6328

U-003-307 .35

CALCULATIONS, FERNALD PIT VOLUME CALCULATION - (USED AS A REFERENCE IN OU1 RI AND OU1 FS)

03/10/92

PROJECT 303317
IT DOE-FN
45
REPORT

INTERNATIONAL TECHNOLOGY CORPORATION

1/18/91

6328

By B. Brown Date 01/08/91 Subject Fernald Operable Unit #1 Sheet No. 1 of ____
Chkd. By ____ Date ____ Waste Pit #1 Tables - Vol vs Depth Proj. No. 303317

OU #1 Waste Area #1.

Refs: 1) Pit calculations performed 11/20/90 (Barry Brown)
2) Weston Drawing 25X-5500-G-00113 Rev 0.
3) IT Drawing 303317-D-C140, C144, and C145.

NEW IT

The Pit #1 waste area has an existing cap with elevations ranging from 579 ft MSL on the eastern portion of the waste area to an elevation of 582 ft on the northwestern portion of the site.

Assume Avg. Elevation of site = 580 ft MSL

Volume vs. Depth Calculations.

Elev 580.5 → 579 (Depth to 1 ft)

Cap area = surface area of pit.

Surface area of Waste area #1 = 112,220 ft²
Surface area of Pit #1 = 82,693 ft²

Cap area = 82,693 ft²

Cap volume = 82,693 ft² × 1.0 ft = 82,693 ft³ = 3063 yd³

Contaminated soil = (112,220 ft² × 1.0 ft) - 82,693 ft³ = 29,527 ft³
= 1,093 yd³

INTERNATIONAL TECHNOLOGY CORPORATION

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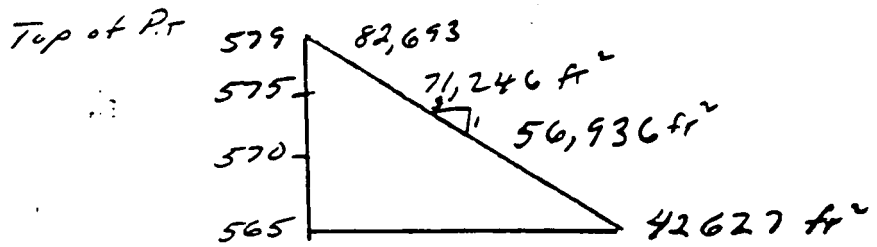
By S Brown Date 01/08/91 Subject Fernald Operable Unit #1 Sheet No. 2 of ____

Chkd. By ____ Date ____ Waste Pit #1 Table - Vol vs Depth Proj. No. ____

Elev 579 to 575 (Depth 1 to 5 ft)

Waste Pit elevation = 579 ft MSL (surface area = 82,693 ft²)



Area @ Elev 575:

$$\frac{82,693 - 42,627}{14} = \frac{x}{10} \rightarrow x = 28,619$$

$$28,619 + 42,627 = 71,246 \text{ ft}^2$$

@ Elev 570, Area = 56,936 ft² (by same method)

Elev 579 → 575:

Waste:

$$\frac{82,693 \text{ ft}^2 + 71,246 \text{ ft}^2}{2} \times 4 \text{ ft} = 307,878 \text{ ft}^3 = 11,403 \text{ yd}^3 \text{ (waste)}$$

C. Soils Surface Area of Waste Area #1 = 112,220 ft²

$$112,220 \text{ ft}^2 \times 4 \text{ ft} = 448,880 \text{ ft}^3 = 16,625 \text{ yd}^3$$

$$16,625 \text{ yd}^3 - 11,403 \text{ yd}^3 = 5,222 \text{ yd}^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/09/91 Subject Fernald Operable Unit #1 Sheet No. 3 of ____
Chkd. By ____ Date ____ Waste Pit #2 Tables - Vol vs Depth Proj. No. ____

Elev 575 - 570

Waste:

$$\frac{71,246\ ft^2 + 56,936\ ft^2}{2} \times 5\ ft = 320,455\ ft^3 = 11,868\ yd^3$$

C. Soils:

$$112,220\ ft^2 \times 5\ ft = 561,100\ ft^3 = 20,781\ yd^3$$

$$20,781\ yd^3 - 11,868\ yd^3 = 8913\ yd^3$$

Elev 570 - 565

Waste:

$$\frac{56,936\ ft^2 + 42,627\ ft^2}{2} \times 5\ ft = 248,907\ ft^3 = 9219\ yd^3$$

