CONOCO

Docket 40-8743

PDR

RETURN D. CRAMER 396 SS

T. W. Quigley
Environmental Project Leader
Sand Rock Mill
Minerals Department

Conoco Inc.
555 Seventeenth Street
Denver, CO 80202
(303) 575-6069

June 19, 1981

Mr. Thomas E. Fleming
Project Manager
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, Maryland 20910

Re: Final Responses to NRC Comments Dated April 13, 1981 - Sand Rock Mill Project - NRC Docket No. 40-8743

Dear Mr. Fleming:

Enclosed you will find Conoco's response (11 copies) to Comment No. 26 along with supplementary information which deals with Comment No. 20 which was initially addressed by Conoco on May 12, 1981.

Under separate cover, three copies of this material is being sent to Dr. M. Kelley at Oak Ridge. Also, a copy is being transmitted directly to Mary Cervera of Ott Water Engineers in Denver.

If you have any questions regarding this material, please contact me.

Sincerely,

T. W. Quigley

T. W. Quigley

kr

Enclosures

cc: J. E. Cearley (w/enc.)
D. W. Bollig (w/enc.)
D. Martin - NRC (w/o enc.)
Dr. M. Kelley (w/enc.)
M. T. Cervera (w/enc.)

FEE EXEMPT

10157

Add'l Info

Additional Data for Comment No. 20

Supplements Conoco's May 12, 1981 Response.

SAND ROCK MILL PROJECT
NRC DOCKET NO. 40-8743
JUNE, 1981

Comment No. 20

In the pit and evaporation pond, natural clay materials will be relied upon to minimize seepage either in their existing state or as compacted clay liners. Furthermore, tailings solutions will be in direct contact with the evaporation pond embankment. Provide test data to indicate the long-term stability and non-dispersivity of the site-specific clay materials in contact with low pH tailings solution. The data presented for pin hole tests in Appendix C of Chen and Associates' report 6210B-W, July 25, 1980, does not indicate the nature of the water that was used in those tests.

Response

A) Conclusions developed in several recent publications, Gee et al (1980) and Markos (1979) indicate the integrity and permeability of compacted clay liners are not adversely affected by the contact of the low pH tailings solutions, and that geochemical reactions can occur at the tailings/liner interface that will actually enhance the liner effectiveness by decreasing the permeability over time. Lab analyses of the clay minerals present in the bottom of the evaporation pond for the Sand Rock Mill Project show a very good correlation to the clay liner material tested in Gee et al (1980). No deterioration of the clay liner is anticipated at the Sand Rock Mill, and there is every reason to expect the same decrease in permeability as occurred in the published lab tests.

Five samples were taken from the claystone bedrock that underlies the Sand Rock evaproation pond site (Figure 1). Core descriptions of these five sample drill holes can be found in the Sand Rock ER Reference Document Chen (1980).

This claystone bedrock will form the pond bottom once the surface alluvium and the sandstone strata above the claystone has been stripped away and stockpiled.

The samples were analyzed using x-ray diffraction to determine clay minerals present along with the relative percentage of each clay mineral (Figure 2). The samples were then analyzed for the parameters presented in Figure 3. The lab analysis sheets and x-ray diffraction plots are included as Figure 4.

Gee et. al. (1980) documents long-term (300-500 days) tests run on the interaction of low pH tailings solutions with representative samples of clay liner, overburden, and sandstone for United Nuclear Corporation's Morton Ranch mill site, located in Converse County, Wyoming.

The clay liner samples used in the tests were representative clays and silts from the Wasatch formation, the formation from which the overburden material comes from on the Morton Ranch project site. Clay minerals analysis indicate a relative low abundance of smectites (montmorillonite) and an even lower abundance of kaolinite and illite.

The overburden at the Sand Rock Mill project site is also part of the Wasatch formation, and the clay mineral composition in the claystone at the evaporation pond site is similar to that at the Morton Ranch site. Clay minerals present are montmorillonite, kaolinite, and illite (Figure 2).

Montmorillonite can be present in two forms, calcium- or sodium-montmorillonite. As seen in Figure 3, the low values of sodium adsorbtion ratio (SAR), exchangeable sodium percentage (ESP), and percent sodium in the soluable extract indicate a low percentage of sodium montmorillonite in the claystone sample.

The tests run on the Morton Ranch samples used tailings solutions from Exxon's Highland mill, a sulphuric-acid-leach mill similar to the proposed Sand Rock Mill. The pH of the test tailings solution was 1.8; pH of the Sand Rock Mill's tailings solutions will range from 1.0 to 2.0.

The Morton Ranch test results with respect to liner permeability indicated that over a period of 300 to 500 days the permeability of the six samples decreased. This decrease ranged from a factor of two to slightly over a factor of ten.

This decrease in permeability can be attributed to a geochemical reaction at the tailings/liner interface. As the low-pH solutions migrate from the tailings to the neutral or buffering liner, the change from low pH to neutral pH would cause the precipitation of iron hydroxide and an aluminosilicate gel (Markos, 1979). Other mobile ions would coprecipitate or be absorbed by the gel. This gel and precipitate zone would tend to decrease permeability.

The similarities between the Sand Rock and Morton Ranch claystone samples; similar composition and similar low SAR and ESP, indicating a relatively low amount of sodium/cation exchange sites; indicate the claystone base of the Sand Rock Mill evaporation pond should show the same stability, or actual slight decrease, in permeability as was found in the Morton Ranch tests.

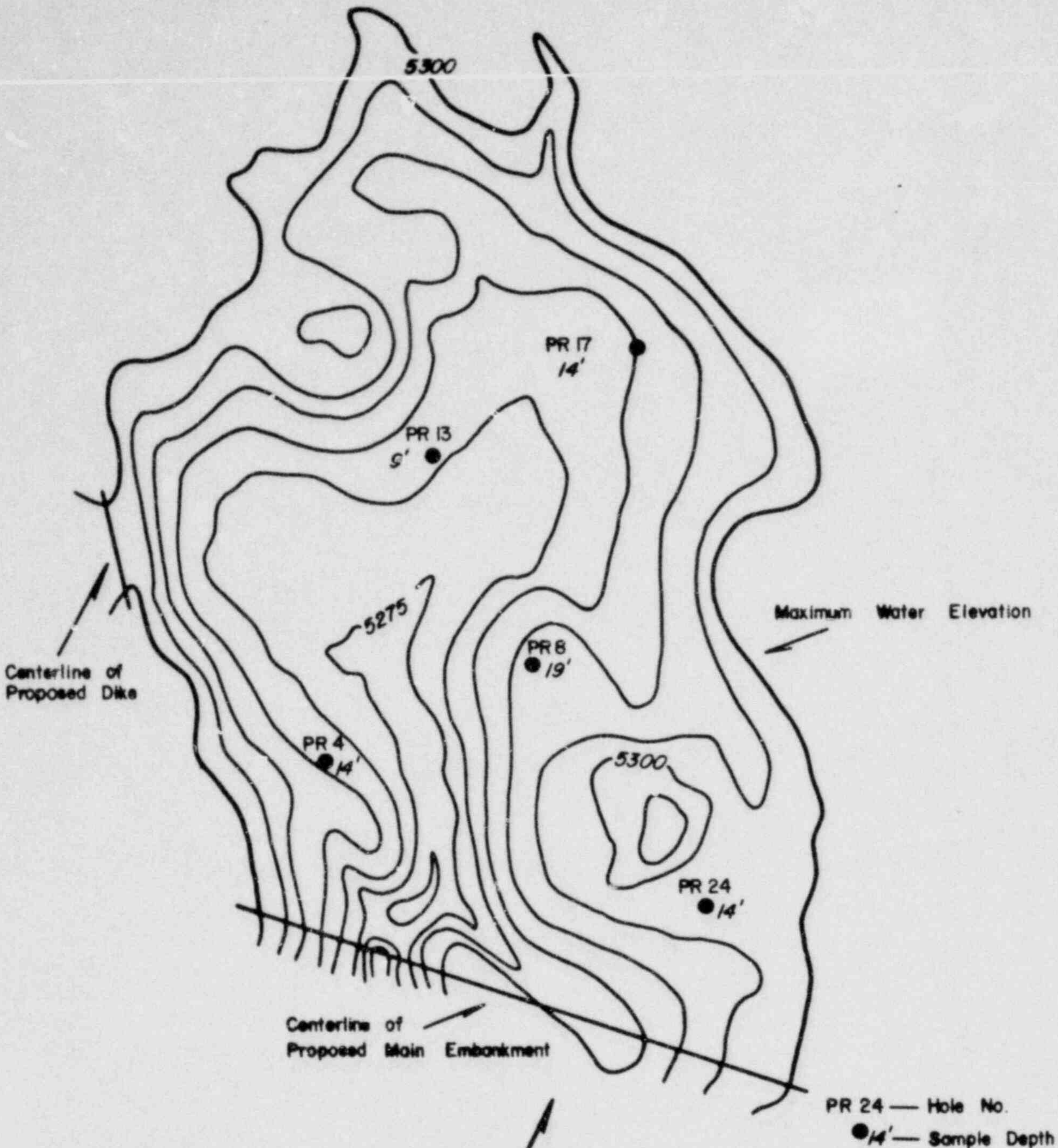
B) The pin hole tests conducted by Chen & Associates as part of the geotechnical investigation of the Sand Rock Mill tailings disposal plan were done using distilled or tap water.

