PDR

WM-20

PIONEER NUCLEAR, INC.
POST OFFICE BOX 151, AMARILLO, TEXAS 79189

STEVEN L. LANGE
Environmental Coordinator

March 6, 1980

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U.S. Nuclear Regulatory Commission
Mail Section

U. S. Nuclear Regulatory Commission
7915 Eastern Avenue
Mail Stop 483 SS
Silver Spring, Maryland 20910

Attn: Ms. Kathy Hamill

Dear Kathy:

The additional information which you have requested over the last several days is enclosed. Specifically, the materials are:

1. Coordinates of receptor locations
2. Map showing restricted area boundary and location of yellowcake drier stack
3. Joint Frequency tables by stability class in percent occurance
4. Clarification of the seepage analysis

I believe these materials satisfy your current needs.

Pioneer Uravan appreciates your attention to the review of the San Miguel Project and wish to assist in any manner necessary. If you have further questions, please contact me.

Sincerely yours,

Steven L. Lange

Steven L. Lange

SLL/dlw

Enclosures

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Seepage Analysis for Unlined Tailings Impoundment

Rate of Water Discharge to Tailings Impoundment

Based on CSMRI's bench test moisture content of tailings expressed as a percentage of total weight ($W_{water}/W_{water} + W_{tai}$) is 25%. A sample of the tailings were obtained from CSMRI during this investigation, and a moisture content determination. The results of this determination indicated a moisture content of 24.5% expressed in terms of total weight. In soil mechanics terms, moisture content is expressed as a percentage of the weight of dry soil (W_{water}/W_{soil}). Expressed in this way, the measured moisture content was 32.3%.

(1) $\frac{W_w}{W_w + W_s} = 0.245$

(2) $W_w = 0.245\ W_w + 0.245\ W_s$

(3) $0.755\ W_w = 0.245\ W_s$

(4) $W_w = \frac{0.245}{0.755} W_s = 0.323\ W_s$

(5) $W = \frac{W_w}{W_s} = \frac{0.323\ W_s}{W_s} = 32.3\%$ Say 32%

If tailings are produced by the mill at a rate of 1000 dry tons per day the weight of water discharged to the tailings impoundment each day is:

$$W_w = wW_s = (.32)(1000\ \text{tons}) = 320\ \text{tons}$$

Assuming a mill efficiency of 90%, the rate of water discharge is:

$$Q_{in} = .90 \times \frac{320\ \text{tons}}{\text{day}} \times \frac{2000\ \text{lb}}{\text{ton}} \times \frac{\text{gal}}{7.48\ \text{lb}} \times \frac{\text{day}}{1440\ \text{min}} = 53\ \text{gpm}$$

Therefore, if all water that is discharged to the impoundment is lost through seepage, the maximum possible seepage rate would be 53 gpm. But some water will be retained in the tailings by molecular and surface tension forces, and will not be lost through seepage. For purposes of this analysis, it will be assumed that all water except for that retained in the tailings will be lost through seepage. Losses through evaporation will be ignored.

Water Retained in Tailings Due to Molecular Forces and Surface Tension

The specific retention of a rock or soil is the ratio expressed as a percentage of the volume of water it will retain after saturation against the force of gravity to its own volume. If S_r is the specific retention, then

$$S_r = \frac{100\ W_r}{V}$$

where W_r is the volume occupied by retained water, and V is the gross volume of the rock or soil[a].

On Page 24 of the reference, the Figure below is presented which provides a relationship between grain size and specific retention. Based on the anticipated gradation fo the tailings presented on Page 4 of the Dames & Moore Design Report, the maximum 10% grain size of the tailings is approximately 0.295 millimeters. As shown on the figure below, this corresponds to a specific retention of about 20%.

