.9	50.07	58.97
	15297.0	46.68	54.98
IP-1/T3/7.6-7.8	0.0	69.07	63.11
	489.5	58.88	53.80
	15297.0	47.09	43.03
IP-1/T3/7.8-8.3/C*	0.0	43.74	63.73
	305.9	43.94	57.46
	15297.0	40.43	52.87
IP-1/T3/8.3-8.5	0.0	28.69	41.86
	489.5	24.86	36.27
	15297.0	21.29	31.06
IP-1/T3/8.5-9.0/C*	0.0	46.93	56.25
	305.9	46.20	55.37
	15297.0	41.77	50.06
IP-2/T3/10.1-10.5/C*	0.0	54.09	58.58
	305.9	53.35	57.78
	15297.0	44.41	48.10
IP-2/T3/10.8-11.5	0.0	31.36	45.84
	489.5	19.73	28.83
	15297.0	9.59	14.01
IP-2/T4/12.2-12.4	0.0	36.19	47.64
	489.5	4.35	5.73
	15297.0	3.75	4.93
IP-2/T4/13.0-13.7/C*	0.0	33.69	46.52
	305.9	33.15	45.77
	15297.0	24.62	33.99
IP-2/T4/13.7-14.0	0.0	57.24	62.32
	489.5	52.95	57.65
	15297.0	49.55	53.95

/C* = Consolidation sample from Vineyard and Associates, Inc.

Load 1500 #/ft² ≈ 15' of core

Table 4. Summary of Moisture Characteristics (continued)

Sample No.	Pressure Head (-cm of water)	Moisture Content Gravimetric (% g/g)	Moisture Content Volumetric (% cm^3/cm^3)
IP-3/T2/5.9-6.1	0.0	29.85	42.91
	489.5	15.28	21.97
	15297.0	9.41	13.52
IP-3/T3/7.7-7.9	0.0	29.82	41.67
	489.5	7.96	11.12
	15297.0	5.23	7.31
IP-3/T5/12.8-13.6	0.0	39.86	48.32
	305.9	5.21	6.31
	15297.0	4.46	5.40
IP-4/T2/7.9-8.3	0.0	28.21	43.90
	305.9	25.18	39.18
	15297.0	18.21	28.34
IP-4/T3/12.2-12.5	0.0	29.03	44.39
	305.9	20.02	30.61
	15297.0	18.27	27.93
IP-4/T3/15.4-15.8	0.0	29.82	46.06
	305.9	20.16	31.14
	15297.0	13.92	21.50
IP-4/T5/16.9-17.3	0.0	48.14	58.05
	305.9	42.51	51.26
	15297.0	37.27	44.95
IP-5/T2/7.5-7.8	0.0	25.22	41.08
	305.9	22.37	36.44
	15297.0	14.29	23.28
IP-5/T3/12.9-13.2	0.0	37.25	48.09
	305.9	4.73	6.11
	15297.0	3.87	5.00
IP-5/T6/22.1-22.4	0.0	37.89	50.43
	305.9	15.18	20.21
	15297.0	14.24	18.95
IP-5/T7/25.8-26.5	0.0	32.86	48.39
	305.9	30.11	44.33
	15297.0	22.66	33.36

Appendix A: INITIAL MOISTURE CONTENT, DRY BULK DENSITY AND POROSITY

Summary of Initial Moisture Content, Dry Bulk Density, and Porosity

Sample No.	Initial Moisture Content Gravimetric (%g/g)	Initial Moisture Content Volumetric (%cm^3/cm^3)	Dry Bulk Density (g/cc)	Calculated Porosity (%)
IP-1/T2/5.8-6.0	60.40	64.21	1.06	59.89
IP-1/T2/6.0-6.5/C*	52.19	61.47	1.18	55.56
IP-1/T3/7.6-7.8	76.12	69.56	0.91	65.52
IP-1/T3/7.8-8.3/C*	59.43	77.72	1.31	50.66
IP-1/T3/8.3-8.5	31.98	46.65	1.46	44.95
IP-1/T3/8.5-9.0/C*	46.93	56.25	1.20	54.78
IP-2/T3/10.1-10.5/C*	54.09	58.58	1.08	59.13
IP-2/T3/10.8-11.5	24.87	36.35	1.46	44.85
IP-2/T4/12.2-12.4	9.76	12.84	1.32	50.33
IP-2/T4/13.0-13.7/C*	33.69	46.52	1.38	47.89
IP-2/T4/13.7-14.0	58.97	64.21	1.09	58.91
IP-3/T2/5.9-6.1	17.76	25.53	1.44	45.75
IP-3/T3/7.7-7.9	10.03	14.02	1.40	47.28
IP-3/T5/12.8-13.6	6.52	7.90	1.21	54.26
IP-4/T2/7.9-8.3	28.32	44.07	1.56	41.28
IP-4/T3/12.2-12.5	30.62	46.82	1.53	42.30
IP-4/T4/15.4-15.8	30.69	47.41	1.54	41.71
IP-4/T5/16.9-17.3	47.62	57.43	1.21	54.49
IP-5/T2/7.5-7.8	24.31	39.60	1.63	38.54
IP-5/T3/12.9-13.2	7.26	9.37	1.29	51.28
IP-5/T6/22.1-22.4	19.89	26.47	1.33	49.77
IP-5/T7/25.8-26.5	32.51	47.86	1.47	44.44

* Initial gravimetric and volumetric moisture contents of the consolidated samples are measured after the consolidated analysis was completed

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-1/T2/5.8-6
RING NUMBER:	#6 BRASS
DEPTH:	5.8-6 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	184.36 (g)
TARE WEIGHT, RING:	71.50 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	70.36 (g)
DRY BULK DENSITY:	1.06 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	59.89 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	64.21 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	60.40 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY:	L. Simpson
CALCULATIONS MADE BY:	L. Simpson
CHECKED BY:	E. Mattson

DATA FOR INITIAL MOISTURE CONTENT, BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T2/6.0-6.5
RING NUMBER: 3
DEPTH: 6.0-6.5

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	165.82 (g)
TARE WEIGHT, RING:	45.33 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	67.22 (cc)
DATE AND TIME INTO OVEN:	9/23/89
DATE AND TIME OUT OF OVEN:	9/25/89
DRY WEIGHT OF SAMPLE:	79.17 (g)
DRY BULK DENSITY:	1.18 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	55.56 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	61.47 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	52.19 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT, BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-1/T3/7.6-7.8
RING NUMBER:	#4 BRASS
DEPTH:	7.6-7.8 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	179.29 (g)
TARE WEIGHT, RING:	72.77 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	60.48 (g)
DRY BULK DENSITY:	0.91 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	65.52 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	69.56 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	76.12 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/7.8-8.3
RING NUMBER: 4
DEPTH: 7.8-8.3

FIELD WEIGHT OF SAMPLE (W/CAP AND RING): 171.77 (g)
TARE WEIGHT, RING: 46.87 (g)
TARE WEIGHT, PAN: 0.00 (g)
SAMPLE VOLUME: 59.91 (cc)
DATE AND TIME INTO OVEN: 9/23/89
DATE AND TIME OUT OF OVEN: 9/25/89

DRY WEIGHT OF SAMPLE: 78.34 (g)
DRY BULK DENSITY: 1.31 (g/cc)
PARTICLE DENSITY: 2.65 (g/cc)
(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY: 50.66 (% vol)

INITIAL MOISTURE CONTENT (VOLUMETRIC): 77.72 (% vol)

INITIAL MOISTURE CONTENT (GRAVIMETRIC): 59.43 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-1/T3/8.3-8.5
RING NUMBER:	#5 BRASS
DEPTH:	8.3-8.5 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	200.79 (g)
TARE WEIGHT, RING:	73.35 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	96.56 (g)
DRY BULK DENSITY:	1.46 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	44.95 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	46.65 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	31.98 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/8.5-9.0
RING NUMBER: 2
DEPTH: 8.5-9.0

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	163.84	(g)
TARE WEIGHT, RING:	45.47	(g)
TARE WEIGHT, PAN:	0.00	(g)
SAMPLE VOLUME:	67.22	(cc)
DATE AND TIME INTO OVEN:	9/23/89	
DATE AND TIME OUT OF OVEN:	9/25/89	
DRY WEIGHT OF SAMPLE:	80.56	(g)
DRY BULK DENSITY:	1.20	(g/cc)
PARTICLE DENSITY:	2.65	(g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	54.76	(% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	56.25	(% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	46.93	(%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-2/T3/10.1-10.5
RING NUMBER:	1
DEPTH:	10.1-10.5

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	160.23	(g)
TARE WEIGHT, RING:	43.18	(g)
TARE WEIGHT, PAN:	0.00	(g)
SAMPLE VOLUME:	70.14	(cc)
DATE AND TIME INTO OVEN:	9/23/89	
DATE AND TIME OUT OF OVEN:	9/25/89	
DRY WEIGHT OF SAMPLE:	75.96	(g)
DRY BULK DENSITY:	1.08	(g/cc)
PARTICLE DENSITY:	2.65	(g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	59.13	(% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	58.58	(% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	54.09	(%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT, BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-2/T3/10.8-11.5
RING NUMBER:	#1 BRASS
DEPTH:	10.8-11.5 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	194.38 (g)
TARE WEIGHT, RING:	73.58 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	96.74 (g)
DRY BULK DENSITY:	1.46 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	44.85 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	36.35 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	24.87 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY:	L. Simpson
CALCULATIONS MADE BY:	L. Simpson
CHECKED BY:	E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-2/T4/12.2-12.4
RING NUMBER:	#9 BRASS
DEPTH:	12.2-12.4 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	169.01 (g)
TARE WEIGHT, RING:	73.39 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	87.12 (g)
DRY BULK DENSITY:	1.32 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	50.33 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	12.84 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	9.76 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/13.0-13.7
RING NUMBER: 5
DEPTH: 13.0-13.7