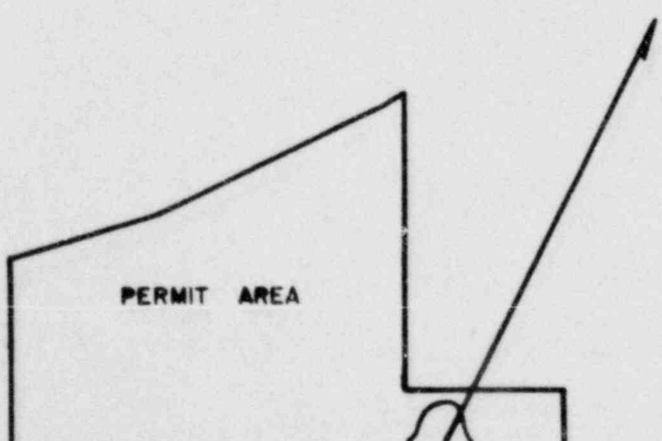
References

Chen and Associates, Inc., Geotechnical Investigation for the Proposed Evaporation Pond and Tailings Disposal Area to be Constructed During Phase I of the Sand Rock Mill Project, Campbell County, Wyoming, 1980.

Gee, G. W., Campbell, A. C., Opitz, B. E., and Sherwood, D. R. (1980) Interaction of Uranium Mill Tailings Leachate with Morton Ranch Clay Liner and Soil Material. Uranium Mill Tailings Management: Proceedings of the Third Symposium, Fort Collins, Colorado, p. 333-352.

Markos, Gergely, (1979) Geochemical Mobility and Transfer of Contaminants in Uranium Mill Tailings. Uranium Mill Tailings Management: Proceedings of the Second Symposium, Fort Collins, Colorado, p. 55-69.





CONOCO INC.
MINERALS DEPARTMENT
555 Seventeenth St. Denver, CO 80202

SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

EVAPORATION POND AREA
CLAY MINERALS
SAMPLE SITES

Date: 5/21/81	Drawn By: M.D.	Figure 1

CONOCO INC.
SAND ROCK MILL PROJECT

X-RAY DIFFRACTION ANALYSIS OF CLAYSTONE FROM THE EVAPORATION POND AREA

Sample #	Relative Abundances of Clay Minerals (%) Montmorillonite-Illite	Kaolinite	Illite	Percentage of Expandable Layers in Mixed Layer Montmorillonite-Illite	Percentage of Mont-morillonite in Sample
PR 8 @ 19'	75	14	11	80	60
PR13 @ 9'	60	20	20	60	36
PR24 @ 14'	70	18	12	60	42
PR 4 @ 14'	45	49	6	60	27
PR17 @ 14'	75	20	5	100	75

Figure 2
June 1981

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SAND ROCK MILL PROJECT

CHEMICAL ANALYSIS OF CLAYSTONES FROM THE EVAPORATION POND AREA

Sample #	pH	$CaCO_3$ (wt. %)	Organic Carbon (wt. %)	CEC $\left(\frac{meq}{100\ g}\right)$	SAR[1]	ESP (%)[3]	PAR[2]	% Na in Soluable Extract
PR 4 @ 14'	7.0	0.8	0.3	28.0	3.12	3.23	0.11	19
PR 8 @ 19'	7.1	0.7	0.3	38.8	1.47	0.90	0.13	17
PR13 @ 9'	5.5	0	0.3	42.0	1.63	1.13	0.10	14
PR17 @ 14'	6.9	0.1	0.4	39.7	1.45	0.89	0.13	13
PR24 @ 14'	6.9	0.3	0.1	38.8	2.14	1.86	0.14	30
Average	6.7	0.4	0.3	37.5	1.96	1.60	0.12	19

[1]SAR = Sodium adsorption ratio = $Na^+ / \sqrt{(Ca^{+2} + Mg^{+2})/2}$

[2]SAR = Potassium adsorption ratio = $K^+ / \sqrt{(Ca^{++} + Mg^{+2})/2}$

[3]ESP = Exchangeable sodium percentage

Methods of Analysis

1. pH - of saturation paste - U.S.D.A. Handbook #60, method (21a), p.102
2. Organic carbon - Leco furnace
3. Carbonate - total carbon by Leco furnace - organic carbon by Leco furnace
4. CEC - Na saturation method U.S.D.A. Handbook #60. Na analysis by atomic absorption
5. SAR, ESP, PAR - soluble cations analyzed from saturation extract U.S.D.A. Handbook #60, method (3a), p. 84. Na and K analysis by atomic absorption; Ca and Mg analysis by ICP (inductively-coupled argon plasma spectroscopy).

Figure 3
June 1981

CONOCO INC.

CLAYSTONE CORES FROM SAND ROCK MILL PROJECT 6/81

Sample Number		Analytical Number
PR4 @ 14′	Soluble Cations	KW 30
	Cation Exchange Capacity	KW 35
	Carbon Analysis	KW 40
PR 8 @ 19′	Soluble Cations	KW 31
	Cation Exchange	KW 36
	Carbon	KW 41
PR 13 @ 9′	Soluble Cations	KW 32
	Cation Exchange	KW 37
	Carbon	KW 42
PR 17 @ 14′	Soluble Cations	KW 33
	Cation Exchange	KW 38
	Carbon	KW 43
PR 24 @ 14′	Soluble Cations	KW 34
	Cation Exchange	KW 39
	Carbon Analysis	KW 44

Figure 4a

CONOCO INC.
SAND ROCK MILL PROJECT

ANALYSIS REPORT
SPECTROSCOPY GROUP

2-10

Name: Kubeck / Stimpson

Analysis No. 27692 thru 27697

Sample No. KW-30 thru 34

Notebook No. ESICP 1981

Spectrum, Film or Plate No.

Type of Analysis Requested: ESICP

Element	mg/L KW-30-81	KW-31-81	KW-32-81	KW-33-81	KW-34-81		
Ag	<.30	<.30	<.30	<.30	<.30		
Al	<1.5	<1.5	<1.5	<1.5	<1.5		
B	<.50	<.50	<.50	<.50	<.50		
Ba	<.050	.080	.10	.080	.070		
Be	<.050	<.050	<.050	<.050	<.050		
Ca	530	210	450	440	150		
Cd	<.050	<.050	<.050	<.050	<.050		
Co	<.30	<.30	<.30	<.30	<.30		
Cu	1.6	.52	.22	<.15	<.15		
Fe	<.30	<.30	<.30	<.30	<.30		
Mg	720	180	350	290	54		
Mn	<.50	<.50	<.50	<.50	<.50		
Mo	<.50	<.50	<.50	<.50	<.50		
Ni	24	2.0	<.75	<.75	<.75		
Pb	23	11	15	21	24		
Sb	<2.5	<2.5	<2.5	<2.5	<2.5		
Se	<1.0	<1.0	<1.0	<1.0	<1.0		
Si	3.4	2.3	1.6	3.4	1.3		
Ti	<.25	<.25	<.25	<.25	<.25		
Tl	<5.0	<5.0	<5.0	<5.0	<5.0		
V	<.25	<.25	<.25	<.25	<.25		
Zn	2.5	4.4	12.	<.25	<.25		
Na	560	140	240	180	140		

*No line was observed for this element. The < value given is the lowest concentration standard for this element in our calibration. All < or > values are outside our calibration range. If other analytical data are needed contact the Emission Laboratory.

