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UNION CARBIDE CORPORATION
METALS DIVISION
137 47TH STREET, P.O. BOX 97, NIAGARA FALLS, N.Y. 14302
TELEPHONE: 716-278-3000
CABLE: TWIX NO. 710-524-1664

TECHNOLOGY DEPARTMENT
— ENGINEERING

April 3, 1980

Mr. Albert J. Hazle, Director
Radiation and Hazardous Wastes Control Division
Colorado Department of Health
4210 East 11th Avenue
Denver CO 80220

Subject: Uravan Tailings - Pond 3, Phase IIA

Dear Mr. Hazle:

Attached are five (5) copies of our analysis of Pond 3 short term stability (6 months) after Phase IIA construction is completed. The following documents are attached:

1. Memo describing Pond 3, Phase IIA Berm and resultant stability.

2. Material specifications for drainage gravel and rock fill.

3. Construction drawings for typical sections.
   Drawings: 244-1636, 244-1640 and 244-1642

We propose discharging into Pond 3 (with appropriate lift as shown in sketches) as soon as Phase IIA, Pond 3 construction is completed.

We solicit your approval.

Very truly yours,

T. J. Kagetsu

T. J. Kagetsu
Assistant Director - Engineering

TJK/FPC
Enclosures

cc: Dr. Gonzalo Castro - GEI
    Mr. A. Pearson/R. Junge (2)
    Dr. L. Person - NRC ✓

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FEE EXEMPT

Add'l info

ACRES

April 1, 1980
P5387.01

Union Carbide Corporation
Metals Division
P.O. Box 97
Niagara Falls, New York 14302

Attention: Mr. R Brown

Gentlemen: Pond 3 Phase 2A Berm

This letter report provides our stability analysis results for the Pond 3 Phase 2A design and justification for our design criteria.

We have attached sketch drawings SF 7505, SF 7506, SF 7507, SF 7508, SF 7509 and SF 7510 showing our stability analysis results for three typical sections through Pond 3 and also attached is plan drawing 244888 showing section locations.

The Phase 2A berm represents a minimum berm size required to permit continued safe operation of Pond 3 for an interim period (approximately 6 months) until the final berm can be constructed. The Phase 2B or final configuration will be designed to provide for long term safe operation of the tailings pond.

In considering the seismic design criteria to be utilized in both of these cases, it is our judgement that a 0.05 g peak horizontal acceleration, which is equivalent to a 200 year return period seismic event, will suffice for the Phase 2A design. Over a maximum operating period of 6 months, the probability of a single exceedance is 0.25 percent, which is minimal.

For a five year operating period with the Phase 2A and B work in place and utilizing a seismic design criteria of 0.12 g peak horizontal acceleration

ACRES AMERICAN INCORPORATED
Consulting Engineers
The Liberty Bank Building, Main at Court
Buffalo, New York 14202
Telephone 716-853-7525 Telex 91-6423 ACRES BUF
Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC

corresponding to a 1000 year return period event, the probability of a single exceedance of the 0.12 g criteria is 0.5 percent.

Correspondingly, for the same five year period the probability of a single exceedance of a 0.05 g event is 2.5 percent.

It is our opinion, therefore, that the low exceedance probabilities of the seismic events justify our selection of 0.05 g for Phase 2A and 0.12 g for the final or Phase 2B berm.

The slope stability was determined using the Acres "Janbu" slope stability program. We have included in our analysis that there exists a continuous horizontal weak layer of slimes, however, due to the method of deposition it is highly unlikely such a layer exists. The weaker layers are assumed to start in the slimes and continue through the hydraulically deposited sands until they reach the outer shell where construction practices preclude their existence. The weak slime layers were determined by analyzing the cross-sections assuming that all the material was composed of the weaker slimes. After the deep seated and the higher critical failure planes were determined, the weak layers were located on the section where they would cause the greatest reduction in the factor of safety.

The static stability was analyzed using effective stress parameters which represent soil behavior under drained conditions (see sketches). The driving forces were obtained on the basis of total weights and resisting forces were determined using the effective weights.

A pseudo-static analysis was carried out to simulate slope stability conditions during the previously mentioned design earthquake. The likelihood of failure was then determined and expressed by the factor of safety (see sketches). This pseudo-static stability analysis was conservatively performed considering effective weights corresponding to those existing before the seismic event. The effect of pore pressure generation during earthquake was included in the analysis through the use of undrained strength parameters obtained from isotropically consolidated undrained triaxial shear tests. In these tests, the samples were first saturated and then consolidated to a vertical effective stress corresponding to field conditions prior to the earthquake. Then, they were tested rapidly without allowing for pore pressure dissipation. Hence, similating field conditions during very quick loading (earthquake).

Very truly yours,

John B. Berry, P.E.
Manager - Industrial Projects

JBB:sd
Attachments

cc: Mr. A. J. Hazle - Colorado Dept. of Health
Mr. A. E. Pearson - Colorado Dept. of Natural Resources
Dr. L. Person - Division of Waste Management
Dr. G. Castro - Geotechnical Engineers, Inc.

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MATERIAL SPECIFICATIONS

Material Specifications for the Drainage Gravel and the Graded Rock fill are as follows:

DRAINAGE GRAVEL

Drainage gravel material shall consist of sand and gravel or crushed rock, or an approved combination thereof. The gravel material shall be comprised of hard durable, non-degrading particles free from organic matter, flat or elongated particles, dirt, clay, and rock fines.

