NUS CORPORATION

106862

INTERNAL CORRESPONDENCE

TO: S779 File

DATE: September 12, 1985

FROM: Erich Sonnenberg

COPIES: G. Gartseff

SUBJECT: Leachate Production Estimates, Douglassville Disposal Site

Leachate production is of interest because generally the more water that flows through a waste source, the more pollutants could be leached out. As requested by Ed Shoener, estimates of the leachate due to (1) vertical infiltration resulting from rainfall and (2) subsurface contact due to rising groundwater have been calculated for the Douglassville Disposal Site.

Annual leachate production resulting from infiltration was determined using the Water Balance Method published in "EPA/530/SW-168, October 1975." The Water Balance Method incorporates the following assumptions: (1) the hydraulic characteristics of the soil cover and compacted solid waste are uniform in all directions; and (2) all surface runoff from adjacent drainage areas is diverted around the disposal area.

Leachate production due to subsurface contact resulting from rising groundwater was determined by calculating the lateral groundwater flow through the buried waste. The flow velocity was calculated from hydraulic properties determined during the Remedial Investigation (RI). The flow area was calculated from the height of the groundwater table above the bottom of buried waste elevation. The basic assumptions made to facilitate computation of leachate volume by this method include: (1) the difference between the average seasonal high and average seasonal low water elevations is 9 feet, (2) the bottom of the buried waste is 10 feet below the ground surface, and (3) the variation in groundwater elevation occurs at a constant rate with the seasonal low occurring during November and the seasonal high occurring in May.

The results of the leachate volume calculations for an average and wet water year for the Facility Sludge Disposal Area and the Former Sludge Lagoon Area are indicated in the following table:

Location	Infiltration Leachate Vol. (Ft^3)	Subsurface Leachate Vol. (Ft^3)	Total Leachate Vol (Ft^3)	% Leachate Vol. From Infiltration
Facility Disposal Area (ave. yr.)	25,900	5,900	31,800	81
Facility Disposal Area (wet yr.)	161,100	22,300	183,400	88
Former Lagoon Area (ave. yr.)	101,600	0	101,600	100
Former Lagoon Area (wet yr.)	632,600	2,300	634,900	99

NUS 064 REVISED 0181

AR300029

It should be realized that the above estimates of leachate production are rough estimates based on very limited field data. The determination of leachate production from rising groundwater is difficult to calculate due to the uncertainty of the magnitude and duration of groundwater level fluctuations. Actual determinations of leachate volumes and concentrations can be found by long-term sampling or performing pilot column studies of the onsite materials.

Backup data for these estimates are attached.