Signed: H. L. Evans

Date: 6-4-81

FIGURE 4b

CONOCO INC.
SAND ROCK MILL PROJECT

ANALYSIS REPORT
SPECTROSCOPY GROUP

3-10

Name Kebrick / Stimpson

Analysis No. 27698 thru 27701

Sample No. KW-35 thru 39

Notebook No. ESKP 1981

Spectrum, Film or Plate No.

Type of Analysis Requested ESICP

Mg/L

Element	KW-35-81	KW-36-81	KW-37-81	KW-38-81	KW-39-81		
Ag	<.030	<.030	<.030	<.030	<.030		
Al	<.15	.29	.37	.24	.29		
B	<.050	<.050	<.050	<.050	<.050		
Ba	.086	.11	.085	.091	.12		
Be	<.0050	<.0050	<.0050	<.0050	<.0050		
Ca	63	60	29	45	38		
Cd	.019	.019	.017	.019	.017		
Cr	.23	.24	.24	.24	.22		
Cu	1.1	.17	.14	.11	.27		
Fe	.20	.22	.31	.19	.27		
Mg	2.2	2.2	2.0	2.1	2.3		
Mn	.075	<.050	<.050	<.050	<.050		
Mo	.46	.48	.47	.48	.45		
Ni	<.075	<.075	<.075	<.075	<.075		
Pb	2.7	2.5	2.5	2.6	2.6		
Sb	.66	.69	.67	.68	.63		
Sn	.81	<.10	<.10	<.10	<.10		
Se	.54	.54	.47	.50	.50		
Ti	<.025	<.025	<.025	<.025	<.025		
Tl	3.5	3.5	3.5	3.5	3.3		
V	<.025	<.025	<.025	<.025	<.025		
Zn	<.025	.37	.62	.22	.16		
Na	140	170	170	170	160		

*No line was observed for this element. The < value given is the lowest concentration standard for this element in our calibration. All < or > values are outside our calibration range. If other analytical data are needed contact the Emission Laboratory.

Signed N. L. Evans

Date 6-4-81

Figure 4c

4-10

CONOCO

Continental Oil Company
Analytical Research Section
Research and Development Department

Analysis Report
Chemical Analysis Group

SAND ROCK MILL PROJECT

Date 6-4-81

To KABACK-STIMPSON

Location 19 R+D W

Project Number 1230-5-8

Reference WJNA267-19-20

Sample Description Soil

Notes

Analysis Codes			
TOT C	ORG C	Carbonate C	

Method (Number or Technique)			
Leco	Leco		

Assay and Units			
%C	%C	%C	

Analytical Number	Sample Number	Data			
	STd 6%	6.02			
		1.10	.31	0.79	PR7@14
27642	KW-40				
	41	1.04	.34 - .34	0.70	PR8@19
THRU					
	42	.27	.26	0.01	PR13@9
27646					
	43	.48	.39	0.09	PR17@14
	44	.43 - .46	.11 - .10	0.34	PR24@14
	STd .60		.61		

Analyst WJN

Approved Vahabzadeh

Page 1 of 1

Figure 4d

CONOCO INC.
SAND ROCK MILL PROJECT

5-10

ATOMIC ABSORPTION ANALYSIS REPORT

SPECTROSCOPY GROUP

Name Dawn Kaback / Ron Stimpson **Date** 6-5-81 **Notebook No.** AA-19, p. 8

(ppm)

Analysis No.	Sample Number		Na	K	
1-27692	KW-30-81	Soluble	470	29	PR4 @ 14'-A
	-31-		120	18	PR8 @ 19'-A
	-32-		190	19	PR13 @ 9'-A
	-33-		160	24	PR17 @ 14'-A
	-34-		120	13	PR24 @ 14'-A
	-35-	Extractable ~~Exchangeable~~	260	5.3	PR4 @ 14'-
	-36-		360	5.9	PR8 @ 19'-
	-37-		390	5.7	PR13 @ 9'-
	-38-		380	6.1	PR17 @ 14'-
1-27701	KW-39-81		370	6.0	PR24 @ 14'

Signed TiTE

Sample Treatment

- ■ None
- ☐ Muffle Ash
- ☐ Plasma Ash
- ☐ Acid Digestion

Calibration Standards

- ☒ Fisher Scientific
- ☐ CONOSTAN
- ☐ Other

Figure 4e

CONOCO INC.
SAND ROCK MILL PROJECT

PR 4 @ 14'

6-10

2-7-21 CLAY

29-MAY-81

GIVE ANOTHER STANDARD :

Mont is hydrated

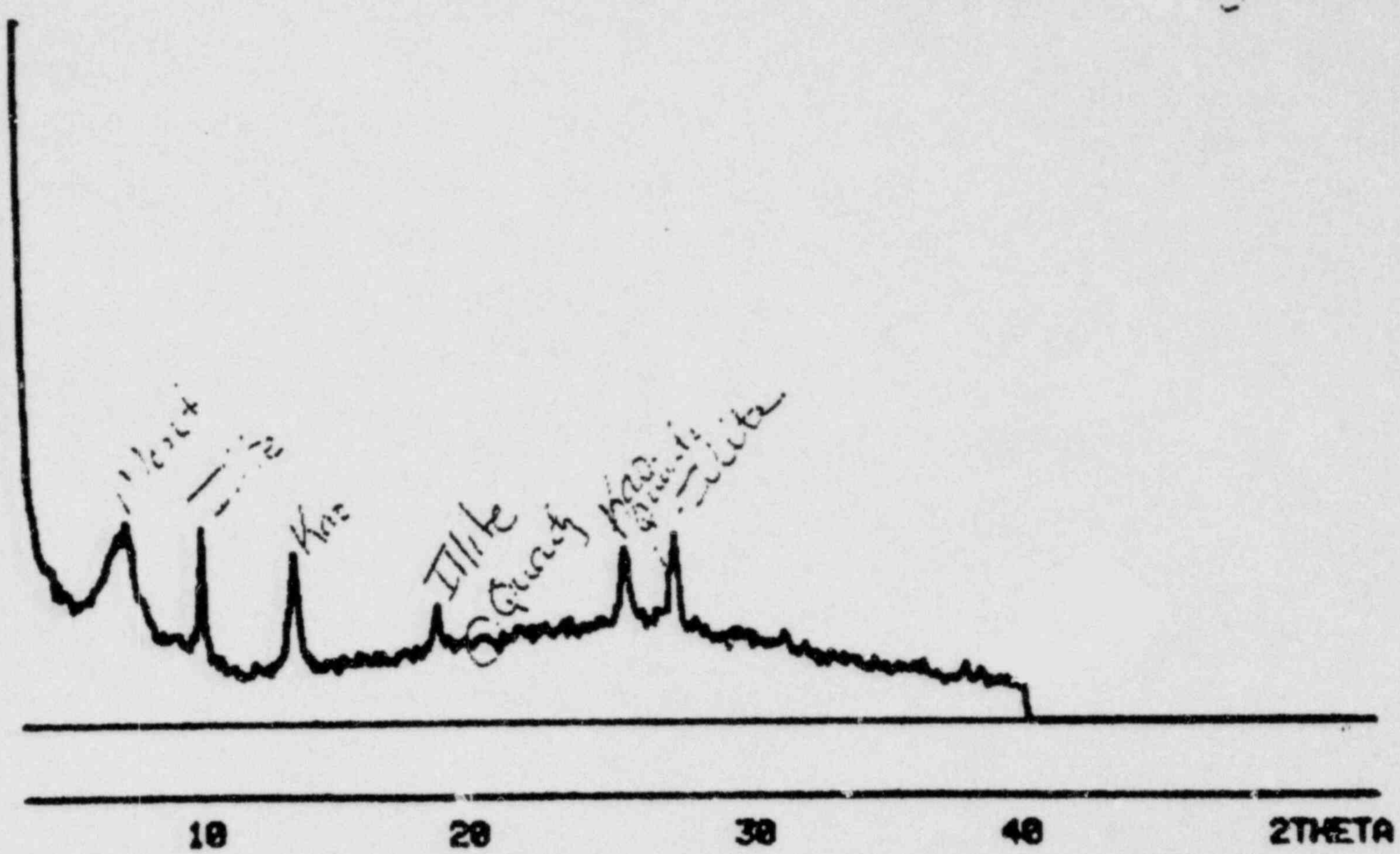


Figure 4f

PR 13@ 9'