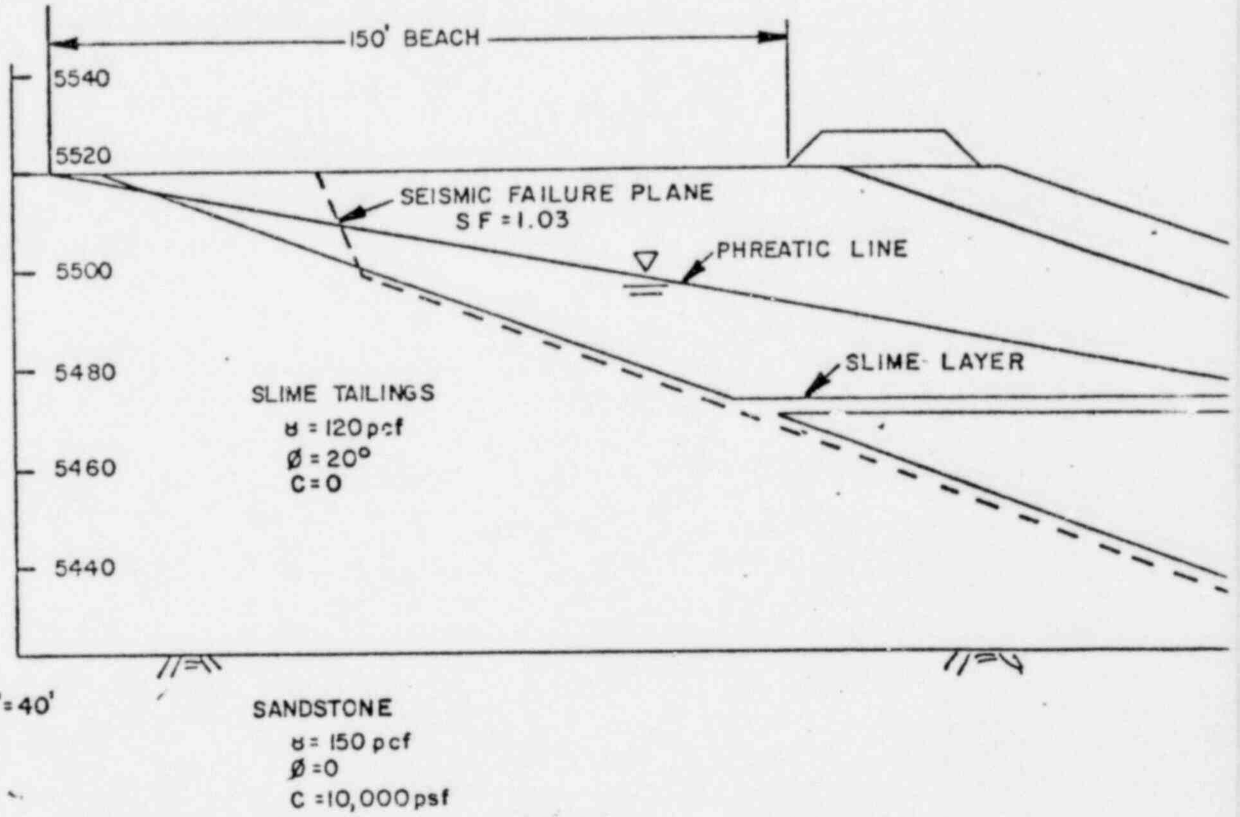
The drainage gravel shall conform to the following grading limits:

U.S. Standard Sieve	Percent Passing by Weight
2 inches	100
1 inch	95-100
3/4 inch	85-100
1/2 inch	75-100
No. 4	50-80
No. 10	30-55
No. 20	10-35
No. 40	0-15
No. 100	0-5

ROCK FILL

The graded rock fill material shall consist of clean sandstone which is free of clay, shale or siltstone fragments, organic debris and shall conform to the following gradation limits:

Sieve Size	Percent Passing by Weight
12 inches	100
8 inches	90-100
2 inches	55-100
3/4 inches	0-85
No. 4	0-70
No. 20	0-40
No. 40	0-15
No. 100	0-10



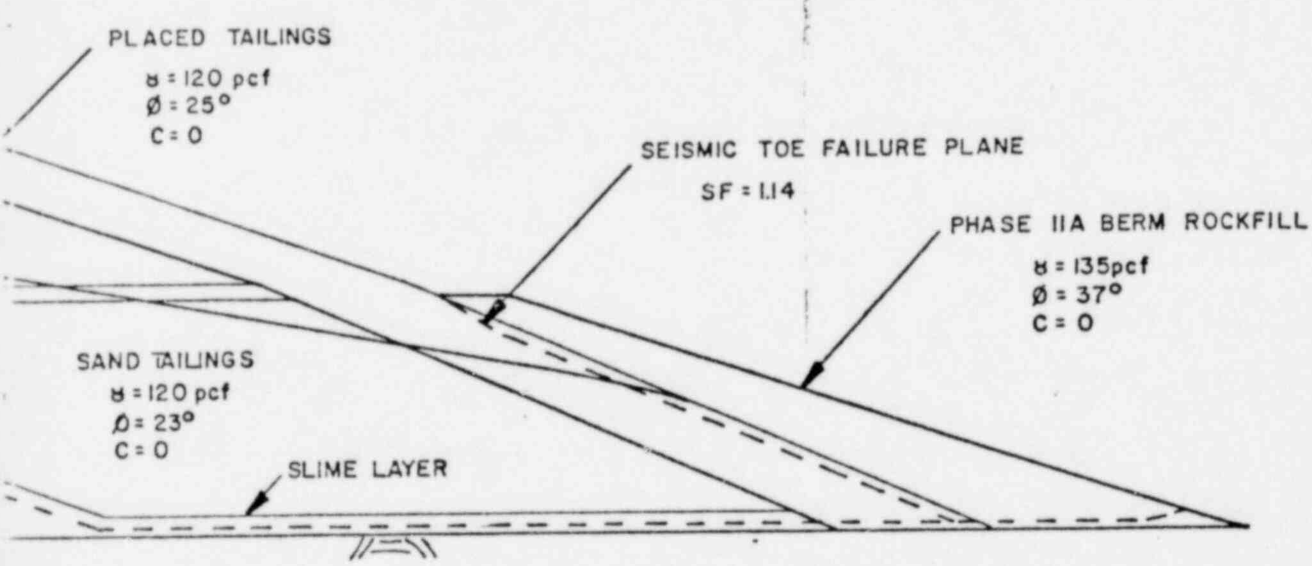
SCALE = 1" = 40'