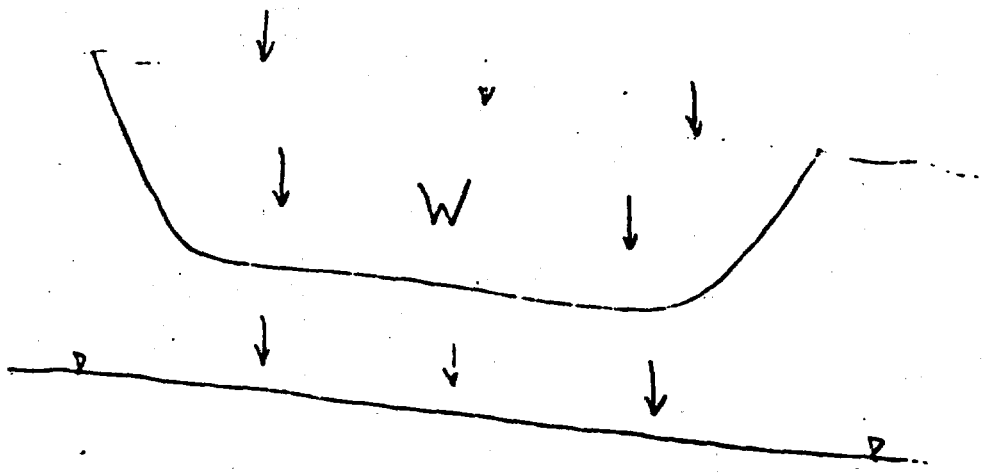
WATER BALANCE

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOT
1) Temperature °FT	32.7	33.4	41.2	52.6	63.3	72.2	76.9	74.8	61.5	52.2	45.1	34.1	
2) Precipitation P	3.07	2.64	3.78	3.42	3.79	3.72	4.26	4.05	3.32	2.84	3.40	3.14	41.4
3) R_1 0.15	.46	.40	.57	.51	.57	.56	.64	.61	.50	.43	.51	.47	6.2
4) R_2													
5) R_3	.46	.40	.57	.51	.57	.56	.64	.61	.50	.43	.51	.47	6.2
6) Infiltration I	2.61	2.24	3.21	2.91	3.22	3.16	3.62	3.44	2.82	2.41	2.89	2.67	
7) Pot. Evap. PE	1.37	1.66	2.42	3.71	4.88	6.01	6.81	5.21	5.14	2.82	1.97	1.12	43.1
8) I - PE	1.24	0.58	0.79	-0.8	-1.66	-2.85	-3.19	-1.77	-2.32	-0.41	0.92	1.55	
9) Σ neg I-PE			0	-0.8	-2.46	-5.31	-8.50	-10.27	-12.59	-13.00	23 -	39	
			0	-20.3	-62	-135	-216	-261	320	-330			
10) Storage 150/m ST	3.94	3.94	3.94	3.46	2.60	1.57	.91	.67	.43	.43	1.34	2.87	
mm	100	100	100	88	66	40	23	17	11	11	34	73	
11) Δ ST	0	0	0	-.48	-.86	-1.03	-.66	-.24	-.24	0	.91	1.53	
12) Act evap	1.37	1.66	2.42	3.39	4.08	4.19	4.28	3.68	3.06	2.41	1.97	1.12	
13) Leachate I - ΔST - AET	1.24	0.58	0.79	0	0	0	0	0	0	0	0	0	2.61

AR300031

NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT: EPA	FILE NO.: [illegible]	BY: [illegible]	PAGE 2 OF 9
SUBJECT: Leachate due to Inf. through FACILITY AREA		CHECKED BY:	DATE: [illegible]



Determine Leachate Volume due to ave. infiltration using Water Balance Method (see attached sheets)

Leachate depth = 2.61 in. = 0.22 ft.
Area = 2.7 Ac = 117,612 ft²
Volume = 25,875 ft³

AR300032

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES

STANDARD CALCULATION SHEET

CLIENT: EPA

SUBJECT:

FILE NO.: 4779.26

BY: ES

CHECKED BY:

PAGE 3 OF 9

DATE: 9-10-

Annual

Facility Area (Leachate production due to arc. rise in GW)

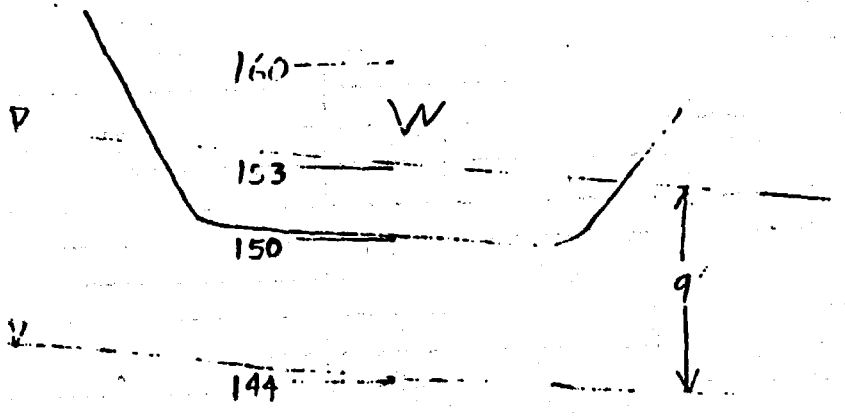
Vel = K I

K = 1×10^{-2} cm/s

I = 0.015 (Fig. 2-3, Facility)

V = 1×10^{-2} cm/s (0.015 (1/30.48 cm)(86,400/day))

= 0.43 ft/day



Month	GW Elev. Ft.	Ht. above waste Ft.	H x 500 Area above waste Ft²	Effective Area Ft²	Velocity Ft/day	Flow Ft³/day	Δ time day	Volume Ft³
Nov	144	—						
Dec	145.5	—						
Jan	147.0	—						
Feb	148.5	—						
Mar	150.0	0	0	0	0.43	0	30	
Apr.	151.5	1.5	750	113	↓	49	30	1470
May	153.0	3.0	1500	225		97	30	2910
Jun	151.5	1.5	750	113		49	30	1470
Jul	150.0	0	0	0		0	30	0
Aug	148.5	—						5,850 ft³
Sept	147.0							
Oct	145.5							
	✓	✓		✓			✓	

AR300033

NUS 155A REVISED 0285

Very Rainy [illegible]
41.43 to [illegible]