7-10

2-7-23 CLAY

28-MAY-81

CONOCO INC.
SAND ROCK MILL PROJECT

TRIAL MATCHING 5.0490:QUARTZ , OK ?

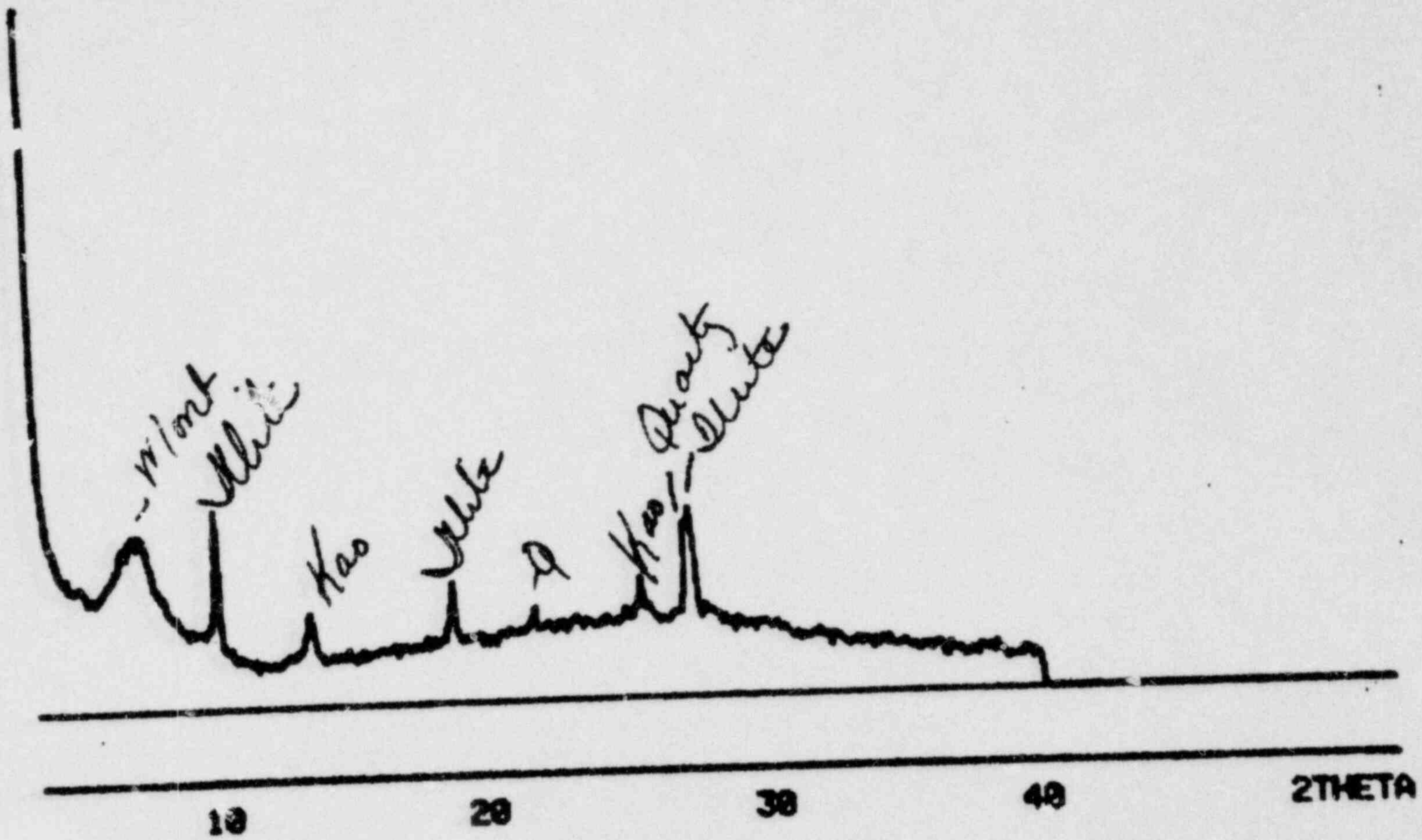


Figure 4h

PR8 @ 19'

8-10

2-7-22 CLAY

20-MAY-81

CONOCO INC.
SAND ROCK MILL PROJECT

TRIAL MATCHING 5.0490 QUARTZ , OK ?