PHASE II /

BERM

TAILIN

PSEUDO STATIC



ND 3

SECTION 14 - 14

LEV. 5470

ELEV. 5520

RTHQUAKE ANALYSIS

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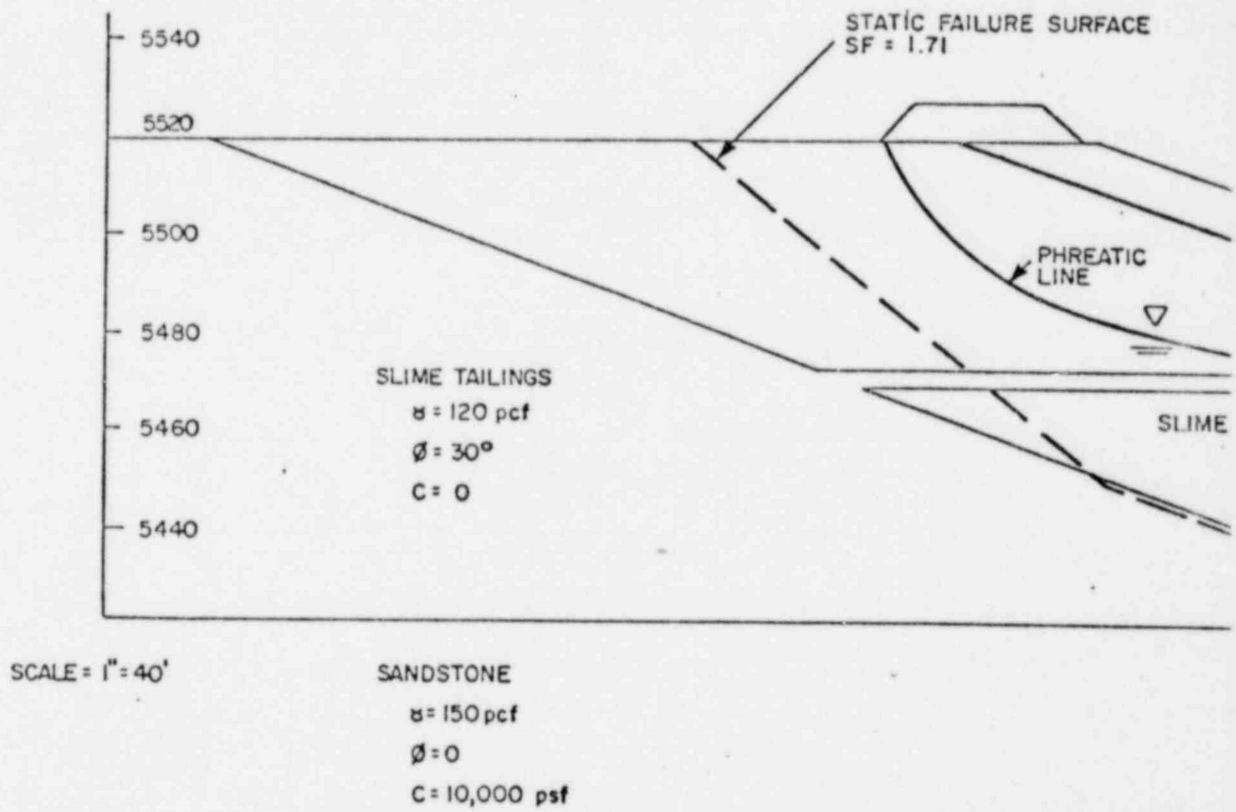
UNION CARBIDE CORPORATION
URAVAN, COLORADO PLANT
DATE: 3-31-80 SF 7505