FIELD WEIGHT OF SAMPLE (W/CAP AND RING): 176.50 (g)
TARE WEIGHT, RING: 47.02 (g)
TARE WEIGHT, PAN: 0.00 (g)
SAMPLE VOLUME: 70.14 (cc)
DATE AND TIME INTO OVEN: 9/23/89
DATE AND TIME OUT OF OVEN: 9/25/89

DRY WEIGHT OF SAMPLE: 96.85 (g)
DRY BULK DENSITY: 1.38 (g/cc)
PARTICLE DENSITY: 2.65 (g/cc)
(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY: 47.89 (% vol)

INITIAL MOISTURE CONTENT (VOLUMETRIC): 46.52 (% vol)

INITIAL MOISTURE CONTENT (GRAVIMETRIC): 33.69 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/13.7-14
RING NUMBER: #11 BRASS
DEPTH: 13.7-14 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	188.14 (g)
TARE WEIGHT, RING:	73.57 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	72.07 (g)
DRY BULK DENSITY:	1.09 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	58.91 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	64.21 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	58.97 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-3/T2/5.9-6.1
RING NUMBER:	#17 BRASS
DEPTH:	5.9-6.1 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	184.96 (g)
TARE WEIGHT, RING:	72.91 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	95.15 (g)
DRY BULK DENSITY:	1.44 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	45.75 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	25.53 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	17.76 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-3/T3/7.7-7.9
RING NUMBER: #14 BRASS
DEPTH: 7.7-7.9 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	175.05 (g)
TARE WEIGHT, RING:	73.29 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	8/30/89 @ 1600
DATE AND TIME OUT OF OVEN:	9/1/89 @ 1045
DRY WEIGHT OF SAMPLE:	92.48 (g)
DRY BULK DENSITY:	1.40 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	47.28 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	14.02 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	10.03 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: L. Simpson
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-3/T5/12.8-13.6
RING NUMBER: #19 BRASS
DEPTH: 12.8-13.6 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	158.19 (g)
TARE WEIGHT, RING:	72.73 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	80.23 (g)
DRY BULK DENSITY:	1.21 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	54.26 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	7.90 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	6.52 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-4/T2/7.9-8.3
RING NUMBER:	#7 BRASS
DEPTH:	7.9-8.3 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	204.92 (g)
TARE WEIGHT, RING:	72.76 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	102.99 (g)
DRY BULK DENSITY:	1.56 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	41.28 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	44.07 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	28.32 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-4/T3/12.2-12.5
RING NUMBER:	#8 BRASS
DEPTH:	12.2-12.5 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	205.50 (g)
TARE WEIGHT, RING:	73.31 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	101.20 (g)
DRY BULK DENSITY:	1.53 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	42.30 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	46.82 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	30.62 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-4/T4/15.4-15.8
RING NUMBER:	#11 BRASS
DEPTH:	15.4-15.8 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	207.18 (g)
TARE WEIGHT, RING:	73.56 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	102.24 (g)
DRY BULK DENSITY:	1.54 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	41.71 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	47.41 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	30.69 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T5/16.9-17.3
RING NUMBER: #12 BRASS
DEPTH: 16.9-17.3 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	190.79 (g)
TARE WEIGHT, RING:	72.96 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	79.82 (g)
DRY BULK DENSITY:	1.21 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	54.49 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	57.43 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	47.62 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-5/T2/7.5-7.8
RING NUMBER:	#18 BRASS
DEPTH:	7.5-7.8 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	207.39 (g)
TARE WEIGHT, RING:	73.37 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	107.81 (g)
DRY BULK DENSITY:	1.63 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	38.54 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	39.60 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	24.31 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-5/T3/12.9-13.2
RING NUMBER:	#14 BRASS
DEPTH:	12.9-13.2 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	164.93 (g)
TARE WEIGHT, RING:	73.28 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	85.45 (g)
DRY BULK DENSITY:	1.29 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	51.28 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	9.37 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	7.26 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-5/T6/22.1-22.4
RING NUMBER:	#15 BRASS
DEPTH:	22.1-22.4 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	178.48 (g)
TARE WEIGHT, RING:	72.86 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	88.10 (g)
DRY BULK DENSITY:	1.33 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	49.77 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	26.47 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	19.89 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATIONS MADE BY: L. Simpson
CHECKED BY: E. Mattson

DATA FOR INITIAL MOISTURE CONTENT,
BULK DENSITY, AND POROSITY

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-5/T7/25.8-26.5
RING NUMBER:	#4 BRASS
DEPTH:	25.8-26.5 FT.

FIELD WEIGHT OF SAMPLE (W/CAP AND RING):	201.88 (g)
TARE WEIGHT, RING:	72.74 (g)
TARE WEIGHT, PAN:	0.00 (g)
SAMPLE VOLUME:	66.19 (cc)
DATE AND TIME INTO OVEN:	9/19/89 @ 1500
DATE AND TIME OUT OF OVEN:	9/20/89 @ 1230
DRY WEIGHT OF SAMPLE:	97.46 (g)
DRY BULK DENSITY:	1.47 (g/cc)
PARTICLE DENSITY:	2.65 (g/cc)

(METHOD: ASSUME MEAN PARTICLE DENSITY = 2.65 g/cc)

CALCULATED POROSITY:	44.44 (% vol)
INITIAL MOISTURE CONTENT (VOLUMETRIC):	47.86 (% vol)
INITIAL MOISTURE CONTENT (GRAVIMETRIC):	32.51 (%)

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY:	S. Stoller
CALCULATIONS MADE BY:	L. Simpson
CHECKED BY:	E. Mattson

Appendix B: MOISTURE CHARACTERISTICS

Summary of Moisture Characteristics

Sample No.	Pressure Head (-cm of water)	Moisture Content Gravimetric (% g/g)	Moisture Content Volumetric (% cm³/cm³)
IP-1/T2/5.8-6.0	0.0	58.41	62.09
	489.5	54.21	51.14
	15297.0	48.41	45.67
IP-1/T2/6.0-6.5/C*	0.0	52.19	61.47
	305.9	50.07	58.97
	15297.0	46.68	54.98
IP-1/T3/7.6-7.8	0.0	69.07	63.11
	489.5	58.88	53.80
	15297.0	47.09	43.03
IP-1/T3/7.8-8.3/C*	0.0	48.74	63.73
	305.9	43.94	57.46
	15297.0	40.43	52.87
IP-1/T3/8.3-8.5	0.0	28.69	41.86
	489.5	24.86	36.27
	15297.0	21.29	31.06
IP-1/T3/8.5-9.0/C*	0.0	46.93	56.25
	305.9	46.20	55.37
	15297.0	41.77	50.06
IP-2/T3/10.1-10.5/C*	0.0	54.09	58.58
	305.9	53.35	57.78
	15297.0	44.41	48.10
IP-2/T3/10.8-11.5	0.0	31.36	45.84
	489.5	19.73	28.83
	15297.0	9.59	14.01
IP-2/T4/12.2-12.4	0.0	36.19	47.64
	489.5	4.35	5.73
	15297.0	3.75	4.93
IP-2/T4/13.0-13.7/C*	0.0	33.69	46.52
	305.9	33.15	45.77
	15297.0	24.62	33.99
IP-2/T4/13.7-14.0	0.0	57.24	62.32
	489.5	52.95	57.65
	15297.0	49.55	53.95

/C* = Consolidation sample from Vineyard and Associates, Inc.