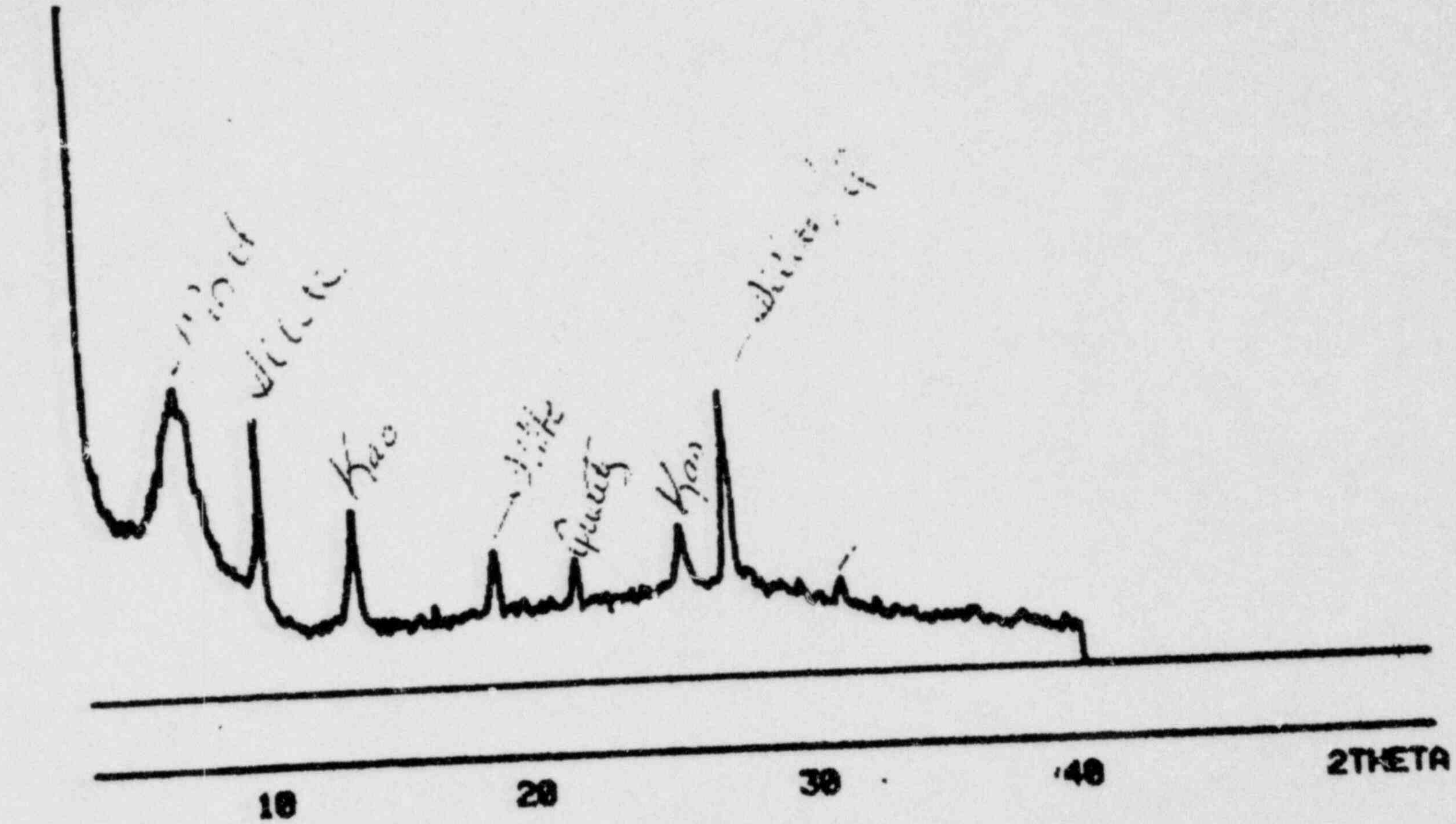


Figure 4g

PR 17 @ 14' 9-10

29-MAY-81

2-7-24 CLAY

CONOCO INC.
SAND ROCK MILL PROJECT

TRIAL MATCHING 5.0490:QUARTZ , OK ?

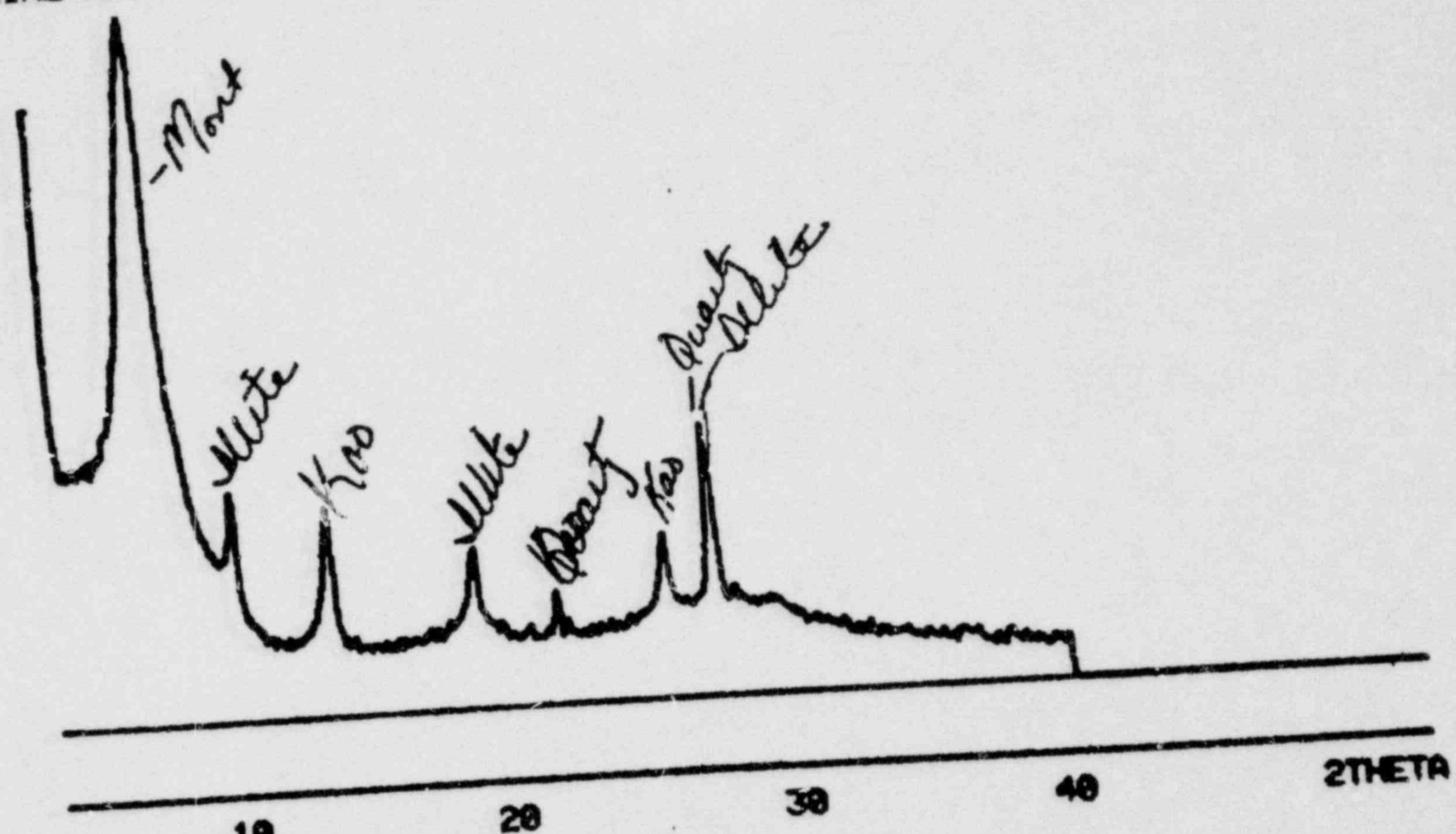


Figure 4i

PR 24 @ 14'

10-10

2-7-25 CLAY

28-MAY-81

CONOCO INC.
SAND ROCK MILL PROJECT

TRIAL MATCHING 5.0490:QUARTZ ; OK ?