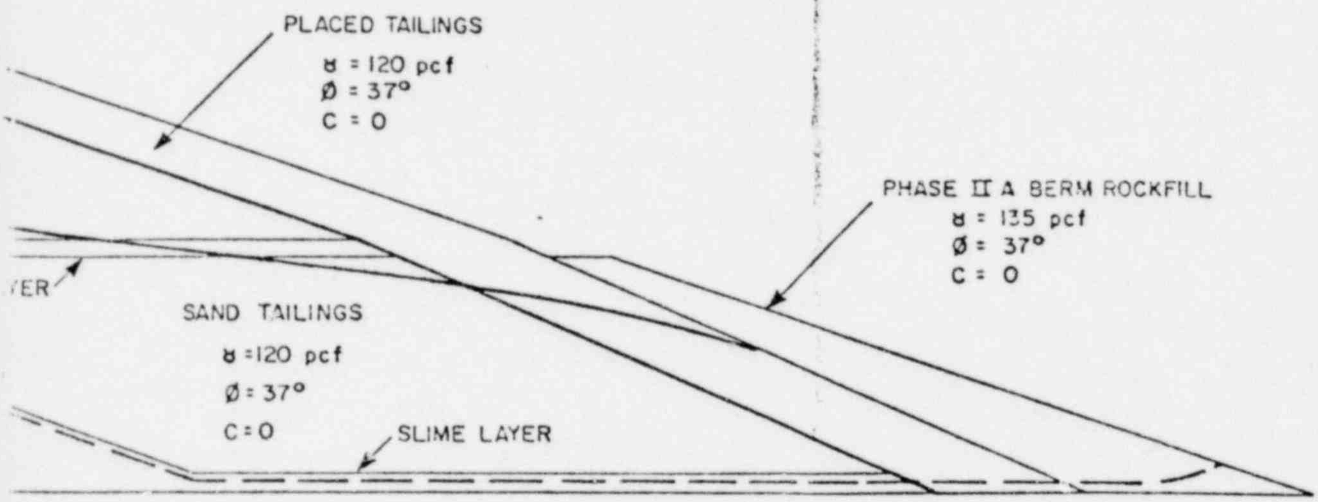


PHASE II

BERM

TAILIN

EFFECTIVE



ND 3

SECTION 14 - 14

LEV. 5470

ELEV. 5520

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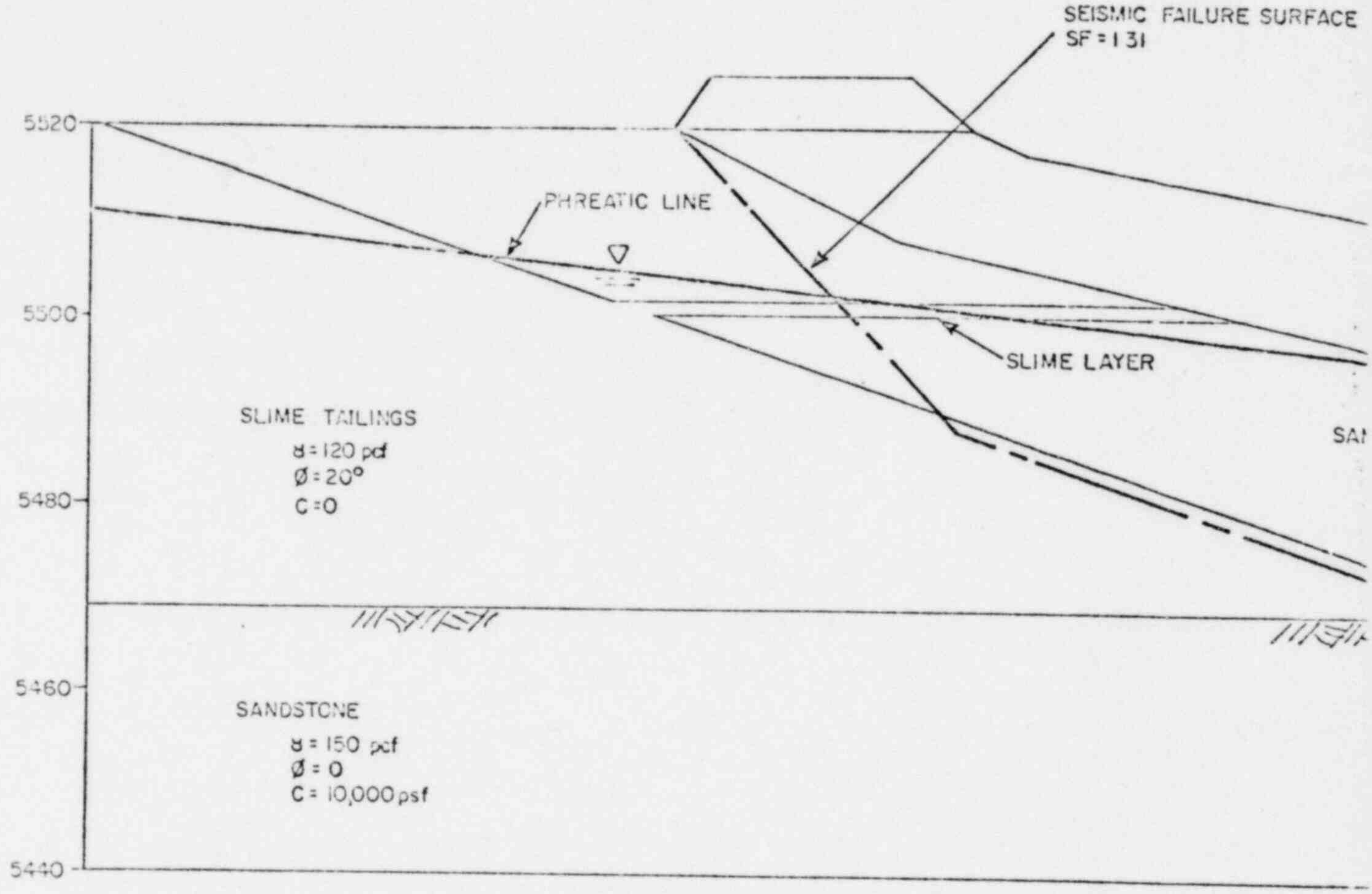
UNION CARBIDE CORPORATION