Summary of Moisture Characteristics (continued)

Sample No.	Pressure Head (-cm of water)	Moisture Content Gravimetric (% g/g)	Moisture Content Volumetric (% cm^3/cm^3)
IP-3/T2/5.9-6.1	0.0	29.85	42.91
	489.5	15.28	21.97
	15297.0	9.41	13.52
IP-3/T3/7.7-7.9	0.0	29.82	41.67
	489.5	7.96	11.12
	15297.0	5.23	7.31
IP-3/T5/12.8-13.6	0.0	39.86	48.32
	305.9	5.21	6.31
	15297.0	4.46	5.40
IP-4/T2/7.9-8.3	0.0	28.21	43.90
	305.9	25.18	39.18
	15297.0	18.21	28.34
IP-4/T3/12.2-12.5	0.0	29.03	44.39
	305.9	20.02	30.61
	15297.0	18.27	27.93
IP-4/T3/15.4-15.8	0.0	29.82	46.06
	305.9	20.16	31.14
	15297.0	13.92	21.50
IP-4/T5/16.9-17.3	0.0	48.14	58.05
	305.9	42.51	51.26
	15297.0	37.27	44.95
IP-5/T2/7.5-7.8	0.0	25.22	41.08
	305.9	22.37	36.44
	15297.0	14.29	23.28
IP-5/T3/12.9-13.2	0.0	37.25	48.09
	305.9	4.73	6.11
	15297.0	3.87	5.00
IP-5/T6/22.1-22.4	0.0	37.89	50.43
	305.9	15.18	20.21
	15297.0	14.24	18.95
IP-5/T7/25.8-26.5	0.0	32.86	48.39
	305.9	30.11	44.33
	15297.0	22.66	33.36

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T2/5.8-6
RING NUMBER: #6 BRASS
DEPTH: 5.8-6 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 182.96 (g)
TARE RING: 71.50 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 70.36 (g)
SATURATED MOISTURE CONTENT: 62.09 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.10 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	182.96	--	--	--
8/26	1420	0.48	175.71	7.25	7.25	51.14
8/30	1545	15.00	172.09	3.62	10.87	45.67

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T2/6.0-6.5
RING NUMBER: 3
DEPTH: 6.0-6.5 FT.
SAMPLE VOLUME: 67.22 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 165.82 (g)
TARE RING: 45.33 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 79.17 (g)
SATURATED MOISTURE CONTENT: 61.47 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.32 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/15	1600	0.00	165.82	--	--	--
9/19	1115	0.30	164.14	1.68	1.68	58.97
9/23	945	15.00	161.46	2.68	4.36	54.98

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: K. Turnham
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/7.6-7.8
RING NUMBER: #4 BRASS
DEPTH: 7.6-7.8 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 175.02 (g)
TARE RING: 72.77 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 60.48 (g)
SATURATED MOISTURE CONTENT: 63.11 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.77 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	175.02	--	--	--
8/26	1420	0.48	168.86	6.16	6.16	53.80
8/30	1545	15.00	161.73	7.13	13.29	43.03

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/7.8-8.3
RING NUMBER: 4
DEPTH: 7.8-8.3 FT.
SAMPLE VOLUME: 73.06 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 171.77 (g)
TARE RING: 46.87 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 78.34 (g)
SATURATED MOISTURE CONTENT: 63.73 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 46.56 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/15	1600	0.00	171.77	--	--	--
9/19	1115	0.30	167.19	4.58	4.58	57.46
9/23	945	15.00	163.84	3.35	7.93	52.87

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: K. Turnham
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/8.3-8.5
RING NUMBER: #5 BRASS
DEPTH: 8.3-8.5 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 197.62 (g)
TARE RING: 73.35 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 96.56 (g)
SATURATED MOISTURE CONTENT: 41.86 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 27.71 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	197.62	--	--	--
8/26	1420	0.48	193.92	3.70	3.70	36.27
8/30	1545	15.00	190.47	3.45	7.15	31.06

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-1/T3/8.5-9.0
RING NUMBER: 2
DEPTH: 8.5-9.0 FT.
SAMPLE VOLUME: 67.22 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 163.84 (g)
TARE RING: 45.47 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 80.56 (g)
SATURATED MOISTURE CONTENT: 56.25 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 37.81 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/15	1600	0.00	163.84	--	--	--
9/19	1115	0.30	163.25	0.59	0.59	55.37
9/23	945	15.00	159.68	3.57	4.16	50.06

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: K. Turnahm
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T3/10.1-10.5
RING NUMBER: 1
DEPTH: 10.1-10.5 FT.
SAMPLE VOLUME: 70.14 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 160.23 (g)
TARE RING: 43.18 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 75.96 (g)
SATURATED MOISTURE CONTENT: 58.58 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.09 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/15	1600	0.00	160.23	--	--	--
9/19	1115	0.30	159.67	0.56	0.56	57.78
9/23	945	15.00	152.88	6.79	7.35	48.10

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: K. Turnham
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T3/10.8-11.5
RING NUMBER: #1 BRASS
DEPTH: 10.8-11.5 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 200.66 (g)
TARE RING: 73.58 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 96.74 (g)
SATURATED MOISTURE CONTENT: 45.84 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 30.34 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	200.66	--	--	--
8/26	1420	0.48	189.40	11.26	11.26	28.83
8/30	1545	15.00	179.59	9.81	21.07	14.01

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/12.2-12.4
RING NUMBER: #9 BRASS
DEPTH: 12.2-12.4 FT.
SAMPLE VOLUME: 66.19 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP AND RING):	192.04	(g)
TARE RING:	73.39	(g)
TARE CAP:	0.00	(g)
DRY WEIGHT OF SAMPLE:	87.12	(g)
SATURATED MOISTURE CONTENT:	47.64	(% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	31.53	(cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	192.04	--	--	--
8/26	1420	0.48	164.30	27.74	27.74	5.73
8/30	1545	15.00	163.77	0.53	28.27	4.93

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/13.0-13.7
RING NUMBER: 5
DEPTH: 13.0-13.7 FT.
SAMPLE VOLUME: 70.14 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 176.50 (g)
TARE RING: 47.02 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 96.85 (g)
SATURATED MOISTURE CONTENT: 46.52 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 32.63 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/15	1600	0.00	176.50	--	--	--
9/19	1115	0.30	175.97	0.53	0.53	45.77
9/23	945	15.00	167.71	8.26	8.79	33.99

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: K. Turnham
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/13.7-14
RING NUMBER: #11 BRASS
DEPTH: 13.7-14 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 186.89 (g)
TARE RING: 73.57 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 72.07 (g)
SATURATED MOISTURE CONTENT: 62.32 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.25 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	186.89	--	--	--
8/26	1420	0.48	183.80	3.09	3.09	57.65
8/30	1545	15.00	181.35	2.45	5.54	53.95

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-3/T2/5.9-6.1
RING NUMBER: #17 BRASS
DEPTH: 5.9-6.1 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 196.46 (g)
TARE RING: 72.91 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 95.15 (g)
SATURATED MOISTURE CONTENT: 42.91 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 28.40 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	196.46	--	--	--
8/26	1420	0.48	182.60	13.86	13.86	21.97
8/30	1545	15.00	177.01	5.59	19.45	13.52

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-3/T3/7.7-7.9
RING NUMBER: #14 BRASS
DEPTH: 7.7-7.9 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 193.35 (g)
TARE RING: 73.29 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 92.48 (g)
SATURATED MOISTURE CONTENT: 41.67 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 27.58 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
8/22	1830	0.00	193.35	--	--	--
8/26	1420	0.48	173.13	20.22	20.22	11.12
8/30	1545	15.00	170.61	2.52	22.74	7.31

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-3/T5/12.8-13.6
RING NUMBER: #19 BRASS
DEPTH: 12.8-13.6 FT.
SAMPLE VOLUME: 55.15 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP AND RING): 179.61 (g)
TARE RING: 72.73 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 80.23 (g)
SATURATED MOISTURE CONTENT: 48.32 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 26.65 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	179.61	--	--	--
9/15	1500	0.30	156.44	23.17	23.17	6.31
9/19	1030	15.00	155.94	0.50	23.67	5.40

COMMENTS: Sample was full in ring at time of sample preparation, but was 0.5 cm less in height at time of saturated weight.

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME:	HOMESTAKE
JOB NUMBER:	89-L-100
SAMPLE NUMBER:	IP-4/T2/7.9-8.3
RING NUMBER:	#7 BRASS
DEPTH:	7.9-8.3 FT.
SAMPLE VOLUME:	66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION (WITH CAP AND RING):	204.81 (g)
TARE RING:	72.76 (g)
TARE CAP:	0.00 (g)
DRY WEIGHT OF SAMPLE:	102.99 (g)
SATURATED MOISTURE CONTENT:	43.90 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	29.06 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	204.81	--	--	--
9/15	1500	0.30	201.68	3.13	3.13	39.18
9/19	1030	15.00	194.51	7.17	10.30	28.34

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T3/12.2-12.5
RING NUMBER: #8 BRASS
DEPTH: 12.2-12.5 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 203.89 (g)
TARE RING: 73.31 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 101.20 (g)
SATURATED MOISTURE CONTENT: 44.39 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 29.38 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	203.89	--	--	--
9/15	1500	0.30	194.77	9.12	9.12	30.61
9/19	1030	15.00	193.00	1.77	10.89	27.93

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T4/15.4-15.8
RING NUMBER: #11 BRASS
DEPTH: 15.4-15.8 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 206.29 (g)
TARE RING: 73.56 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 102.24 (g)
SATURATED MOISTURE CONTENT: 46.06 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 30.49 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	206.29	--	--	--
9/15	1500	0.30	196.41	9.88	9.88	31.14
9/19	1030	15.00	190.03	6.38	16.26	21.50

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T5/16.9-17.3
RING NUMBER: #12 BRASS
DEPTH: 16.9-17.3 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 191.20 (g)
TARE RING: 72.96 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 79.82 (g)
SATURATED MOISTURE CONTENT: 58.05 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 38.42 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	191.20	--	--	--
9/15	1500	0.30	186.71	4.49	4.49	51.26
9/19	1030	15.00	182.53	4.18	8.67	44.95

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-5/T2/7.5-7.8
RING NUMBER: #18 BRASS
DEPTH: 7.5-7.8 FT.
SAMPLE VOLUME: 66.19 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP AND RING):	208.37	(g)
TARE RING:	73.37	(g)
TARE CAP:	0.00	(g)
DRY WEIGHT OF SAMPLE:	107.81	(g)
SATURATED MOISTURE CONTENT:	41.08	(% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	27.19	(cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	208.37	--	--	--
9/15	1500	0.30	205.30	3.07	3.07	36.44
9/19	1030	15.00	196.59	8.71	11.78	23.28

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-5/T3/12.9-13.2
RING NUMBER: #14 BRASS
DEPTH: 12.9-13.2 FT.
SAMPLE VOLUME: 59.57 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP AND RING):	187.38	(g)
TARE RING:	73.28	(g)
TARE CAP:	0.00	(g)
DRY WEIGHT OF SAMPLE:	85.45	(g)
SATURATED MOISTURE CONTENT:	48.09	(% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	28.65	(cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	187.38	--	--	--
9/15	1500	0.30	162.37	25.01	25.01	6.11
9/19	1030	15.00	161.71	0.66	25.67	5.00

COMMENTS: Sample was full in ring at time of sample preparation, but was 0.3 cm less in height at time of saturated weight.