WATER BALANCE

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOT
1) Temperature °F T	32.7	33.4	41.3	52.6	63.3	72.2	76.9	74.8	67.5	57.2	45.1	34.7	
2) Precipitation P	5.19	4.46	6.39	5.78	6.40	6.29	7.20	6.84	5.61	4.80	5.74	5.31	10.0
3) R_1 0.15	.78	.67	.96	.87	.96	.94	1.08	1.03	0.84	.72	.86	.80	
4) R_2													
5) R_T	.78	.67	.96	.87	.96	.94	1.08	1.03	.84	.72	.86	.80	
6) Infiltration I	4.41	3.79	5.43	4.91	5.44	5.35	6.12	5.81	4.77	4.08	4.88	4.51	
7) Pot. Evap. PE	1.37	1.66	2.42	3.71	4.88	6.01	6.81	5.21	5.14	2.82	1.97	1.12	
8) I - PE	3.04	2.13	3.01	1.20	0.56	-.66	-.69	.60	-.37	1.26	2.91	3.39	
										32	74	86	
9) Σ neg I-PE					0	-.66	-1.35	-1.35	-1.72	0			
mm					0	-16.8	-34.3	-34.3	-43.7	0			
10) Storage ST	3.94	3.94	3.94	3.94	3.94	3.50	3.11	3.11	2.91	3.94	3.94	3.94	
mm	100	100	100	100	100	89	79	79	74	100	100	100	
11) Δ ST	0	0	0	0	0	-.44	-.39	0	-.20	1.03	0	0	
12) Act evap	1.37	1.66	2.42	3.71	4.88	5.79	6.51	5.21	4.97	2.82	1.97	1.12	
13) Leachate I - ΔST - AET	3.04	2.13	3.01	1.20	0.56	0	0	.60	0	.23	2.91	3.39	16.4

AR300034

NUS CORPORATION

Page 5 of

DATE 9-10

CLIENT

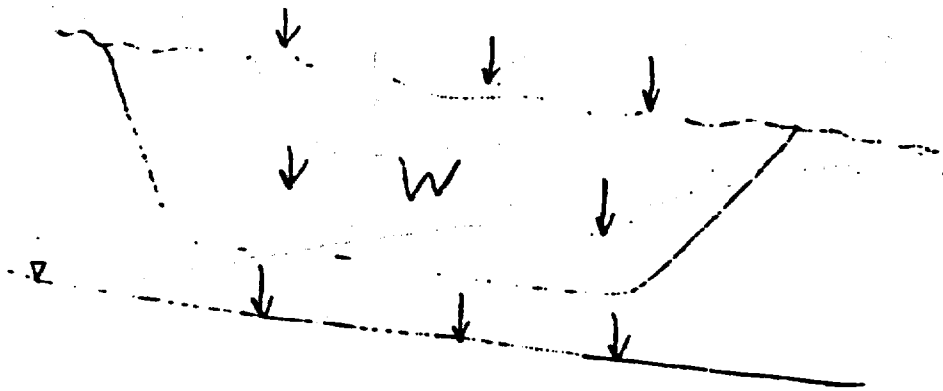
FILE NO. 5779.26

BY ES

SUBJECT Leachate due to Infiltration for wet Year

Checked By

FACILITY AREA



Determine Leachate Volume due to Wet Year infiltration using Water Balance Method