URAVAN, COLORADO PLANT

DATE: 3-31-80 SF 7506



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PHASE II A

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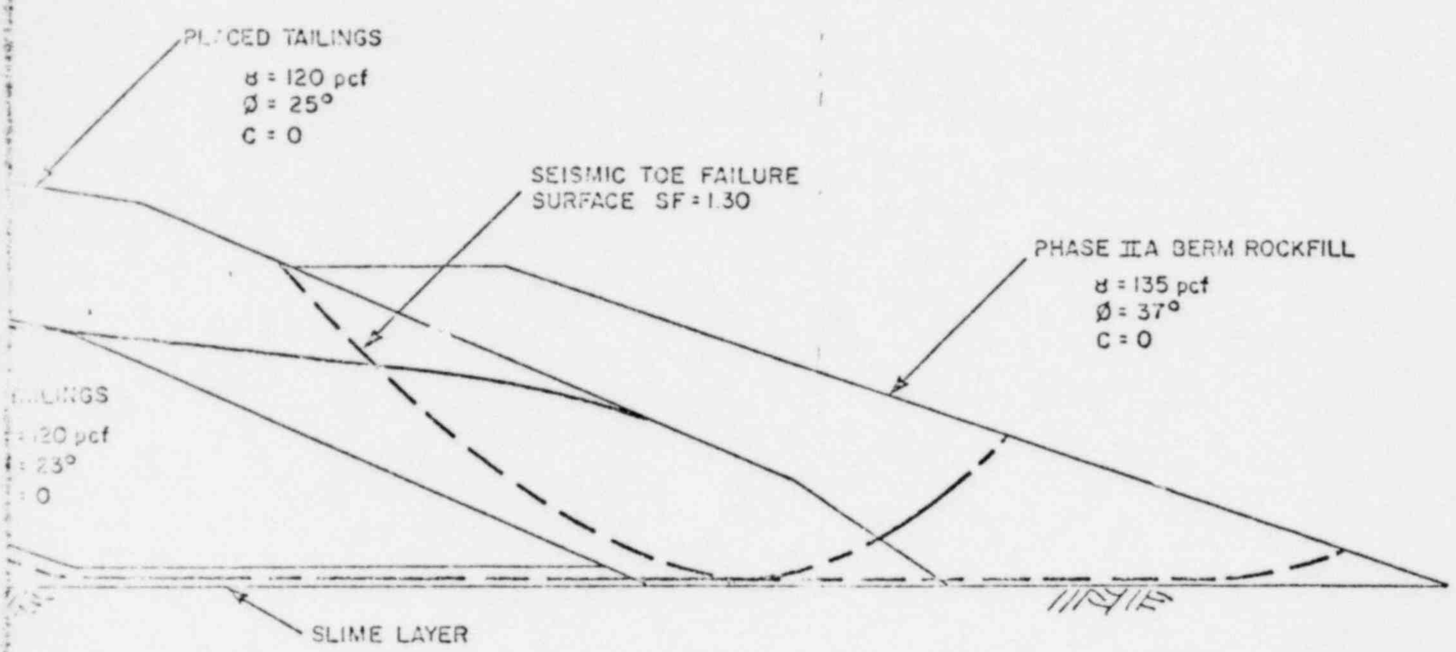

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CTION 25-25

EV. 5500

EV. 5520

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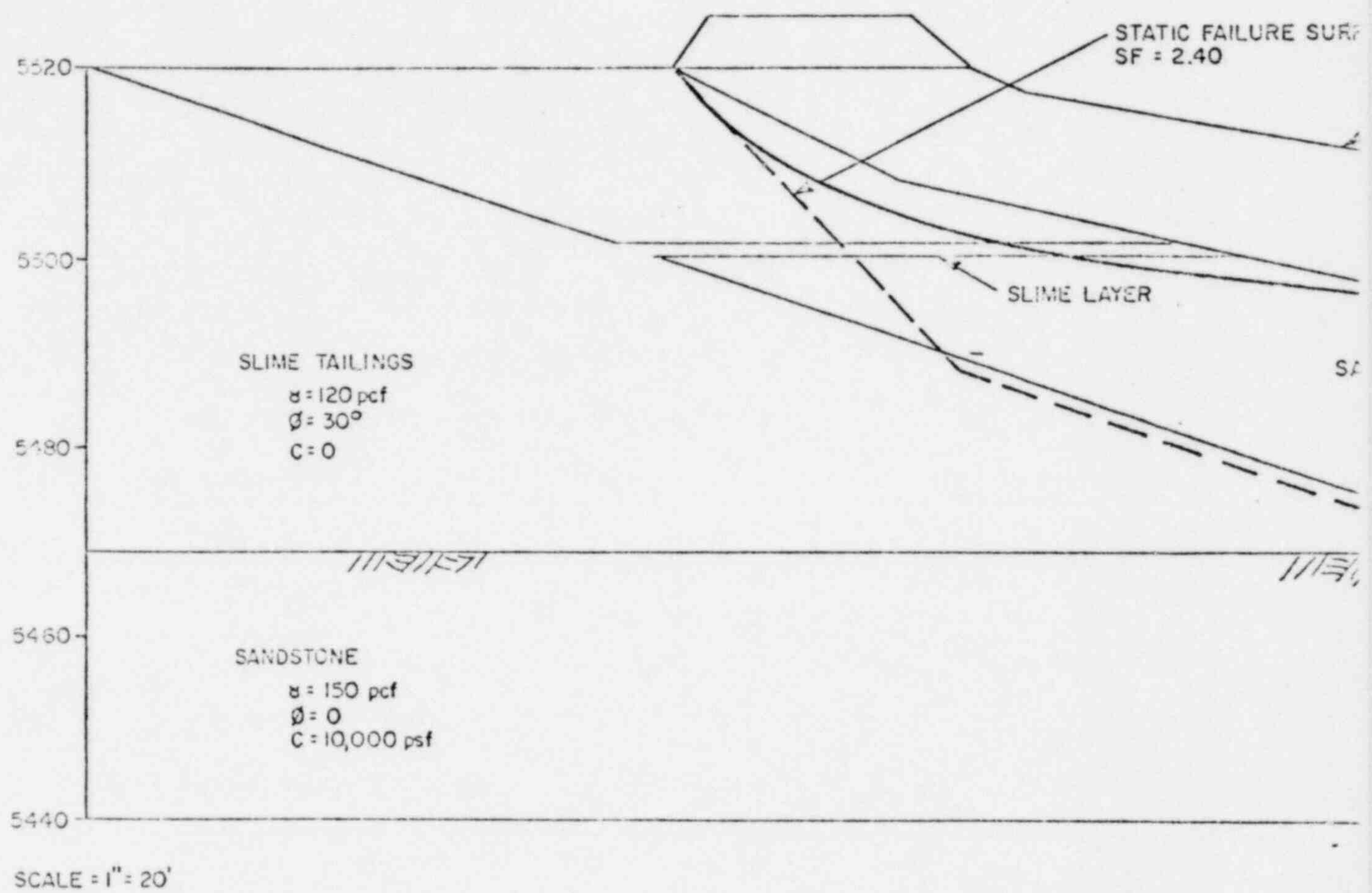
UNION CARBIDE CORPORATION
URAVAN, COLORADO PLANT
DATE: 3-31-80 SF 7507