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-5/T6/22.1-22.4
RING NUMBER: #15 BRASS
DEPTH: 22.1-22.4 FT.
SAMPLE VOLUME: 59.57 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 191.00 (g)
TARE RING: 72.86 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 88.10 (g)
SATURATED MOISTURE CONTENT: 50.43 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 30.04 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	191.00	--	--	--
9/15	1500	0.30	173.00	18.00	18.00	20.21
9/19	1030	15.00	172.25	0.75	18.75	18.95

COMMENTS: Sample was full in ring at time of sample preparation, but was 0.3 cm less in height at time of saturated weight.

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-5/T7/25.8-26.5
RING NUMBER: #4 BRASS
DEPTH: 25.8-26.5 FT.
SAMPLE VOLUME: 66.19 (cc)
SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 202.23 (g)
TARE RING: 72.74 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 97.46 (g)
SATURATED MOISTURE CONTENT: 48.39 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 32.03 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
9/11	1430	0.00	202.23	--	--	--
9/15	1500	0.30	199.54	2.69	2.69	44.33
9/19	1030	15.00	192.28	7.26	9.95	33.36

COMMENTS:

LABORATORY ANALYSIS PERFORMED BY: S. Stoller
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

Appendix C: LABORATORY METHODS

INITIAL MOISTURE CONTENT

(Oven Drying Method)

Method

Methods and procedures outlined under ASTM standard D2216-80 are followed to determine the moisture content of a soil by the oven drying method. The oven drying method does not give true representative results for materials containing significant amounts of halloysite, montmorillonite, or gypsum minerals; highly organic soils; or materials in which the pore water contains dissolved solids.

Laboratory Procedure

To prepare disturbed samples, a sample is selected from the material after it has been thoroughly mixed. The mass of the selected sample follows the guidelines in Table 1.

To prepare core samples, different procedures for cohesionless and cohesive soils must be followed. For cohesionless soils, the material is mixed thoroughly and a sample with a mass in accordance with Table 1 is selected. For cohesive soils, about 3mm of material is removed from the exposed ends, and the remaining sample is sliced lengthwise to check if the sample is layered. If the sample is layered, then an average portion, is selected.

TABLE 1. Test Specimen Masses

Sieve Retaining Not More Than About 10% of Sample	Recommended Mass of Moist Specimen (g)
2.00 mm (No. 10)	100 to 200
4.75 mm (No. 4)	300 to 500
19.00 mm (3/4 in.)	500 to 1000

The moist sample is placed in a dry container of known mass. The masses of the sample and of the container are determined and recorded. The sample and the container are placed in a drying oven maintained at 110° ± 5° C and dried to a constant mass. The time required to obtain a constant mass will vary depending on the type of material, the size of the specimen, and the oven type and capacity. Weights are recorded on a daily basis, but, in most cases, drying a test specimen over night (about 24 hours) is sufficient.

Calculations

The initial moisture content on a percent volume basis is calculated as follows: [1]

$$\theta_i = \frac{(M_i - M_f)}{(V_T \times q\ )} * 100$$

[1] Gardner, Walter H. 1986. Water Content. Methods of Soil Analysis, Part 1, ed. A. Klute. American Society of Agronomy, Madison Wis., pp 493-545.

where

θ_i = initial moisture content (% volume)

M_i = initial mass of soil & water (g)

M_f = final mass of soil (g)

V_T = total volume of sample (cc)

ρ = density of pores fluid in the soil when initial mass was determined (g/cc). The density of the pore fluid initially present in the sample is assumed to be 1.0 g/cc

The initial moisture content determined on a percent weight basis is according to:

$$w = \frac{(M_i - M_f)}{M_f} * 100$$

where

w = initial moisture content (%)

M_i = initial mass of soil only (g)

M_f = final mass of soil only (g)

[1] Gardner, Walter H. 1986. Water Content. <u>Methods of Soil Analysis</u>, Part 1, ed. A. Klute. American Society of Agronomy, Madison Wis., pp 493-545.

BULK DENSITY

Method

Bulk density is calculated from the initial soil sample volume and oven dried mass of the soil sample.

Laboratory Procedures

The volume of the soil sample is calculated from geometric measurements of the sample. The sample mass is determined from methods outlined in ASTM D2216-80 (oven drying) or ASTM D4643-87 (microwave oven drying).

Calculations

The bulk density is calculated as follows:

$$\rho_b = M_D/V_T$$

where

ρ_b = dry bulk density (g/cc)

M_D = mass of oven dried soil sample (g)

V_T = total volume of soil sample (cc)

POROSITY

(Particle Density Method)

Method

Porosity can be calculated from dry bulk density and particle density. The particle density method is based on sample geometry and mass relationships.

Laboratory Procedures

Bulk density is calculated by the sample geometry and sample mass determined by oven drying, as described in the section outlining the bulk density determination. Particle density is determined from measurements following the procedures outlined in the particle density principles and methods.

Calculations

Porosity is calculated as follows:

$$n = [1 - (\rho_b/\rho_s)] \times 100$$

where

n = porosity (%)

ρ_b = bulk density (g/cc)

ρ_s = particle density (g/cc)

MOISTURE RETENTION CHARACTERISTICS

(Pressure Plate Method)

Method

Methods and procedures outlined under ASTM standard D2325-68 (81) are followed to determine the moisture retention characteristics in the 1 to 15 bar suction range. Moisture retention characteristics are obtained using a pressure plate extractor (Soil Moisture Inc., Santa Barbara, CA, Model 1500), with a 1, 3, or 15 bar ceramic plate. Pressure is provided by high pressure nitrogen from cylinders.

Laboratory Procedure

The porous ceramic plate is placed in a shallow pan with deaired distilled water and allowed to stand overnight. The plate is then removed from the pan and placed in the extractor. De-aired distilled water is poured over the plate to the limit allowed by the rubber skirt, which generally just submerges the plate. The pressure plate is sealed and pressure brought to 50% of the plate's maximum rated pressure. This pressure is maintained until outflow ceases. The extractor is opened and any excess water around the plate is removed.

The soil samples in their sample rings are then placed on the plate, assuring that good hydraulic contact is established. The extractor is then sealed and the pressure brought to the level desired. The pressure is maintained until outflow ceases. The extractor is then opened and the samples weighed quickly on an electronic top-loading balance. Subsequently, the samples are returned to the extractor, and the pressure is increased to the next increment.

Calculations

The decrease in mass of the water in the sample during a period of applied pressure is converted to an equivalent decrease in volume of water according to:

$$V_w = m_w/\rho_w \tag{1}$$

where

V_w = equivalent volume of water (cc)

m_w = mass of water loss (g)

ρ_w = density of water at temperature of experiment (g/cc)

Volumes of water calculated from equation 1 are then used to calculate the moisture content at that pressure as follows:

$$\theta_p = (V_i - \Sigma V_w)/V_T \times 100 \tag{2}$$

where

θ_p = moisture content at pressure p (% vol)

V_i = initial volume of water in the sample (cc)

ΣV_w = cumulative water volume change (cc)

V_T = total volume of the sample (cc)

DANIEL B. STEPHENS & ASSOCIATES, INC.
CONSULTANTS IN GROUND-WATER HYDROLOGY

• GROUND-WATER CONTAMINATION • UNSATURATED ZONE INVESTIGATIONS • WATER SUPPLY DEVELOPMENT •

October 20, 1989

Mr. Alan K. Kuhn
AK GeoConsult Inc.
13212 Manitoba Drive NE
Albuquerque, NM 87111-2955

Dear Alan:

I have enclosed revised laboratory summary tables (Tables 1 through 4) of the hydraulic properties of the Homestake mill tailings samples. The revised tables include three additional consolidated samples (IP-2/T4/11.5-14.0/C, IP-4/T2/8.5-9.0/C, and IP-4/T4/15.0-15.4/C) delivered from Martin Vineyard and Assoc., Inc. Please replace the laboratory summary tables in the DBS&A report entitled "Laboratory Analysis of Hydraulic Properties of Uranium Mill Tailings from the Homestake Mine in Grants, New Mexico" submitted to you in September, 1989, with these tables.