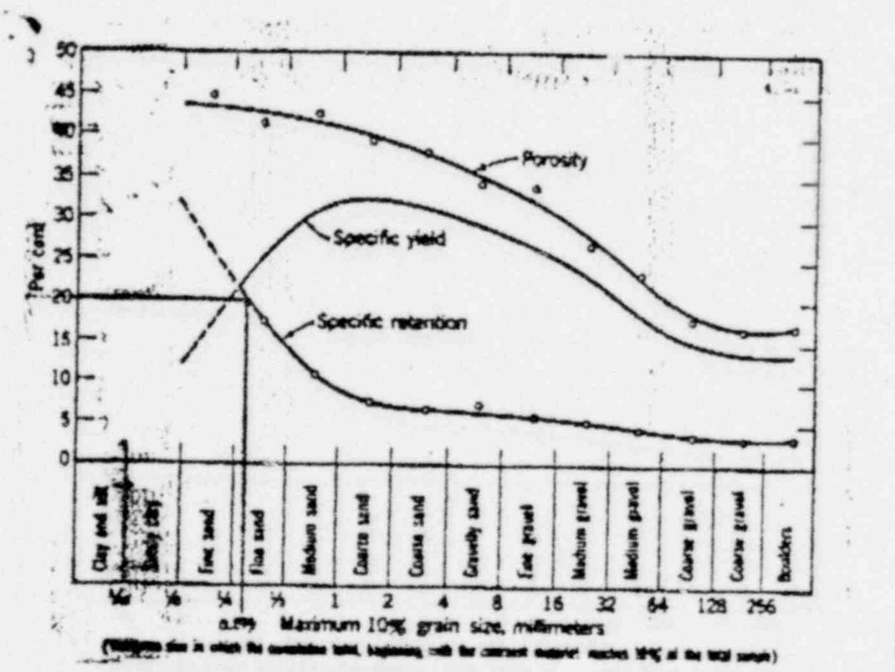

Fig. [illegible] Porosity, specific yield, and specific retention variations with grain size, South Coastal Basin, Calif. (after Eckis[13]).

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[a]Todd, D.K. Ground Water Hydrology, John Wiley & Sons, Inc., 1966, pg. 23

POOR ORIGINAL

A consolidtion test was conducted on a sample of the tailings during this investigation to estimate the density of the tailings after placement in the impoundment and covering with approximately 20 feet of reclamation cover. Based on results of this test, it is anticipated that the average dry density of the tailings after consolidation will be about 90 pounds per cubic foot. This value was used in sizing of the tailings impoundment trenches.

If $S_r = \frac{W_r}{V} = 0.20$, each 1 ft^3 of tailings in the impoundment

will contain 0.20 ft^3 of water. The weight of retained water will be

$$W_w = 0.20\ ft^3 \times \frac{62.4\ lb}{ft^3} = 12.5\ pcf$$

Therefore, the moisture content of the tailings following consolidation and seepage of free water will be:

$$w = \frac{W_w}{W_s} = \frac{12.5\ pcf}{90.0\ pcf} = 13.9\% \quad \text{Say } 14\%$$

If the initial moisture content was 32% and the moisture content following consolidation and seepage is 14%, the difference was lost to seepage.

Therefore, the percentage the total water discharged to the impoundment that is retained in the tailings is

$$W_s\ \frac{14\%}{32\%} = 44\% \quad \text{or} \quad .44 \times 53\ gpm = 23\ gpm$$

and the percentage of total water discharged to the impoundment that is lost through seepage is

$$\frac{32\% - 14\%}{32\%} = 56\% \text{ or } .56 \times 53\ gpm = 30\ gpm$$

Seepage Analysis for Tailings Impoundment with Dewatering System

Dewatering system will consist of (1) grading the bottom of each impoundment trench so that it slopes toward its center and toward its south end, (2) scarifying and recompacting the upper 6 inches of the weathered Mancos shale in the bottom of each trench so that it will serve to restrict seepage through its bottom, and (3) installation of a drain pipe longitudinally along the center of each trench and a sump at its south end to collect the seepage.