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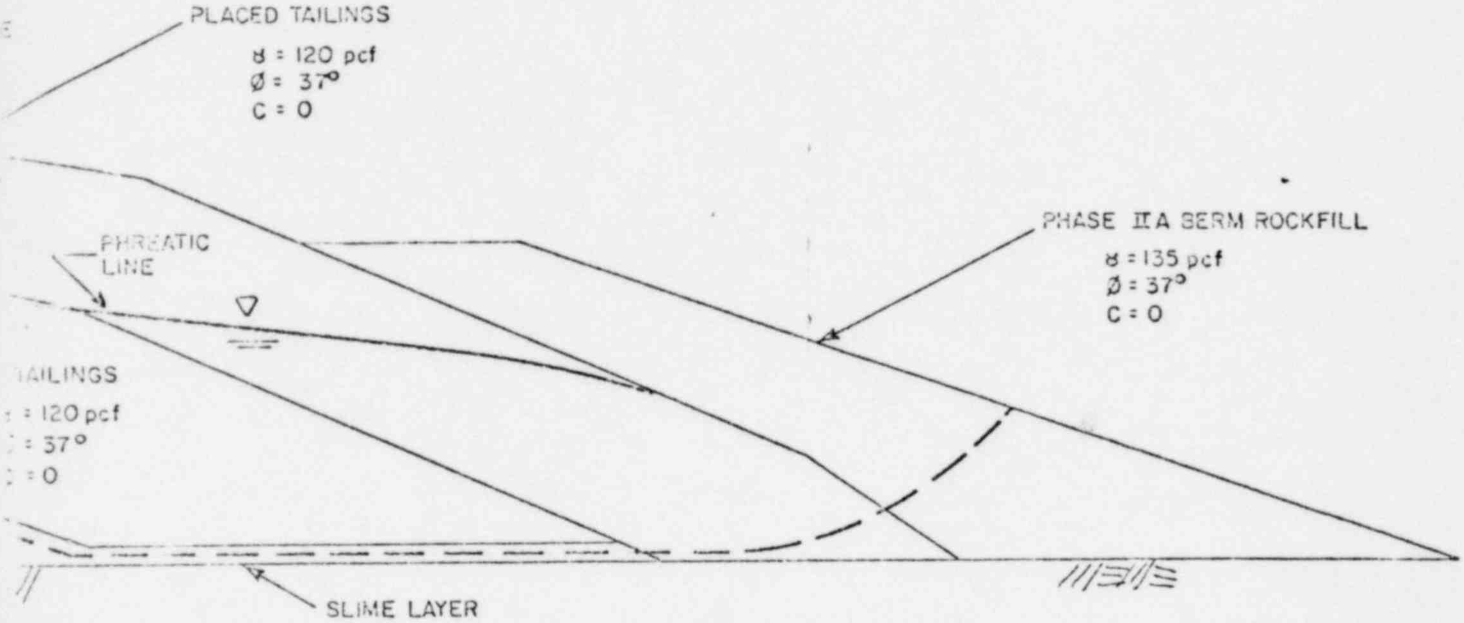