DBS&A is please to provide this service to AK GeoConsult, Inc., Hydro Engineer, and the Homestake Mining Company. If you have any questions, please do not hesitate to call me. Thank you.

Sincerely,

Daniel B. Stephens & Associates, Inc.

Earl D. Mattson
Laboratory Manager/Hydrologist

EDM/alm

Enclosures

Disk: 89-L-100
File: Kuhn.020

4415 Hawkins NE Albuquerque, New Mexico 87109 (505) 345-4567 FAX 345-4560

Table 1. Summary of Tests Performed
(revised 10/20/89)

Sample No.	Initial Moisture Content	Dry Bulk Density	Porosity	Moisture Characteristics Pressure Plate
IP-1/T2/5.8-6	X	X	X	X
IP-1/T2/6.0-6.5/C*	X	X	X	X
IP-1/T3/7.6-7.8	X	X	X	X
IP-1/T3/7.8-8.3/C*	X	X	X	X
IP-1/T3/8.3-8.5	X	X	X	X
IP-1/T3/8.5-9.0/C*	X	X	X	X
IP-2/T3/10.1-10.5/C*	X	X	X	X
IP-2/T3/10.8-11.5	X	X	X	X
IP-2/T4/11.5-14.0/C*	X	X	X	X
IP-2/T4/12.2-12.4	X	X	X	X
IP-2/T4/13.0-13.7/C*	X	X	X	X
IP-2/T4/13.7-14	X	X	X	X
IP-3/T2/5.9-6.1	X	X	X	X
IP-3/T3/7.7-7.9	X	X	X	X
IP-3/T5/12.8-13.6	X	X	X	X
IP-4/T2/7.9-8.3	X	X	X	X
IP-4/T2/8.5-9.0/C*	X	X	X	X
IP-4/T3/12.2-12.5	X	X	X	X
IP-4/T4/15.0-15.4/C*	X	X	X	X
IP-4/T4/15.4-15.8	X	X	X	X
IP-4/T5/16.9-17.3	X	X	X	X

Table 1. Summary of Tests Performed
(revised 10/20/89)

Sample No.	Initial Moisture Content	Dry Bulk Density	Porosity	Moisture Characteristics Pressure Plate
IP-5/T2/7.5-7.8	X	X	X	X
IP-5/T3/12.9-13.2	X	X	X	X
IP-5/T6/22.1-22.4	X	X	X	X
IP-5/T7/25.8-26.5	X	X	X	X

/C* = Consolidated sample from Vineyard and Associates, Inc.

DANIEL B. STEPHENS & ASSOCIATES, INC.

Table 2. Summary of Sample Characteristics
(revised 10/20/89)

Sample No.	Depth (ft)	Color	Visual Texture	Comments
IP-1/T2/5.8-6.0	5.8-6.0	olive green and light olive	slime	saturated, moderately dense compaction
IP-1/T2/6.0-6.5/C	6.0-6.5	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-1/T3/7.6-7.8	7.6-7.8	olive green	slime	saturated, moderately dense compaction
IP-1/T3/7.8-8.3/C	7.8-8.3	olive green	slime	consolidated sample from Martin Vineyard and Assoc. Inc.
IP-1/T3/8.3-8.5	8.3-8.5	olive green	slime	saturated, moderately dense compaction
IP-1/T3/8.5-9.0/C	8.5-9.0	olive green	slime	consolidated sample from Martin Vineyard an Assoc. Inc.
IP-2/T3/10.1-10.5/C	10.1-10.5	olive green	slime	consolidated sample from Martin Vineyard an Assoc. Inc.
IP-2/T3/10.8-11.5	10.8-11.5	olive greenish brown with olive layers	silt	moist, moderately dense compaction
IP-2/T4/11.5-14.0/C*	11.5-14.0	olive green	slime with sand on top, slime on bottom	consolidated sample from Martin Vineyard an Assoc. Inc.
IP-2/T4/12.2-12.4	12.2-12.4	tan	sand	moist, moderately loose compaction, slightly remolded

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-2/T4/11.5-14.0
RING NUMBER: MV7
DEPTH: 11.5-14.0 (ft)
SAMPLE VOLUME: 74.52 (cc)
INITIAL WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 173.20 (g)
TARE RING: 46.66 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 86.71 (g)
INITIAL MOISTURE CONTENT: 53.45 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 39.83 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
10/2	1710	INITIAL	173.20	--	--	--
10/6	920	0.30	172.53	0.67	0.67	52.55
10/10	830	15.00	168.56	3.97	4.64	47.22

COMMENTS: SAMPLE WAS NOT SATURATED PRIOR TO MOISTURE CHARACTERISTIC ANALYSIS

LABORATORY ANALYSIS PERFORMED BY: M. Burkhard
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T2/8.5-9.0
RING NUMBER: MV6
DEPTH: 8.5-9.0 (ft)
SAMPLE VOLUME: 74.52 (cc)
INITIAL WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 154.64 (g)
TARE RING: 47.06 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 100.55 (g)
INITIAL MOISTURE CONTENT: 9.43 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 7.03 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
10/2	1710	INITIAL	154.64	--	--	--
10/6	920	0.30	154.80	-0.16	-0.16	9.65
10/10	830	15.00	152.28	2.52	2.36	6.27

COMMENTS: SAMPLE WAS NOT SATURATED PRIOR TO MOISTURE CHARACTERISTIC ANALYSIS

LABORATORY ANALYSIS PERFORMED BY: M. Burkhard
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE
(PORE SIZE DISTRIBUTION)

JOB NAME: HOMESTAKE
JOB NUMBER: 89-L-100
SAMPLE NUMBER: IP-4/T4/15.0-15.4
RING NUMBER: MV8
DEPTH: 15.0-15.4 (ft)
SAMPLE VOLUME: 74.52 (cc)
INITIAL WEIGHT AT 0 CM TENSION
(WITH CAP AND RING): 185.00 (g)
TARE RING: 46.38 (g)
TARE CAP: 0.00 (g)
DRY WEIGHT OF SAMPLE: 107.74 (g)
INITIAL MOISTURE CONTENT: 41.44 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 30.88 (cc)

DATE (1989)	TIME	PRESSURE (BAR)	WEIGHT W/RING(G)	CHANGE WT (G)	CHANGES WT (G)	MOISTURE CONTENT (% VOL)
10/2	1710	INITIAL	185.00	--	--	--
10/6	920	0.30	177.77	7.23	7.23	31.74
10/10	830	15.00	172.10	5.67	12.90	24.13

COMMENTS: SAMPLE WAS NOT SATURATED PRIOR TO MOISTURE CHARACTERISTIC ANALYSIS

LABORATORY ANALYSIS PERFORMED BY: M. Burkhard
CALCULATION MADE BY: L. Simpson
CHECKED BY: E. Mattson

Boring No. IP-1

84102 B

TEST BORING LOG

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

Boring No. IP-1 Date Drilled 8/3/89 Driller: D. TANNER Logged by WGH

Drilling Method CONTINUOUS SAMPLER

Sampling Method(s) ACRYLIC TUBE

Location: N ______ E ______ Descriptive ______

Ground Elev. ______ Elev. Top of Rock ______ Ground Water Elev ______

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
0'				0'
1	TUBE #1 (1–4)			
2				0-4' compacted into 2.5' sample tube - sample
3				seems to be all fill material
4				4'
5	TUBE #2			fill material to 5.5' then
6			5.5' - Change from fill to slime	dark gray silt clay saturated mill slime ? ML ? (some compaction)
7				6.5'
8	TUBE #3			all dark gray silt, clay saturated mill slime - unstratified
9				9'
10	TUBE #4			dark gray silt, clay saturated mill slime to ~ 11' then soil below pile
11			11' → Change from slime to old soil	
12				11.5' Tube 4 & 5 compacted or pushed away from sampler; recovery was 2.5' ~ 2' sand and the rest slime
13				sand from 11-14' SP fn-med.
14				14' grain below base of pile, damp sat,
15	TUBE #5			SP sand to 15.0' fn red brown
16				damp then clay soil or lense to 16.5' (CL?)
17				16.5' clay soil or lense to 18' (CL?) then
18	TUBE #6			red-brown sand to 19' fn. & med. grain SP
19				19' TD
20				

COMMENTS: TD=19'

[illegible]

Tube # [illegible]

[illegible] w/ bentonite clay to 11 [illegible] 5' slotted [illegible]

[illegible] 2" [illegible]

[illegible]

Boring No. IP-2
84102-B

TEST BORING LOG

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

Boring No IP-2 Date Drilled 8/3/89 Driller: D. Tanner Logged by WGH
Drilling Method Continuous Sampler
Sampling Method(s)
Location: N E Descriptive
Ground Elev. Elev. Top of Rock Ground Water Elev

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
	0 to 1.5' was discarded			Mixture soil, sand, mill tailings
1			1.5'	SP Brown some roots & organic matter. damp.
2	Tube #1			
3				
4			4'	5' sample run produced 2' of sample. seems that soft material pushes away from auger in side walls.
5	TUBE #2	2' of saturated slime between 4' & 6.5' - lost?		
6				Sample is SP sand as above
7		sample remaining believed to be from 6.5 to 9'		
8				
9			9	
10	Tube #3			mill slime dark gray - saturated silt, clay (ML) there is a sand split from 10 to 10.5'
11				
12				mostly unstratified
13	Tube # 4			
14			14'	Mill slimes from 14 to 16.5' pressed into side wall
15				
16			16.5	old soil surface roots clay, silt dark grey brown damp (ML)
17	Tube #5			
18				fine sand (SP) tan to brown fine grained
19			19	
20				

COMMENTS: T D - 19

Hole completed w/ bentonite plug to 15'. Set 10' slotted casing and sand pack and solid casing to surface for a piezometer location.