Estimate seepage through sides of tailings trenches and effectiveness of drain

(1) Compute seepage by means of hand-drawn flow net presented on following page. Bottom of trench is assumed to be impervious. Sides are assumed to be free draining. 2" diameter drain pipe at centerline of trench bottom.

(2) Determine quantity of water in section of trench that discharges to drain.

(a) Volume of one lineal foot of trench cross-section:

$$V = (137.5 \times 30) + \frac{(30 \times 60)}{2} + \frac{(30 \times 52.5)}{2}$$

$$= 4215 + 900 + 787.5$$

$$= 5812.5 \text{ ft}^3 \text{ per lineal foot}$$

(b) Weight of tailings contained in one lineal foot of trench

$$W = 5812.5 \text{ ft}^3 \times 90 \frac{\text{lb}}{\text{ft}^3} \times \frac{\text{ton}}{2000 \text{ lb}} = 261.6 \text{ tons}$$

(c) Quantity of water in one lineal foot of trench

Weight of water = wW_s = 0.32 x 261.6 tons = 83.7 tons

Volume of water = $83.7 \text{ tons} \times \frac{2000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{62.4 \text{ lb}} \times \frac{7.48 \text{ gals}}{\text{ft}^3}$

= 20,067 gals

(d) Amount of free water in tailings

From seepage analysis for unlined tailings impoundment, 50% of the water discharged in the impoundment is free water; therefore, 0.56 x 20,067 = 11,238 gal of free water is contained in each lineal foot of tailings trench. This equals $\frac{11,238}{5,812.5}$ = 1.93 gal/cubic foot of tailings.

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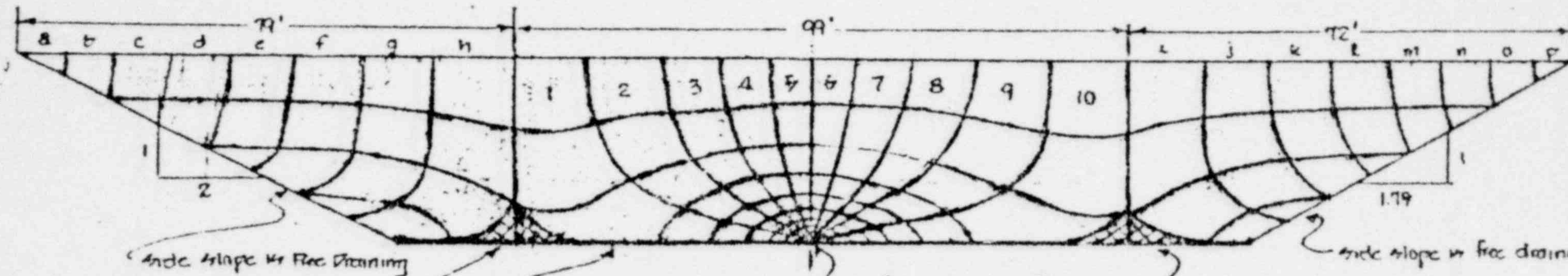

FLOW NET FOR TAILINGS TRENCH

SCALE 1" - 25'

(e) Volume of trench cross section discharging to drain

From flow net, width of trench discharging to drain is 99 ft. Volume of trench cross section is

$$99 \text{ ft} \times 30 \text{ ft} = 2970 \text{ ft}^3$$

(f) Volume of water in cross section discharging to drain

$$Q' = 2970 \text{ ft}^3 \times 1.93 \frac{\text{gal}}{\text{ft}^3} = 5{,}732 \text{ gal per lineal foot of trenches}$$

(3) Percentage of all free water in trench cross section that is collected in dewatering system is:

$$\frac{5{,}732}{11{,}238} = 0.51 \qquad 51\%$$

(4) Therefore, percentage of free water in impoundment that is lost to seepage through side slopes is 49%.
Volume of water lost to seepage through side slopes (Q') is

$$Q' = 0.49 \times 11{,}238 \text{ gal} = 5.507 \text{ gal per lineal foot of trench}$$

(5) Thus, of the 30 gpm of free water discharge into the impoundment, 49% is lost to seepage.