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CTION 25 - 25

EV. 5300

LEV. 5520

ESS ANALYSIS

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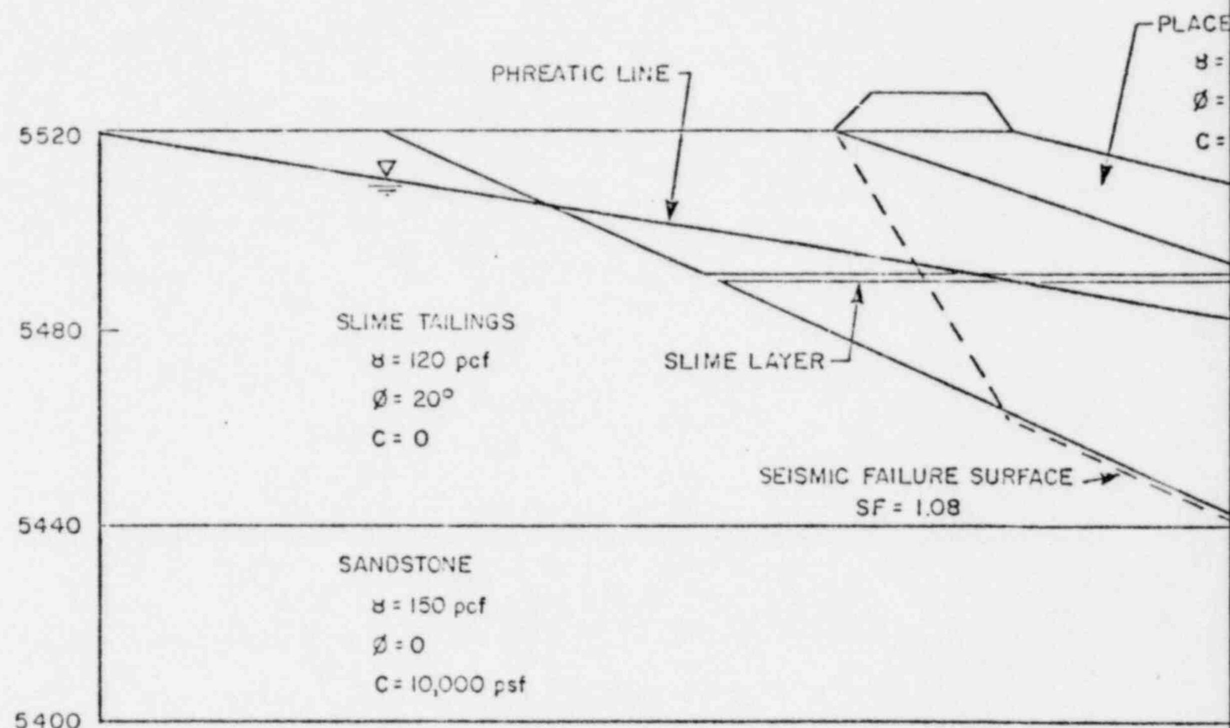
UNION CARBIDE CORPORATION
URAVAN, COLORADO PLANT
DATE: 3-31-80 SF 7503



SCALE = 1" = 40'

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PHASE IIA

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TAILINGS

PSEUDO STATIC E

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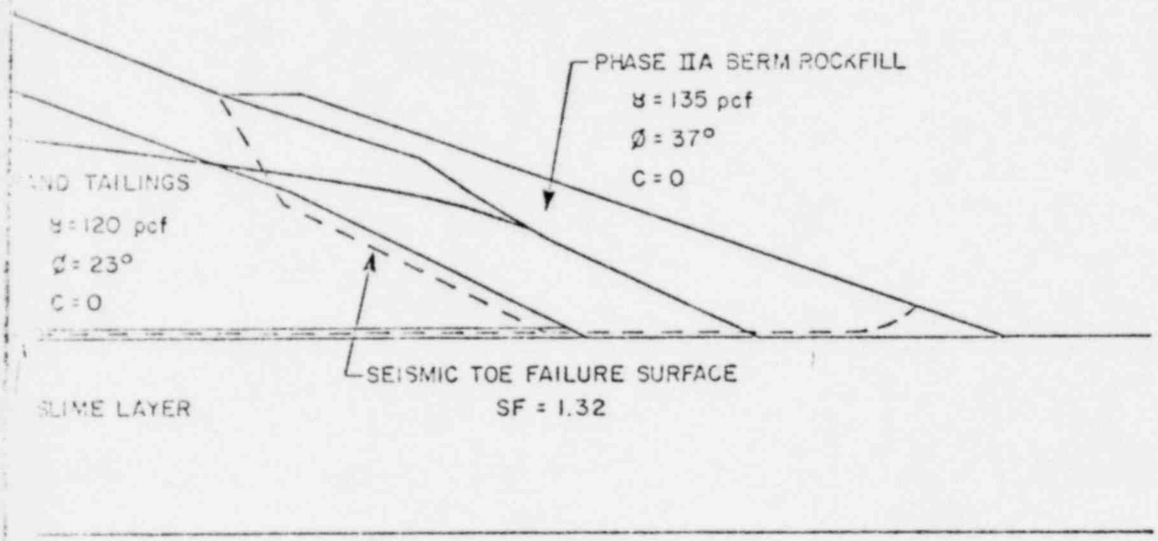