1
2

Boring No. IP-3 ○
84102 B

TEST BORING LOG

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

Boring No. IP-3 Date Drilled 8/3/89 Driller: D. TANNER Logged by WGH
Drilling Method CONTINUOUS SAMPLER
Sampling Method(s) ACRYLIC TUBE
Location: N____ E____ Descriptive____
Ground Elev.____ Elev. Top of Rock ____ Ground Water Elev____

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
1-----	+	+	+	light grey-tan sand - fill material SP
2-----	+	+	+	LOST 6" SAMPLE (compaction?)
3----- Tube # 1	+	+	+	mill tailings sand grey-brown
4-----	+	+	4 +	damp fine-grain 0
5----- Tube # 2	+	+	+	mill sand tailings SP grey to brown fine some clay unstratified
6-----	+	+	+	
7-----	+	+	6.5 + SP	mill sand tailings but clay breaks from 7' to 7.5' and 8' to 8.5'
8----- Tube # 3	+	+	+	all are grey to grey brown
9-----	+	+	9 +	sands are damp and clays are wet
10----- Tube # 4	+	+	+	lost 1.5' sample
11----	+	+	11' +	mill tailings sand, SP
12----	+	+	+	grey to grey brown some clay
13---- Tube # 5	+	+	+	no clay splits
14----	+	+	14' +	
15----	+	+	+	Same as above damp
16----	+	+	+	
17----	+	+	16.5 + 17-8?	soil surface grey brown sand SP fine
18----	+	+	+	and med grain damp
19----	+	+	+	
20----			+	

Continued on Page 2/2

COMMENTS: Found no mill slime in this hole

BORING NO. IP-3 84102-[illegible]

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

TEST BORING LOG
Continued

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
19			19	
20				lost 2.5' sample
21			21.5	as in Tube 7
22	Tube #8		22.5	
23				22.5
24			24'	?CH red-maroon weathered clay shale

COMMENTS: TD - 24'

Hole completed with bentonite from TD to 17', set 10' of slotted casing sand packed slotted area, solid casing to surface for a piezometer location. Pipe is 2" diameter and solvent welded filled with cutting from sand pack to 2' below surface and bentonite [illegible]

Boring No. IP-4
82102B

TEST BORING LOG

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

Boring No. IP-4 Date Drilled 8/3/89 Driller: D. TANNER Logged by WGH
Drilling Method CONTINUOUS SAMPLER
Sampling Method(s) ACRYLIC TUBE
Location: N ________ E ________ Descriptive ________
Ground Elev. ________ Elev. Top of Rock ________ Ground Water Elev ________

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
1-----	+	+	+	
2-----	+	+	+	sand silt clay, mill Tailings SP damp brown some organic material roots etc.
3----- Tube #1	+	+	+	
4-----	+	+	+ —4	
5-----	+	+	+	
6-----	+	+	+	
			—6.5	sand silt, clay, organic material to 8' then mostly sand dk gray very damp
7----- Tube #2	+	+	+	
8-----	+	+	+	
9-----	+	+	+ —9'	lost 2.5' of sample (pulled 5.5 to 6.5)
10----	+	+	+	
11----	+	+	+	
			—11.5	dark grey and brown sand silt & clay saturated to 12.3' then damp brown & gray sand to 14 seems to be part fill & [illegible]
12----	+	+	+	
13---- Tube #3	+	+	+	
14----	+	+	+ —14	saturated dark gray mill slimes SP-SM
15---- Tube #4	+	+	+	
16----	+	+	+	
			—16.5'	SP-SM saturated dark grey mill slimes
17----	+	+	+	
18---- Tube #5	+	~~+~~ 18	slime / old soil	damp grey-brown some organic material
19----	+	+	19 +	
20----	+	+	+	

COMMENTS:
[illegible]
Hole completed w/ bentonite to 15', set 10' slotted casing 2" and sand packed [illegible]
[illegible]

1/2

Boring No. IP-5

84102B

TEST BORING LOG

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

Boring No IP-5 Date Drilled 8/3/89 Driller: D. TANNER Logged by WGH

Drilling Method CONTINUOUS SAMPLE

Sampling Method(s) ACRYLIC TUBE

Location: N ______ E ______ Descriptive ______

Ground Elev. ______ Elev. Top of Rock ______ Ground Water Elev ______

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
1-----	+	+	+	SP mill tailings - sand very fine grain grey tan damp some organic matter
2-----	+	+	+	
3----- Tube #1	+	+	+	
4-----	+	+	+ — 4'	
5-----	+	+	+	Lost 2.5' of sample
6-----	+	+	+	
7-----	+	+	+ — 6.5	mill tailing sand wet dk gray SP some stratification mostly color change in sand but one clay silt zone.
8----- Tube #2	+	+	+	
9-----	+	+	+ — 9	
10----	+	+	+	Lost 2.5' of sample
11----	+	+	+	
12----	+	+	+ — 11.5	dk. grey mill tailings sand some clay. wet unstratified
13 Tube #3	+	+	+ SP	
14----	+	+	+ — 14	
15----	+	+	+	Lost 2.5' of sample
16----	+	+	+	
17----	+	+	+ — 16.5'	uniform mill tailing sand dk. gray no stratification wet, some clay
18 Tube #4	+	+	+ SP	
19----	+	+	— 19'	
20----	+		+	

continued on Page 2/2

COMMENTS:

Homestake Mining Company, Grants Mill - Inactive Tailing Impoundment

TEST BORING LOG
Continued

DEPTH	SAMPLE TYPE	SPT BLOWS	PROFILE SYMBOL	DESCRIPTION
?				SP dark gray mill tailing sand
0	Tube #5	+	+	+ damp, some clay very little
1		+	+	+ —21.5 compaction change some
2		+	+	+ lightening of color
3	Tube #6	+	+	+ lost about 1'
24		+	+	—24 believe slime flowed into well in drilling
5	Tube #7	+	+	+ lost 1.5 sample; mill tailings sand and slime
6		+	+	+ —26.5 Tailings wet, slime saturated
7		+	+	27 + old soil @ 27.0' fine & med sand some silt & clay damp
-	Tube #8	+	+	+
?		+	+	—29 lost 1.8' of sample
)	Tube #9	+	+	+ SP fn. med grain sand
,		+	+	+ —31.5 some silt and clay
	Tube #10	+	+	+
;		+	+ clay CH 32.5 6" 33	+ —clay seam 6" thick (CH)
		+	+	—34 TD
		+	+	+
		+	+	+
		+	+	+
		+	+	+
		+	+	+

COMMENTS: Drilling below 29' @ request of [illegible]
TD-34'
Hole completed w/Bentonite to 26.5', set 15' of slotted casing and sand packed slotted area - solid casing to surface for a piezometer location
Pipe [illegible] 2' [illegible] and [illegible] filled w/cuttings [illegible] sand to 2' below surface and capped with bentonite

R
A
E

Rogers & Associates Engineering Corporation

Post Office Box 330
Salt Lake City, Utah 84110
(801) 263-1600

February 24, 1989

Mr. Ed Kennedy
Homestake Mining Co. - Grants
P.O. Box 98
Grants, NM 87020

C8900/5

Dear Mr. Kennedy:

Enclosed are the results of the radium and radon emanation fraction tests performed on the 20 samples sent to us in January. If you have any questions please feel free to contact Dr. Kirk Nielson or me.

I will be shipping your samples back to you within 30 days unless otherwise instructed.

Sincerely,

Renee Y. Bowser
Lab Supervisor

RYB/b

515 East 4500 South · Salt Lake City, Utah 84107

Rogers & Associates Engineering Corporation

REPORT OF RADIUM AND EMANATION COEFFICIENT MEASUREMENTS
(LAB PROCEDURE RAE-SQAP-3.1)

REPORT DATE 2/24/89

CONTRACT C8900/5

BY RYB

SAMPLE IDENTIFICATION Homestake Mining Co.

SUBMITTED BY RYB DATE RECEIVED ______

SAMPLE NUMBER	MOISTURE (DRY WT. %)	RADON EMANATION COEFFICIENT [a]	RADIUM [a] (pCi/gram)	COMMENTS
Inactive Slime #1	17.3	0.56 ± 0.01	602 ± 5	
Inactive Slime #2	7.1	0.48 ± 0.01	545 ± 5	
Inactive Slime #3	14.7 (14.9)	0.48 ± 0.01	776 ± 6	
Inactive Slime #4	15.7	0.51 ± 0.01	767 ± 6	
Inactive Slime #5	19.7	0.32 ± 0.01	969 ± 7	
Inactive Sand #1	7.8	0.52 ± 0.01	455 ± 4	
Inactive Sand #2	16.1	0.31 ± 0.01	557 ± 5	
Inactive Sand #3	3.6 (9.8)	0.36 ± 0.01	419 ± 4	
Inactive Sand #4	3.4	0.38 ± 0.01	250 ± 3	
Inactive Sand #5	18.1	0.40 ± 0.01	359 ± 1	
Active Slime #1	5.1	0.36 ± 0.02	351 ± 3	
Active Slime #2	5.1	0.25 ± 0.02	453 ± 4	
Active Slime #3	748.0	0.29 ± 0.01	* DIDN'T USE 2976 ± 27	

[a] UNCERTAINTIES BASED ON GAMMA-RAY COUNTING STATISTICS ONLY.