<u>Estimate flow rate through drain system and time required to drain</u>

(1) From flow net

$$q = k \frac{N_f}{N_d} h$$

where K = permeability of tailings, 30 feet/year
N_f = number of flow channels, 10
N_d = number of equipotential drops, 9
h = head, from water surface to water level at exit, 30 feet

$$q = 30 \frac{\text{ft}}{\text{yr}} \left(\frac{10}{9}\right) 30 \text{ ft} = 1000 \frac{\text{ft}^3}{\text{yr}}$$

$$= 1000 \frac{\text{ft}^3}{\text{yr}} \times \frac{7.48 \text{ gal}}{\text{ft}^3} \times \frac{\text{yr}}{525{,}600 \text{ min}} = 0.014 \text{ gpm/lineal foot of trench}$$

(2) At this, how long will it take to complete drain

$$T = 5732 \text{ gal} \times \frac{\text{min}}{.014 \text{ gal}} \times \frac{\text{day}}{1440 \text{ min}} = 284 \text{ days}$$

Compute seepage t: ·ough liner

The analysis above a: sumed the bottom of the tailings trench was imp.:vious when in fact it is only very low permeability. Some seepage will be lost through the pond bottom. Compute this seepage.

(1) Determine the degree of saturation in the zone of Mancos shale underlying the tailings area within the first 5 feet above the water table (Refer to Design Report)

Boring No.	Depth of Sample (ft)	Depth of Water (ft)	Moisture Content %	Dry Density (pcf)	Calculated Degree of Saturation S, %	Calculated Porosity n
18*	35	40**	14.4	113	81	.32
5	24	32	11.2	114	65	.32
B*	42	42	18.0	109	91	.35
D*	33.5	40**	18.8	103	81	.38
E*	33.5	35**	21.1	107	100	.36
F	27.5	35**	14	101	58	.39

*those samples within 5 feet of water level.
**estimated

Average value of S = 88%, n_{ave} = .35

(2) Calculate initial volumetric water content

$$\theta_i = \frac{S}{100\%} = n = 0.88 \times 0.35 = 0.31$$

(3) Analyze seepage flow by using McWorter & Nelson approach to unsaturated flow (see calculations presented previously for evaporation ponds for detailed description of approach)

Assume following conditions:

D_t = average depth of tailings below water surface, (30 feet + 0)/2 = 15 feet (full pond conditions)
K_t = permeability of tailings, 30 feet per year
D_l = thichness of liner, 0.5 feet
K_l = permeability of liner, .0035 feet per year
D_f = thichness of foundation material above water table, = 5 feet
K_f = permeability of Mancos Shale, 1,000 feet per year
θ_i = initial volumetric water content
θ_f = final volumetric water content

(a) Check for saturated/unsaturated condition above wetting front:

$$D_t + D_l - K_f \frac{D_t}{K_t} + \frac{D_l}{K_l} < hd\text{, unsaturated}$$

where h_d is the displacement pressure.

(b) Seepage flow through pond bottom lined with 0.5 feet of recompacted shale.

$$q = \frac{D_t + D_l - h_d\ (q/K_f)^{-1/(2+3\lambda)}}{\frac{D_t}{K_t} + \frac{D_l}{K_l}}$$

hd from Figures 3 and 4 of reference, h_d = 60 cm/30.48 cm/foot = 1.97 feet.