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CTION 20-20
V. 5490
LEV. 5520
HQUAKE ANALYSIS
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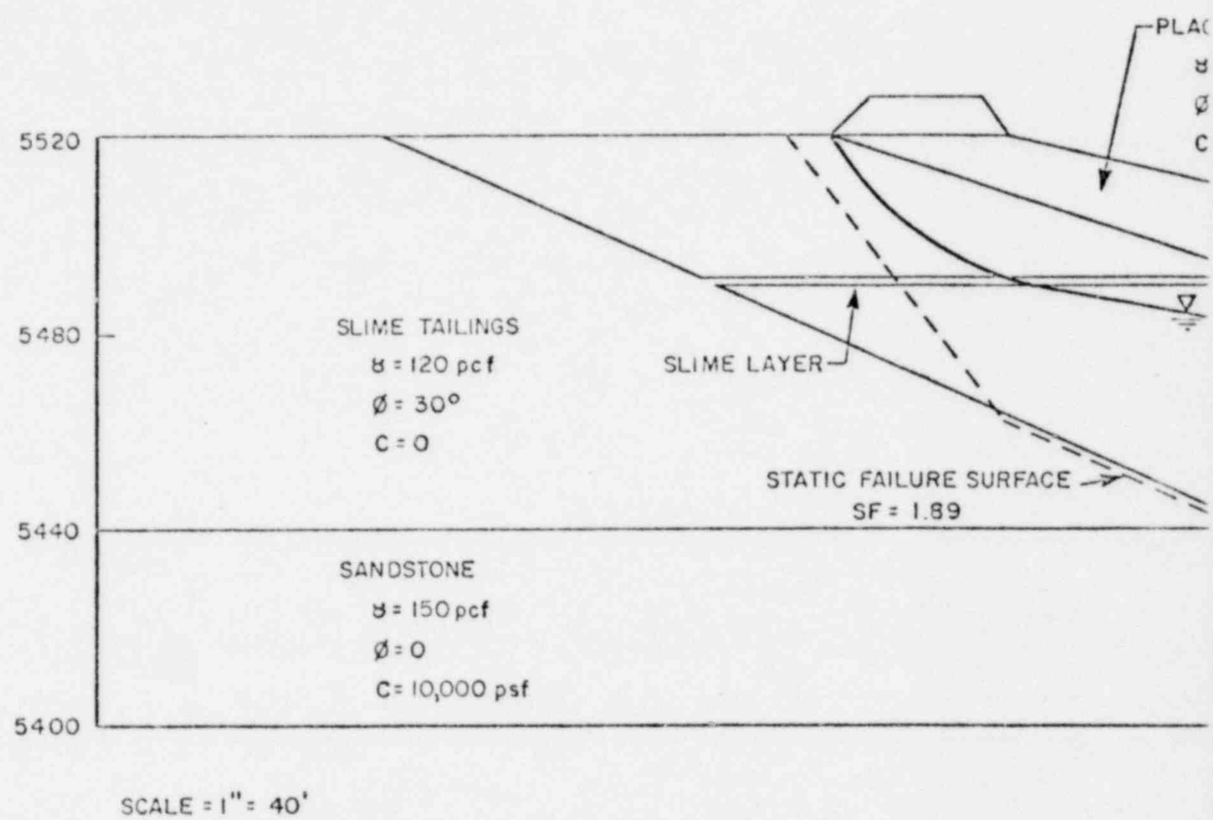
UNION CARBIDE CORPORATION
URAVAN, COLORADO PLANT
DATE: 3-31-80 SF 7509



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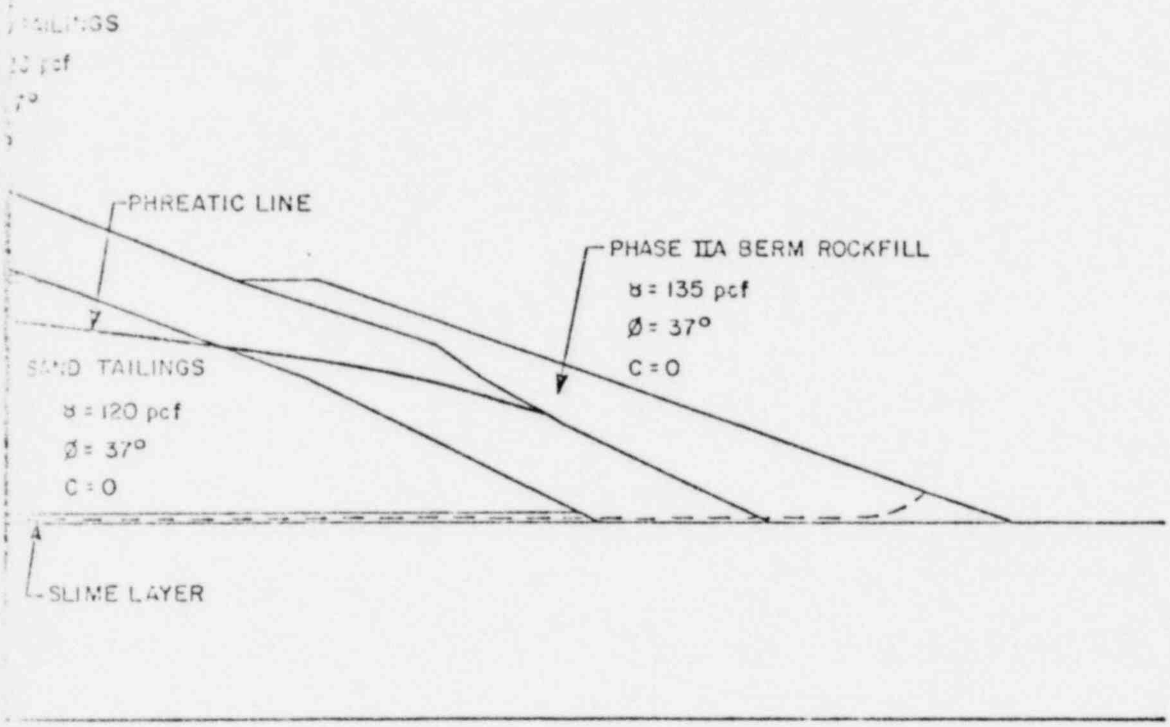

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CTION 20-20
EV. 5490
EV. 5520
SS ANALYSIS

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UNION CARBIDE CORPORATION
URAVAN, COLORADO PLANT
DATE: 3-31-80 SF 7510