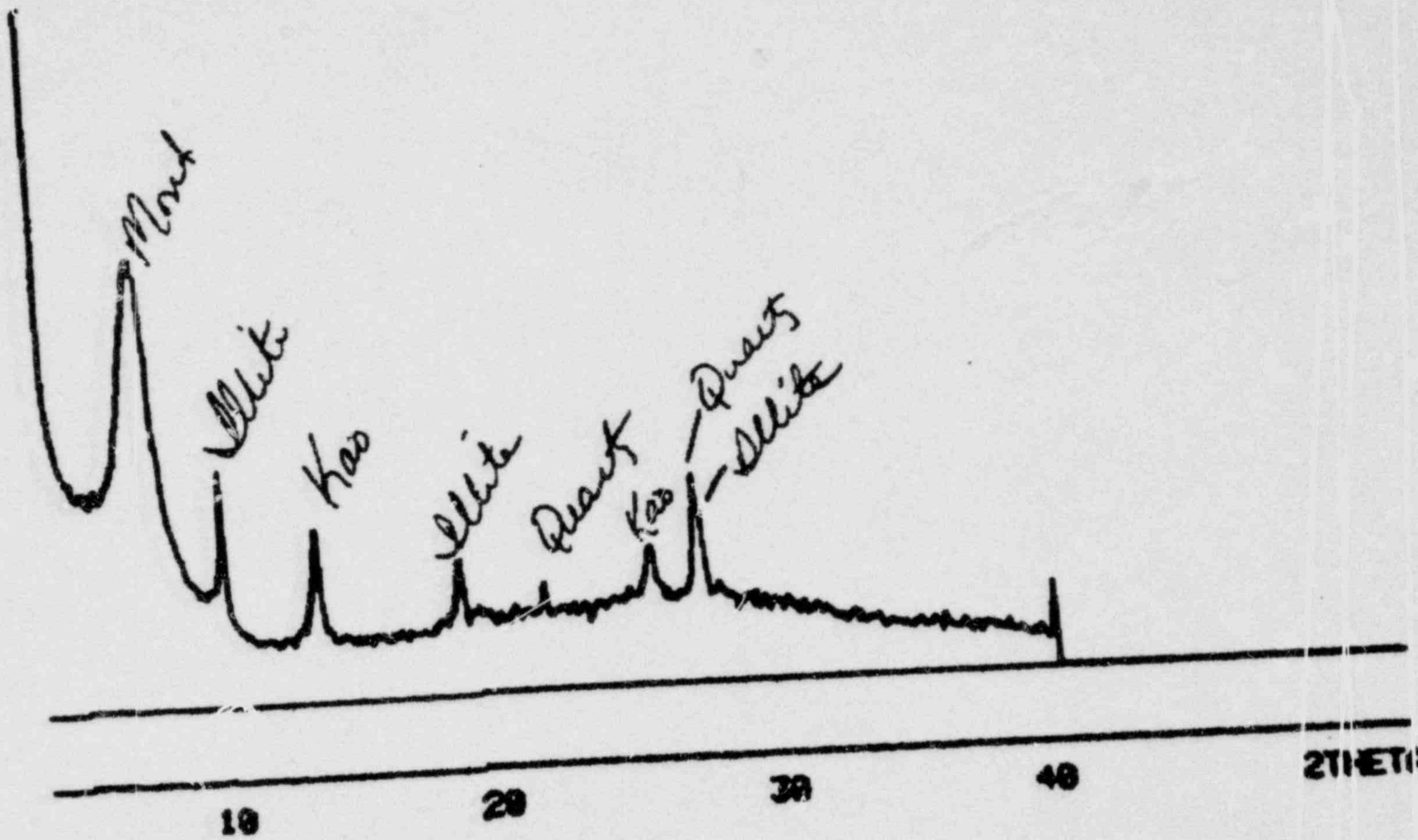


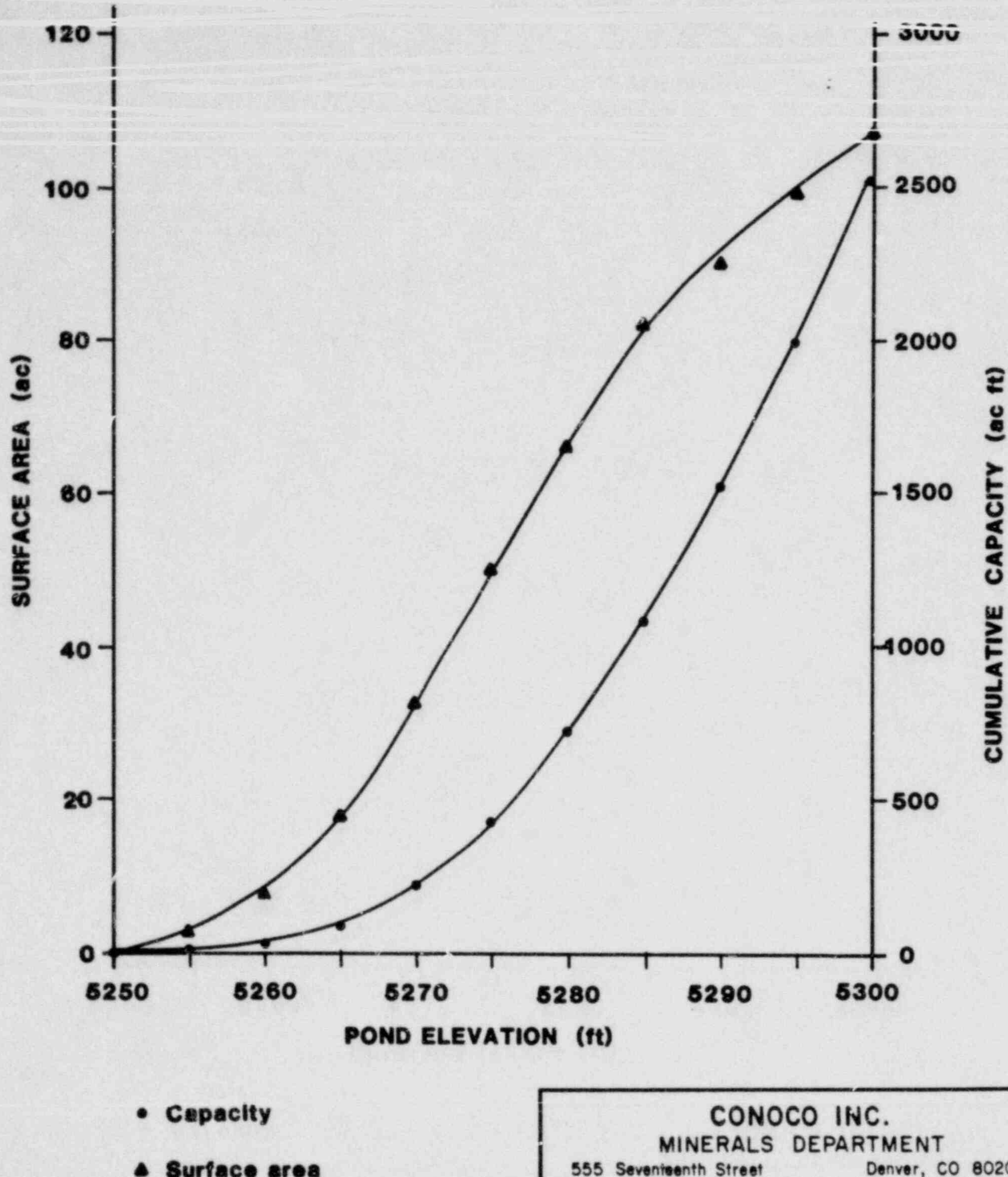
Figure 4j

Comment No. 26

Provide stage-volume-area curves for the evaporation pond and the tailings pit. These curves should be integrated with the five-phase deposition plan and should consider both tailings and water volume.

Response

The requested information is attached.



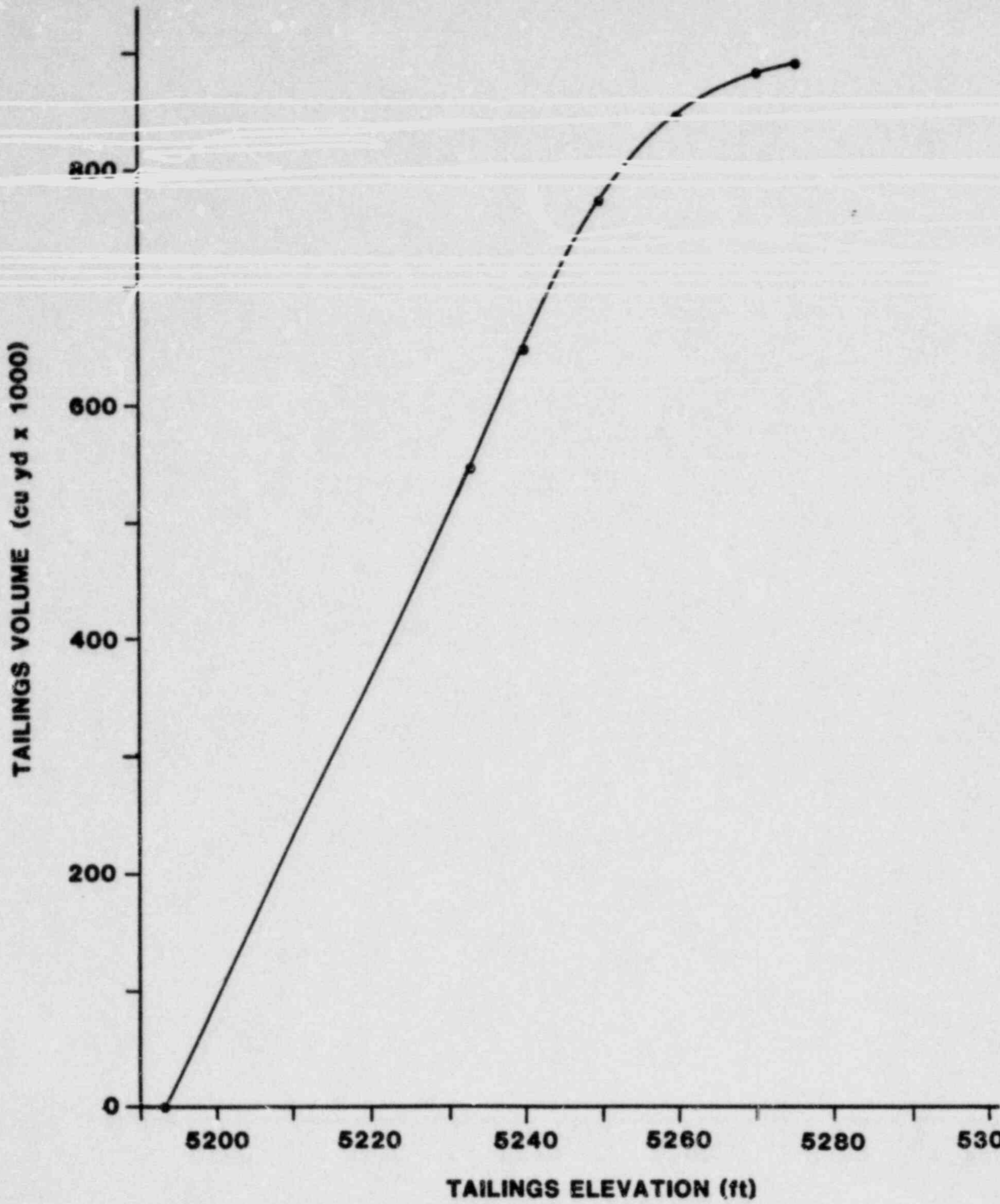
CONOCO INC.
MINERALS DEPARTMENT
555 Seventeenth Street Denver, CO 80202