λ, pore size distribution index assumed as 2.

$$q = \frac{15 + 0.5 + 1.97\ (q/1000)^{-.125}}{143}$$

q = .14981 feet/year per square foot of area.

q = 0.15 x width of one lineal foot of lined trench cross section (see flow net)

$$q = 0.15\ \frac{ft}{year} \times 137\ ft^2 = 20.6\ \frac{ft^3}{year} \text{ per lineal foot of trench}$$

$$q = 20.6\ \frac{ft^3}{yr} \times \frac{7.48\ gal}{ft^3} \times \frac{yr}{525{,}600\ min} = 0.0029 \text{ gpm per lineal foot of trench}$$

(c) But water is in trench section for maximum of 284 days Therefore, $Q'' = 20.6\ \frac{ft^3}{yr} \times \frac{284}{365}\ yr = \frac{7.48\ gal}{ft^3} = 120\ gal$

Q" = 120 gal per lineal foot of trench

Compute Average Seepage Rate From Impoundment

(1) All seepage losses from impoundment should have taken place 284 days after tailings impoundment is filled. Design life of project is 20 years. Therefore total time over which seepage occurs is 20.8 years.

(2) Total seepage losses

(a) Through sides of trenches

$$5{,}507 \frac{\text{gal}}{\text{lineal ft}} \times \frac{2500 \text{ lineal foot}}{\text{trench}} \times 10 \text{ trenches} = 137{,}680{,}000 \text{ gal}$$

(b) Through bottoms of trenches

$$120 \frac{\text{gal}}{\text{lineal ft}} \times 2500 \text{ lineal feet} \times 10 \text{ trenches} = 3{,}000{,}000 \text{ gal}$$

(c) Total seepage quantity over 20.8 years is 140,680,C00 gal

(4) Average seepage rate = $\frac{140{,}680{,}000 \text{ gal}}{20.8 \text{ yrs}} \times \frac{\text{yr}}{525{,}600 \text{ min}} = 12.9$ gpm

Say q_{ave} = 13 gpm

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class A

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.4310	0.3202	0.3325	0.2340	0.5296	0.5788	1.0345	1.0099	0.8128	0.8498	1.0961	1.0222	1.1330	0.7882	0.7882	0.4433	11.4100
5.5	0.3571	0.1108	0.1108	0.0739	0.0862	0.0616	0.2463	0.1478	0.3571	0.4803	0.4433	0.3818	0.9606	0.6897	0.6281	0.4187	5.5541
10.0	0.0985	0.0616	0.0369	0.0123	0.0000	0.0123	0.0369	0.0493	0.1970	0.4803	0.4680	0.2463	0.2217	0.1970	0.2833	0.2217	2.6231
15.5	0.0246	0.0000	0.0123	0.0123	0.0000	0.0000	0.0123	0.0000	0.0862	0.0862	0.1601	0.0123	0.0493	0.0369	0.0739	0.0123	0.5787
21.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0246	0.0000	0.0000	0.0000	0.0000	0.0000	0.0246
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
All	0.9112	0.4926	0.4925	0.3325	0.6158	0.6527	1.3300	1.2070	1.4531	1.8936	2.1921	1.6626	2.3646	1.7118	1.7735	1.0960	20.1816

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class B

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.0493	0.0246	0.0369	0.0369	0.0739	0.2340	0.2217	0.0739	0.0493	0.0493	0.0246	0.0369	0.0985	0.0493	0.0616	0.0369	1.1576
5.5	0.0000	0.0123	0.0369	0.0246	0.0369	0.0369	0.0369	0.0246	0.0493	0.0493	0.0739	0.0369	0.0862	0.0985	0.1355	0.0739	0.8126
10.0	0.0739	0.0123	0.0123	0.0000	0.0123	0.0246	0.0369	0.0123	0.1232	0.3325	0.3941	0.0862	0.2217	0.0493	0.1478	0.0246	1.5640
15.5	0.0123	0.0123	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123	0.0493	0.3202	0.1724	0.0246	0.0246	0.0369	0.0739	0.0000	0.7511
21.5	0.0000	0.0000	0.0123	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0246	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0615
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0123	0.0000	0.0123	0.0123	0.0000	0.0000	0.0000	0.0000	0.0369
All	0.1355	0.0615	0.0984	0.0615	0.1354	0.2955	0.3078	0.1354	0.2834	0.7759	0.6773	0.1969	0.4310	0.2340	0.4188	0.1354	4.3837