RAE

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SALT LAKE CITY • UTAH 84110
(801) 263-1600

Rogers & Associates Engineering Corporation

REPORT OF RADIUM AND EMANATION COEFFICIENT MEASUREMENTS
(LAB PROCEDURE RAE-SQAP-3.1)

REPORT DATE 2/24/89

CONTRACT C8900/5

BY RYB

SAMPLE IDENTIFICATION Homestake Mining Co.

SUBMITTED BY RYB DATE RECEIVED

SAMPLE NUMBER	MOISTURE (DRY WT. %)	RADON EMANATION COEFFICIENT[a]	RADIUM[a] (pCi/gram)	COMMENTS
Active Slime #4	20.5 } 42.7/4	0.25 ± 0.01	203 ± 2	
Active Slime #5	12.1 } 10.1 ave	0.51 ± 0.01	1320 ± 8	
Active Sand #1	4.1	0.38 ± 0.02	124 ± 1	
Active Sand #2	1.0	0.33 ± 0.02	120 ± 1	
Active Sand #3	3.2 } 1.9	0.34 ± 0.01	346 ± 2	
Active Sand #4	1.0	0.35 ± 0.01	120 ± 1	
Active Sand #5	0.3	0.31 ± 0.01	127 ± 1	
ACTIVE SANDS $\bar{x}$	1.9	0.34 ± 0.03	167 ± 100	
ACTIVE SLIMES $\bar{x}$	10.7	0.33 ± 0.11	582 ± 503	
INACTIVE SANDS $\bar{x}$	9.8	0.39 ± 0.08	498 ± 114	
INACTIVE SLIMES $\bar{x}$	14.9	0.47 ± 0.09	732 ± 167	

[a] UNCERTAINTIES BASED ON GAMMA-RAY COUNTING STATISTICS ONLY.

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RAE

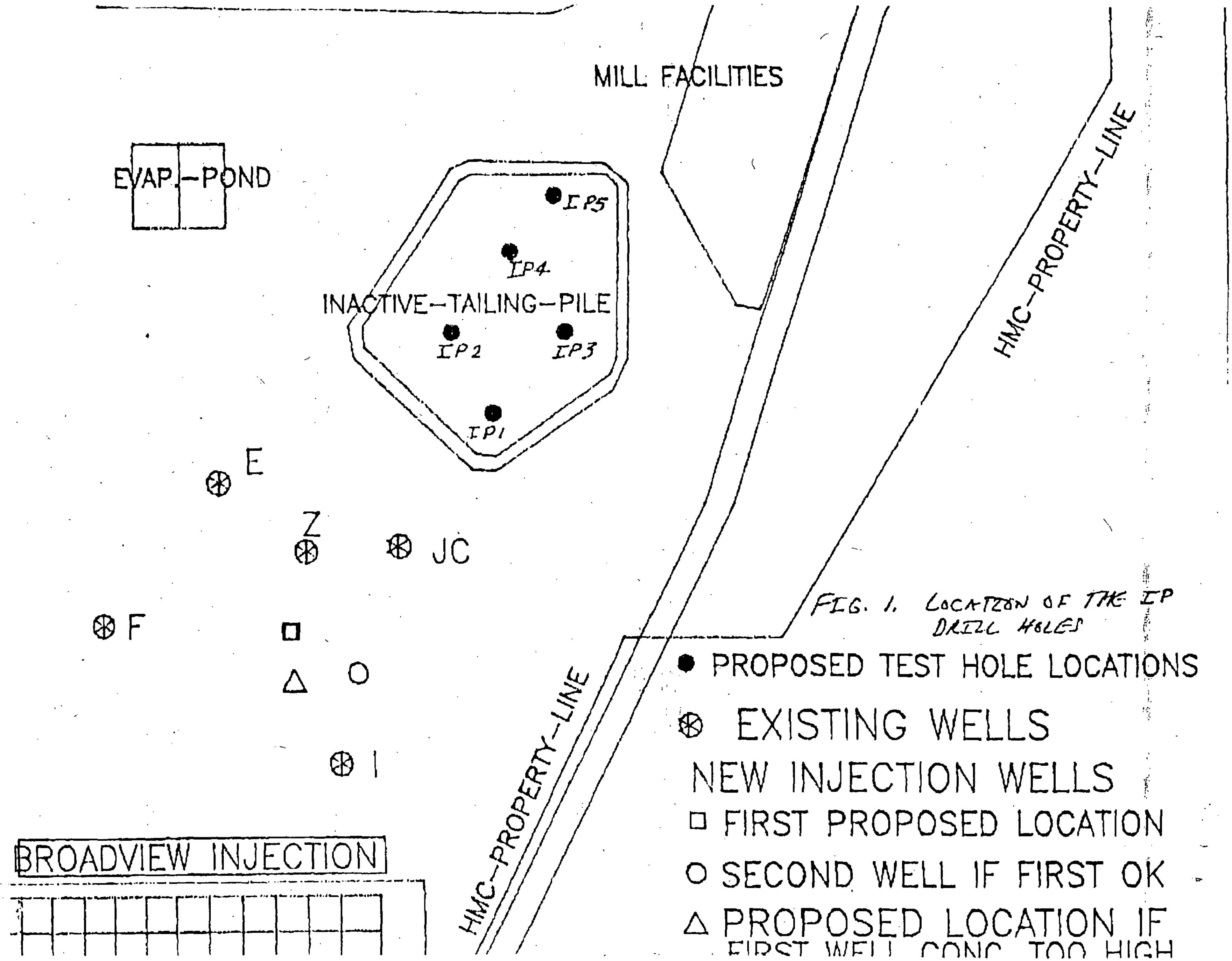


FIG. 1. LOCATION OF THE IP DRILL HOLES

HOMESTAKE MILL AREA

UNITED NUCLEAR — HOMESTAKE PARTNERS

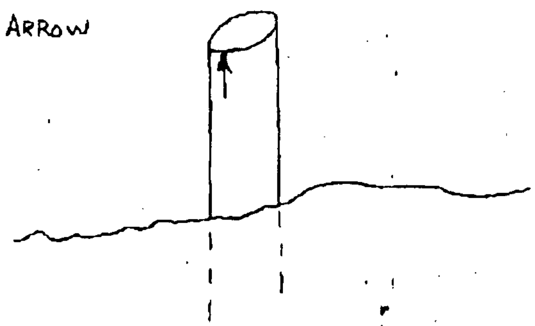
LOCATION INACTIVE - TAILING - PILE

DATE 19

FS	HOR. ANGLE	TURNED ANGLE	VERT. ANGLE	SLOPE DIST.	VERT. DIST.	HI	HP / RAIL	REMARKS	HORZ. DIST.	BEARING	LATITUDE (N)	DEPARTURE (E)	ELEV.
TP 1	118·47·39		89·54·13	3546.76		5.40	6.00	FIELD MARKING TP 1 MARKED TP1 ON MAP	3546.75		1541016.34	492008.24	6582.74
TP 2	116·12·06		89·45·07	2794.75		"	"	FIELD MARKING TP 2 MARKED TP2 ON MAP	2794.72		1541490.71	491407.56	6588.79
TP 3	110·19·08		89·49·29	3797.92		"	"	FIELD MARKING TP 3 MARKED TP3 ON MAP	3797.90		1541405.89	492461.60	6588.43
TP 4	107·19·19		89·44·14	3179.36		"	"	FIELD MARKING TP 4 MARKED TP4 ON MAP	3179.32		1541778.08	491935.16	6591.30
TP 5	101·03·55		89·38·51	3616.72		"	"	FIELD MARKING TP 5 MARKED TP 5 ON MAP	3616.65		1542030.57	492449.44	6599.04

SIXTO T. A   FRANK G. DD   ALFRED D. Φ

NOTE: LOWEST SPOT OF CASING SURVEYED & MARKED WITH ARROW



Location: EVAP. POND SLUGE

Date Collected: DEC. 8,1995

Date Sealed: JAN. 3,1996

Date Read: JAN. 18,1996

EVAPORATION POND NO. 1
SLUDGE SAMPLES
RADIUM 226

JV PICK UP SAMPLE. JV PREP, Final READING 1996 SLUGE SAMPLES

LAB ID	Wind Blown Samples ID.	TOTAL COUNTS RA(ROI) 609KEV CH549-CH658	TH(ROI)911KEV CH861-CH961	K(ROI)1406KEV CH1338-CH1458	COUNT TIME SECONDS	CPS RA 609 KEV CH549-CH658	TH 911 KEV CH861-CH961	K 1460 KEV CH1338-CH1458	SAMPLE WT.	TRUE SAMPLE CT. RATE	HMC Ra 226 pCi/g	
1	EVAP. POND SLUGE # 1	39193	9055	5853	1314	29.83	6.89	4.45	1441.00	22.57	54.24	44.08
2	EVAP. POND SLUGE # 2	33872	7794	5213	1085	31.22	7.18	4.80	1568.20	23.71	52.37	43.86
3	EVAP. POND SLUGE # 3	31865	7119	4774	1006	31.67	7.08	4.75	1602.70	24.50	52.95	43.50
4	EVAP. POND SLUGE # 4	32966	7416	5019	1089	30.27	6.81	4.61	1575.90	23.33	51.27	40.82
5	EVAP. POND SLUGE # 5	35241	7949	5404	1153	30.56	6.89	4.69	1568.40	23.52	51.94	41.75
6	EVAP. POND SLUGE # 6	39013	8833	5960	1278	30.53	6.91	4.66	1522.40	23.43	53.30	43.95