Leachate depth = 16.47 in. = 1.37 ft.
Area = 117,612 ft^2
Volume = 161,128 ft^3

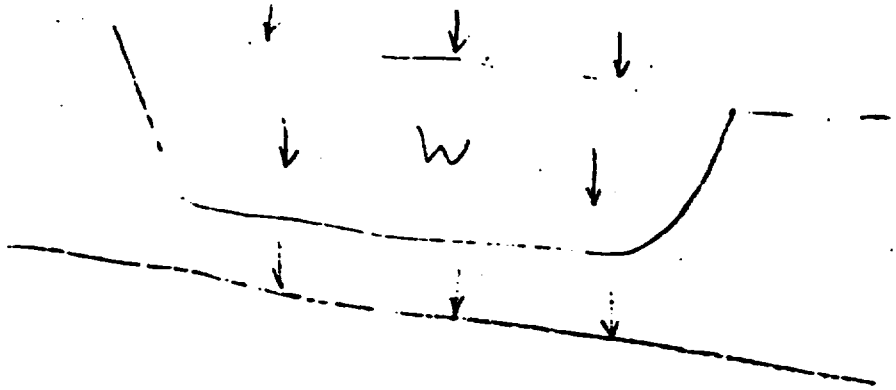
NUS CORPORATION

DATE 9-0

CLIENT _____ FILE NO. 1779.26 BY ES

SUBJECT Leachate due to Infiltration Checked By _____

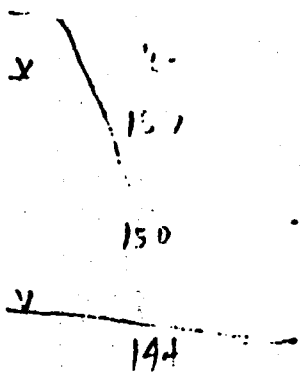
FORMER LAGOON AREA



Determine Leachate Volume due to 1st Year infiltration using Water Balance Method

Leachate depth = 16.47 in. = 1.37 ft.
Area = 16.6 acres = 461,736 ft²
Volume = 632,578 ft³

Facility Area (Leachate production for Wet Year due to rise in GW)



Velocity

K 1×10^{-2} cm/s

I = 0.015

V = 1×10^{-2} cm/s (0.015)(ft/30.4 cm) 86400 s/day

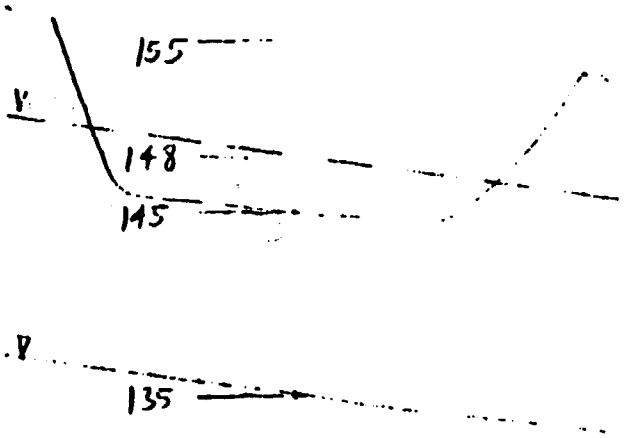
= 0.43 ft/day

Month	GW Elev. Ft	Ht. above waste Ft	Area above waste Ft^2	Effective Area Ft^2	Velocity Ft/day	Flow Ft^3/day	Δ time day	Volume Ft^3
Nov	144	—						
Dec	146.2	—						
Jan	148.3	—						
Feb	150.5	0.5	250	38	0.43	16	30	480
Mar	152.7	2.7	1350	203	↓	87	30	2610
Apr	154.8	4.8	2400	360		155	30	4650
May	157.0	7.0	3500	525		226	30	6780
Jun	154.8	4.8	2400	360		155	30	4650
Jul	152.7	2.7	1350	203		87	30	2610
Aug	150.5	0.5	250	38		16	30	480
Sep	148.3							22,260 Ft^3
Oct	146.2							

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: EPA | SUBJECT: | FILE NO.: 779.26 | BY: ES | CHECKED BY: | DATE: 7-10 | PAGE 8 OF 9

Former Lagoon Area (Leachate production for Wet Year due to rise in GW)



Vel K I

$K = 1 \times 10^{-2}$ cm/s

$I = 0.004$

$V = 1 \times 10^{-2}$ cm/s (0.004) (ft/30.48cm) (86,400/day)

$= 0.11$ ft/day

Month	GW Elev Ft.	Ht. above waste Ft.	H x 1000 Area above waste Ft²	Effective Area Ft²	Velocity Ft/day	Flow Ft³/day	Δ time days	Volume Ft³
Nov	135.0	—						
Dec	137.2	—						
Jan	139.3	—						
Feb	141.5	--						
Mar	143.7	--						
Apr.	145.3	0.8	800	120	0.11	13	30	390
May	148.0	3.0	3000	450	↓	50	30	1500
Jun	145.8	0.8	800	120	↓	13	30	390
Jul	143.7	--						2280 ft³
Aug	141.5							
Sep	139.3							
Oct	137.2							

NUS 155A REVISED 0285

AR300038

NUS CORPORATION

DATE 9-11

CLIENT _____ FILE NO. 8779.36 BY ES

SUBJECT Former Lagoon Area Checked By _____

Former Lagoon area (cont.)

1) Subsurface Contact:

Seasonal high = Seasonal low + 9'
= 135 + 9
= 144 which is still below bottom of waste; therefore, leachate production = 0

2) Infiltration:

Leachate depth = 0.22 ft
Area = 10.6 acres = 461,736 ft²
Volume = 101,582 ft³

AR300039