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class C

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.0369	0.0123	0.0369	0.0123	0.0616	0.1232	0.0985	0.0985	0.0739	0.0246	0.0493	0.0123	0.0246	0.0616	0.0246	0.0369	0.7880
5.5	0.0369	0.0246	0.0123	0.0246	0.0493	0.0369	0.0862	0.0123	0.0246	0.0369	0.0369	0.0616	0.0616	0.0862	0.0739	0.0862	0.7510
10.0	0.0985	0.0123	0.0123	0.0246	0.0000	0.0369	0.0739	0.0123	0.2833	0.3325	0.3918	0.1847	0.1970	0.2217	0.1724	0.1232	2.1774
15.5	0.0246	0.0000	0.0000	0.0000	0.0000	0.0369	0.0369	0.0616	0.3571	0.9483	0.5049	0.0369	0.0985	0.1601	0.0739	0.0493	2.3890
21.5	0.0000	0.0000	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0246	0.0493	0.0616	0.0000	0.0246	0.0000	0.0000	0.0000	0.1724
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
All	0.1969	0.0492	0.0615	0.0615	0.1232	0.2339	0.2955	0.1847	0.7635	1.3916	1.0445	0.2955	0.4063	0.5296	0.3448	0.2956	6.2778

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class D

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.0862	0.0246	0.2094	0.1601	0.5665	0.4557	0.2094	0.0246	0.0493	0.0369	0.0000	0.0616	0.1355	0.1355	0.2586	0.2217	2.6356
5.5	0.5665	0.0862	0.1478	0.2463	0.7512	0.7020	0.3818	0.1232	0.1355	0.2463	0.3202	0.2833	0.6281	0.6773	0.6158	0.3695	6.2810
10.0	0.1724	0.0862	0.0369	0.0616	0.4310	0.5049	0.4926	0.3941	0.5419	0.8251	0.8621	0.3325	0.6527	0.4433	0.3695	0.2586	6.4654
15.5	0.0123	0.0000	0.0123	0.0493	0.0369	0.1355	0.2217	0.1970	0.7020	1.6010	0.8251	0.0862	0.3448	0.3571	0.1601	0.0985	4.8398
21.5	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123	0.0246	0.0246	0.3818	0.7759	0.3571	0.0246	0.0616	0.0739	0.0369	0.0123	1.7979
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0123	0.0862	0.1232	0.0123	0.0000	0.0123	0.0123	0.0000	0.0000	0.2586
All	0.8374	0.1970	0.4064	0.5173	1.7979	1.8104	1.3301	0.7758	1.8967	3.6084	2.3768	0.7882	1.8350	1.6954	1.4409	0.9606	22.2783

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class E

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.2340	0.0862	0.2094	0.4557	1.1700	0.8251	0.1724	0.0493	0.0739	0.0493	0.1108	0.0739	0.1970	0.2956	0.3079	0.2094	4.5199
5.5	0.0862	0.0862	0.2463	0.2833	1.1207	0.5911	0.2833	0.1108	0.1232	0.2217	0.2217	0.2217	0.5788	0.6034	0.4557	0.3079	5.5420
10.0	0.0369	0.0123	0.0246	0.0123	0.1724	0.1847	0.0369	0.0123	0.0862	0.2956	0.1847	0.0616	0.3325	0.4433	0.2586	0.0616	2.2165
15.5	0.0123	0.0123	0.0000	0.0123	0.0246	0.0493	0.0246	0.0123	0.0985	0.4680	0.3941	0.0246	0.0493	0.3202	0.0739	0.0493	1.6256
21.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0369	0.0493	0.0739	0.2363	0.0739	0.0000	0.0243	0.0616	0.0000	0.0000	0.5662
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0985	0.1355	0.0000	0.0000	0.0123	0.0246	0.0000	0.0000	0.2709
All	0.3694	0.1970	0.4803	0.7636	2.4877	1.6502	0.5541	0.2340	0.5542	1.4164	0.9852	0.3818	1.1942	1.7487	1.0961	0.6282	14.7411