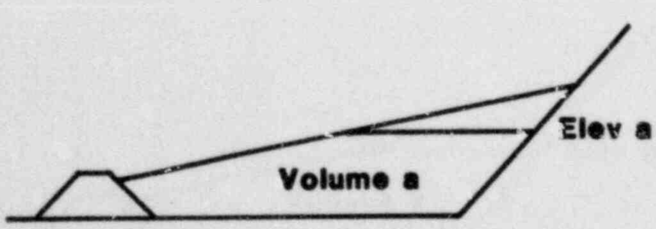
SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

AREA-VOLUME CURVES

EVAPORATION POND

JUNE 1981





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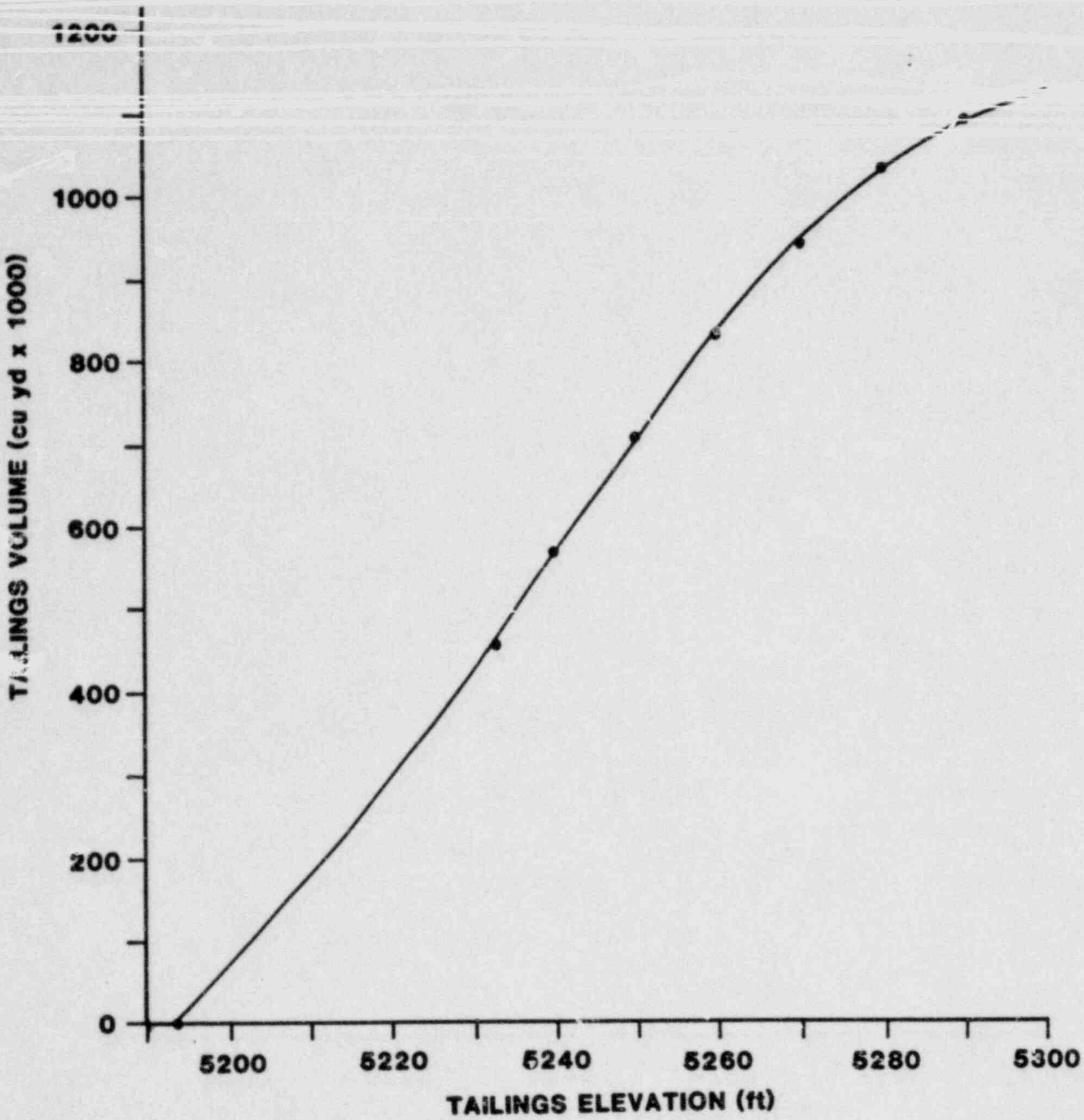
MINERALS DEPARTMENT
555 Seventeenth Street Denver, CO 80202

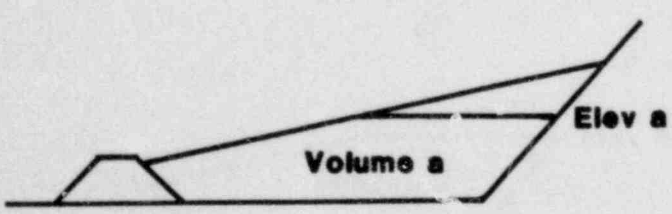
SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