Source and Background data

DATE 1-17-96	Ra226 SOURCE = 25800 pCi			TH 232 Source= 9625.00 pCi			KCL SOURCE = 604.00 grams K			BKG (SUGAR)			
Source Read	Ra226 Source 609KEV (ROI) CH549-CH658	Ra226 Source 911KEV(ROI) CH861-CH961	Ra226 Source 1460KEV(ROI) CH1330-CH1458	TH232 Source 609KEV (ROI) CH549-CH658	TH232 Source 911KEV(ROI) CH861-CH961	TH232 Source 1460KEV(ROI) CH1330-CH1458	K40 SOURCE 609KEV (ROI) CH549-CH658	911 KEV (ROI) CH861-9	1406 KEV (ROI) CH1330-	Ra226 609 KEV (ROI) CH549-	TH232 911 KEV (ROI) CH861-9	K40 1406 KEV (ROI) CH1330-14	(O/S) / PC
TOTAL COUNTS	511238.00	110325.00	79000.00	32400.00	22052.00	11933.00	16210.00	13499.00	41800.00	45380.00	25750.00	19951.00	0.0000
TIME SECONDS	54000.00	54000.00	54000.00	7530.00	7530.00	7530.00	2610.00	2610.00	2610.00	54000.00	54000.00	54000.00	
COUNTS/SECOND	9.467	2.0431	1.46	4.30	2.93	1.58	6.21	5.17	16.04	0.84	0.48	0.37	

	Samp. ID#	Std pCi/	Std Wt.	Std. Ct.	Bkg. Count	ROI (Left)	ROI (609Peak	ROI (Right	ROI (Left)	ROI (609Pea	ROI (RIGHT	Area	Ra-226
			gms.	Time	Time	No. of	No. of	No. of	No. of	No. of	No. of	Of	Concentration
6	1-17-96					Channels	Channels	Channels	Counts	Counts	Counts	609 keV	
	Ra-226	50.20	443.50	54000.00		10.00	110.00	10.00	24399	511238	16002	289032.50	637.15
	BKG				54000.00	10.00	110.00	10.00	5543	45386	3610	-4955.50	-13.82
8	1-18-96												

Appendix B

RAECOM Runs

```
UTPUT INFORMATION :                    09:41:36  03-23-1996
3OTTOM FLUX = 0 pCi/m^2/sec
'IR CONC. = 0 pCi/l
ARE LAYER 1 FLUX = 991.79 pCi/m^2/s
vO OPTIMIZATION APPLIED
```

L	THICK (cm)	POR	MOIST (%)	SOURC (pCi/g)	E.F.	DENS (g/cm^3)	DIFF COEF	FLUX (pCi/m^2/s)	CONC. (pCi/cm^3)	MIC
5	48.5	.475	15.5	0	.35	1.42	0.01380	8.52	0.0	0.657
4	15.2	.412	15.5	0	.35	1.59	0.00600	10.09	5.7	0.557
3	366.0	.4	8	6	.34	1.6	0.02360	11.26	16.7	0.763
2	122.0	.44	8	408	.39	1.49	0.03000	297.25	358.3	0.800
1	213.0	.55	13	732	.47	1.19	0.03170	225.35	575.2	0.792

```
********************************* TOP **********************************
- 5 -* Radon barrier placed at 95 % MDD but degraded by freeze-thaw
                                                                       *
************************************************************************
- 4 -* Radon Barrier-100 percent Maximum Dry Density                   *
************************************************************************
- 3 -* Contaminated Soil                                               *
************************************************************************
- 2 -* Tailings Sands                                                  *
************************************************************************
- 1 -* Tailings slimes                                                 *
************************************************************************
****************************** BOTTOM **********************************
```

RAECOBPC.BAS

OUTPUT INFORMATION : 11:40:00 04-15-1996
BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 508.01 pCi/m^2/s
LAYER 5 ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s FROM LAYER 6

L	THICK (cm)	POR	MOIST (%)	SOURC (pCi/g)	E.F.	DENS (g/cm^3)	DIFF COEF	FLUX (pCi/m^2/s)	CONC. (pCi/cm^3)	MIC
6	48.5	.475	15.5	0	.35	1.42	0.01380	20.00	0.0	0.657
5	51.2	.412	15.5	0	.35	1.59	0.00600	19.40	10.9	0.557
4	152.0	.4	8	6	.34	1.6	0.02360	40.63	106.8	0.763
3	152.0	.4	8	408	.39	1.6	0.03000	263.55	316.9	0.763
2	46.0	.3	11	55	.35	1.75	0.00830	-19.88	312.0	0.525
1	152.0	.44	8	408	.39	1.49	0.03000	37.66	498.9	0.800

```
******************************** TOP *********************************
- 6 -* Radon barrier placed at 95 % MDD, freeze-thaw degraded         *
**********************************************************************
- 5 -* Radon barrier placed at 100 percent MDD                        *
**********************************************************************
- 4 -* Contaminated Soil                                              *
**********************************************************************
- 3 -* Tailings sand                                                  *
**********************************************************************
- 2 -* Pipe, Pond sludge, tailings slurry                             *
**********************************************************************
- 1 -* Sand tailings layer of North End of Pond Area                  *
**********************************************************************
****************************** BOTTOM ********************************
```

RAECOBPC.BAS

```
OUTPUT INFORMATION :                09:14:41  04-14-1996
BOTTOM FLUX = 0 pCi/m^2/sec
AIR CONC. = 0 pCi/l
BARE LAYER 1 FLUX = 582.75 pCi/m^2/s
LAYER 5 ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s FROM LAYER 6
```

L	THICK (cm)	POR	MOIST (%)	SOURC (pCi/g)	E.F.	DENS (g/cm^3)	DIFF COEF	FLUX (pCi/m^2/s)	CONC. (pCi/cm^3)	MIC
6	48.5	.475	15.5	0	.35	1.42	0.01380	20.00	0.0	0.657
5	51.2	.412	15.5	0	.35	1.59	0.00600	19.40	10.9	0.557
4	152.0	.4	8	6	.34	1.6	0.02360	40.66	106.9	0.763
3	152.0	.4	8	408	.39	1.6	0.03000	263.78	317.2	0.763
2	46.0	.3	11	55	.35	1.75	0.00830	-18.99	312.6	0.525
1	274.0	.44	8	408	.39	1.49	0.03000	38.99	502.8	0.800

```
******************************* TOP ********************************
*- 6 -* Radon barrier placed at 95 % MDD, freeze-thaw degraded      *
*********************************************************************
*- 5 -* Radon barrier placed at 100 percent MDD                     *
*********************************************************************
*- 4 -* Contaminated Soil                                           *
*********************************************************************
*- 3 -* Tailings sand                                               *
*********************************************************************
*- 2 -* Pipe, Pond sludge, tailings slurry                          *
*********************************************************************
*- 1 -* Sand tailings layer of South End of Pond Area               *
*********************************************************************
****************************** BOTTOM *******************************
```

RAECOBPC.BAS

UTPUT INFORMATION : 11:05:26 04-15-1996

BOTTOM FLUX = 0 pCi/m^2/sec

^IR CONC. = 0 pCi/l

ARE LAYER 1 FLUX = 587.59 pCi/m^2/s

LAYER 3 ADJUSTED TO GIVE FLUX OF 20 pCi/m^2/s FROM LAYER 4

L	THICK (cm)	POR	MOIST (%)	SOURC (pCi/g)	E.F.	DENS (g/cm^3)	DIFF COEF	FLUX (pCi/m^2/s)	CONC. (pCi/cm^3)	MIC
4	48.5	.475	15.5	0	.35	1.42	0.01380	20.00	0.0	0.657
3	88.9	.412	15.5	0	.35	1.59	0.00600	23.68	13.3	0.557
2	45.7	.32	8	0	.34	1.8	0.01290	80.26	199.2	0.667
1	305.0	.44	8	408	.39	1.49	0.03000	158.91	393.1	0.800

```
********************************* TOP **********************************
- 4 -* Radon Barrier placed at 100% MDD, freeze-thaw degraded          *
************************************************************************
- 3 -* Radon Barrier placed at 100 percent Maximum Dry Density         *
************************************************************************
- 2 -* Existing interim cover                                          *
************************************************************************
- 1 -* Tailings sands beneath the side slope on northern portion of pile
                                                                       *
************************************************************************
******************************* BOTTOM *********************************
```