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class F

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	0.1355	0.1108	0.2094	0.3325	1.0714	0.5049	0.2463	0.0493	0.0985	0.0000	0.0123	0.1108	0.1601	0.2956	0.2586	0.1108	3.7068
5.5	0.0246	0.1108	0.0616	0.1108	0.2709	0.2956	0.1355	0.0862	0.0862	0.1108	0.0369	0.0616	0.1478	0.1355	0.1847	0.1478	2.0073
10.0	0.0000	0.0000	0.0000	0.0000	0.0616	0.0123	0.0000	0.0000	0.0369	0.0369	0.0369	0.0000	0.0493	0.1108	0.0123	0.0369	0.3939
15.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0246	0.0123	0.0000	0.0000	0.0123	0.0246	0.0246	0.0000	0.0369	0.0246	0.0000	0.1599
21.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0246
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
All	0.1601	0.2216	0.2710	0.4433	1.4039	0.8374	0.4064	0.1355	0.2216	0.1723	0.1107	0.1970	0.3572	0.5788	0.4802	0.2955	6.2925

10 Meter Joint Frequency Distribution (%)

Pioneer Uravan from 2/9/78 to 2/8/79

Stability Class G

MWS (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.5	1.3793	0.9729	0.9729	1.6010	2.4138	1.6749	1.4532	0.8251	0.9729	0.9483	0.8990	1.0714	1.9089	2.0074	1.6133	1.3054	22.0197
5.5	0.1724	0.1232	0.1847	0.1970	0.4433	0.4926	0.2709	0.1355	0.1724	0.1232	0.1970	0.1970	0.3448	0.1847	0.2094	0.1970	3.6451
10.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0123	0.0000	0.0000	0.0369
15.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.[illegible]00	0.0000	0.0000	0.0000
21.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
All	1.5517	1.0961	1.1576	1.7980	2.8571	2.1675	1.7241	0.9606	1.1453	1.0838	1.0960	1.2684	2.2660	2.2044	1.8227	1.5024	25.7017

Locations of sources & receptors

Locations given relative to:
x kilometers east of yellowcake dryer stack
y kilometers north of yellowcake dryer stack
z meters elevation from the base of the yellowcake dryer stack
South and west are denoted by a negative value

Sources	X (km)	Y (km)	Z (m)
1. Yellowcake Dryer	0	0	18.5
2. Secondary Crusher	0.114	0.060	18.0
3. Primary Crusher	0.114	0.124	17.0
4. Rod Mill	0.009	0.064	2.5
5. Run of Mine Ore Pad	0.066	0.141	4.8
6. Sampled Ore Storage	0.212	0.099	3.3
7. Fine Ore Blending	0.060	0.062	24.0
8. Evaporation Pond #1	+0.088	-1.339	-13.5
9. Evaporation Pond #2	-0.214	-1.743	-18.0
10. Tailings Disposal Area	-0.422	-0.475	- 7.32

Receptors			
1. Nearest Resident	- 5	0	93
2. Nearest Resident Downwind of Prevailing Wind Direction	6	37	- 90
3. Town 1 - Slickrock	- 6	0	93
4. 2 - Egnar	-12	-14	490
5. City 1 - Naturita	22	19	- 29

Site Boundaries			
N	0.0	0.334	3.60
NE	0.334	0.334	1.22
E	0.743	0.0	3.35
SE	0.743	-0.743	- 8.53
S	0.0	-2.111	-25.60
SW	-0.862	-0.862	-16.46
W	-0.749	0.0	- 3.66
NW	-0.170	-0.170	3.05