TAILINGS VOLUME vs ELEVATION

PIT 35N PHASE 2

JUNE 1981





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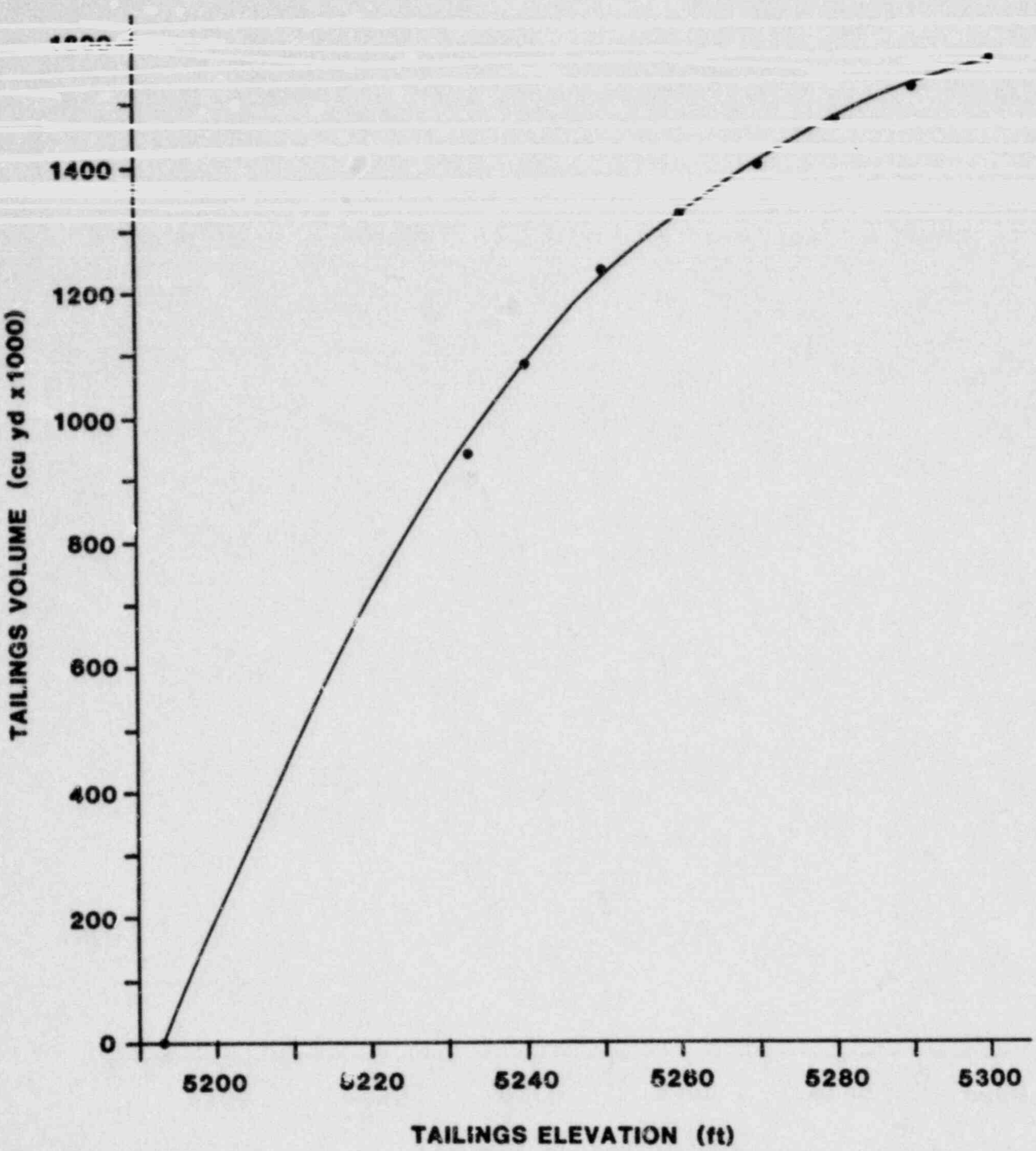
MINERALS DEPARTMENT
555 Seventeenth Street Denver, CO 80202

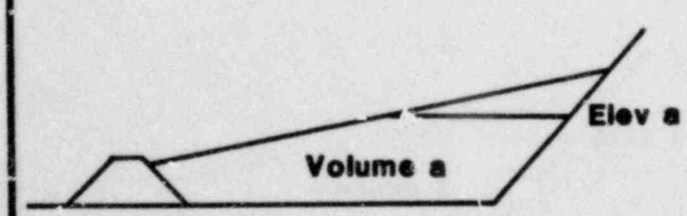
SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

TAILINGS VOLUME vs ELEVATION

PIT 35N PHASE 3

JUNE 1981





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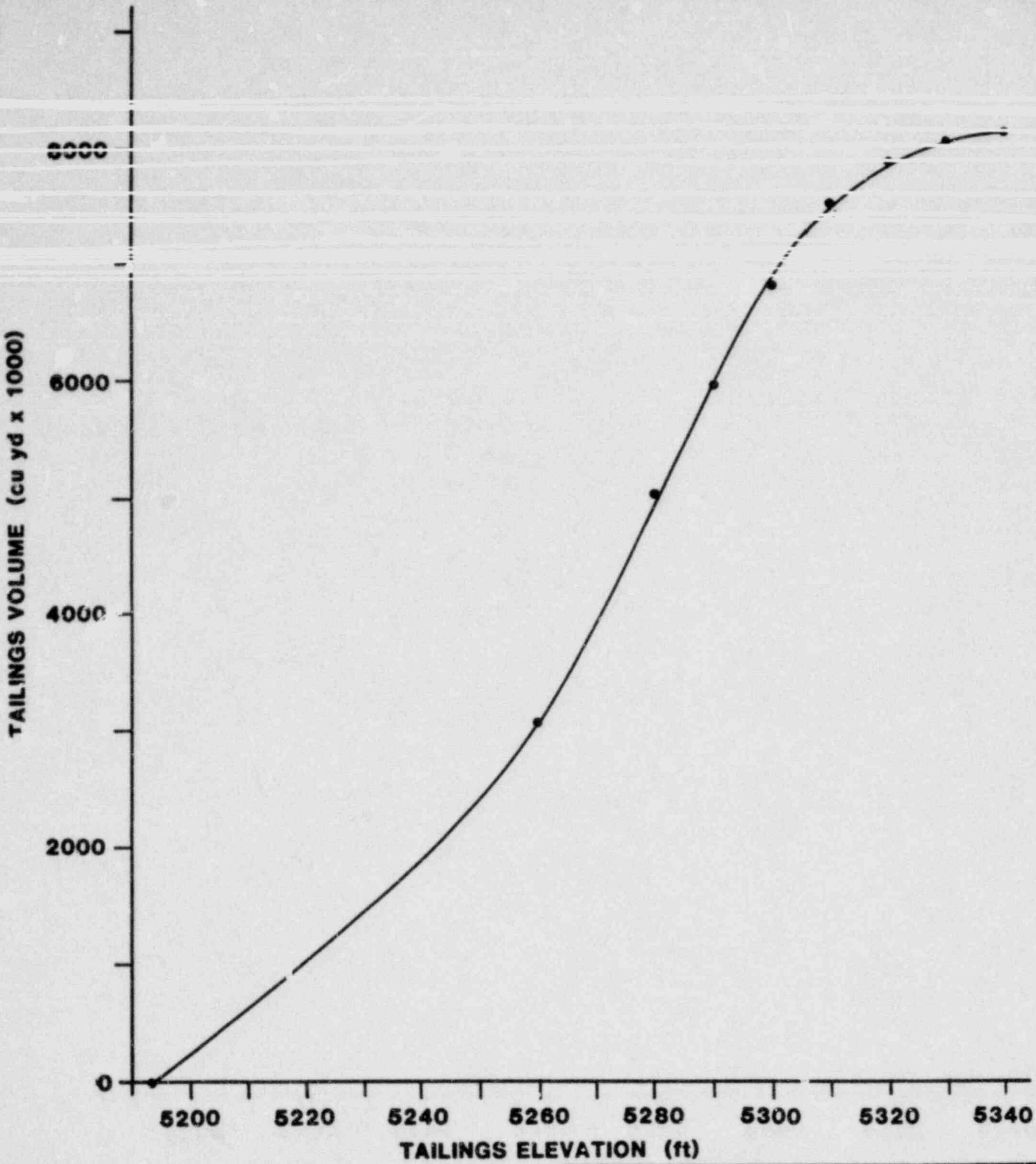
MINERALS DEPARTMENT
555 Seventeenth Street Denver, CO 80202

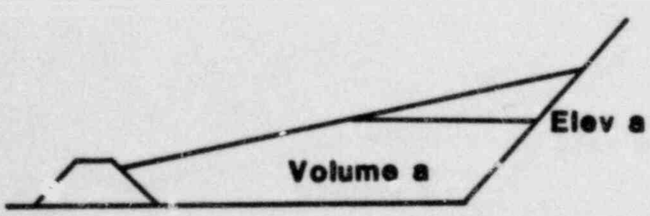
SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

TAILINGS VOLUME vs ELEVATION

PIT 35N PHASE 4

JUNE 1981





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MINERALS DEPARTMENT
555 Seventeenth Street Denver, CO 80202

SAND ROCK MILL PROJECT
CAMPBELL COUNTY, WYOMING

TAILINGS VOLUME vs ELEVATION

PIT 35N PHASE 5

JUNE 1981