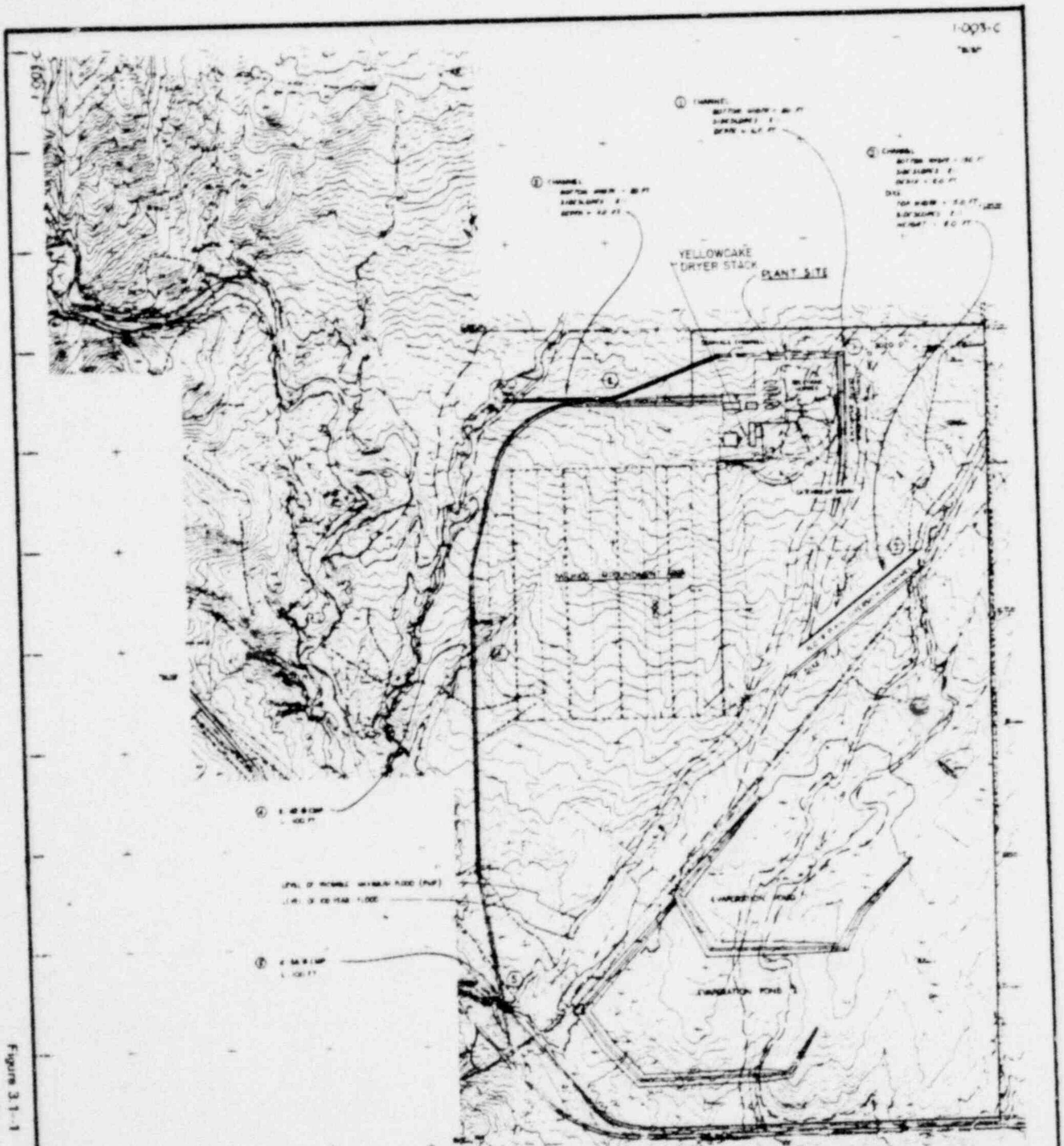
1-003-C
YELLOWCAKE
DRYER STACK
PLANT SITE
EVAPORATION POND
DISAPPOINTMENT VALLEY
PIONEER
PROPERTY MAP - PLANT SITE

Figure 3.1-1