C. Soils:

$$112,220\ ft^2 \times 5\ ft = 561,100\ ft^3 = 20,781\ yd^3$$

$$20,781\ yd^3 - 9219\ yd^3 = 11,562\ yd^3$$

Elevs 565 - 560, 560 - 555, 555 - 550

C. Soils:

$$112,220\ ft^2 \times 5\ ft = 561,100\ ft^3 = 20,781\ yd^3$$

Elev 550 - 548

C. Soils:

$$112,220\ ft^2 \times 2\ ft = 224,440\ ft^3 = 8313\ yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/08/91 Subject Fernald Operable Unit #1 Sheet No. 4 of ____

Chkd. By ____ Date ____ Waste Pit 1 Tables - Vol. vs. Depth Proj. No. 303317

All Waste Area #1:

Refs: 1) Waste Pit Calculations performed 11/20/90 - Barry Brown

2) Weston Drawing 75X-5500-G-00113 Rev 0

The Pit #1 waste area has an existing cap with elevations ranging from 579 ft MSL on the eastern portion of the site to an elevation of 582 ft on the northwestern end of the site. Assuming Avg. Elevation at top of cap = 580 ft. Cap thickness ≈ 1.0 ft ; Cap area will be calculated as surface area of pit.

Depth	Elevation	Vol (yd³) Cap	Cap Cumulative	Water	Water Cumulative	Waste	Waste Cumulative	Cu. Soils	Cu. Soils Cumulative
0-1	580→579	3063	3063	0	0	0	0	1093	1093
1-5	579-575	0	3063	0	0	11,403	11,403	5222	6315
5-10	575-570	0	3063	0	0	11,868	23,271	8913	15,22
10-15	570-565	0	3063	0	0	9,219	32,490	11,562	26,79
15-20	565-560	0	3063	0	0	0	32,490	20,781	47,57
20-25	560-555	0	3063	0	0	0	32,490	20,781	68,35
25-30	555-550	0	3063	0	0	0	32,490	20,781	89,13
30-32	550-548	0	3063	0	0	0	32,490	8,313	97,44

Come back and check consistency between Tables and plans

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/09/91 Subject Fernald Operable Unit #1 Sheet No. 5 of ____
Chkd. By ____ Date ____ Waste Pit #2 Table - Vol. vs Depth Proj. No. 303317

O.U. #1 Waste Area #2

Refs: 1) Pit calculations performed 11/20/90 (Barry Brown)
2) Weston Drawing 75X-5500-G-00113 Rev. 0
3) IT Drawings 303317-D-C144, C-145, C-146.

Top of Cap Elevation is approx 580 ft

Top of Pit elevation is approx. 580 ft

Cap thickness is assumed to be 0.75 ft thick.

Volume vs Depth Calculations

Cap Elev 580 → 579.25 (Depth to ≈ 1 ft)

Cap area = surface area of pit.

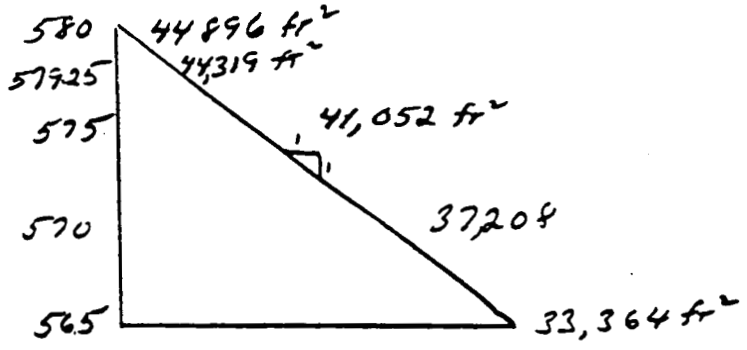
Surface area of waste area #2 = 65,100 ft²
Surface area of Pit #2 = 44,896 ft²

Cap area = 44,896 ft²

Cap volume = 44,896 ft² x 0.75 ft = 33,672 ft³ = 1,247 yd³

Contaminated soils = (65,100 ft² x 0.75 ft) - 33,672 ft³ = 15,153 ft³
(surrounding cap) = 561 yd³

Waste Pit elevation is approx 580 ft MSL



Area @ Elev 575:

$$\frac{44{,}896\,ft^2 - 33{,}364\,ft^2}{15} = \frac{X}{10} \rightarrow X = 7688\,ft^2$$

$$7{,}688\,ft^2 + 33{,}364\,ft^2 = 41{,}052\,ft^2$$

Area @ Elev 570:

37208 ft² (same method as used above)

Elev 57925 → 575

Waste: Area @ 57925 =

$$\frac{44{,}319\,ft^2 + 41{,}052\,ft^2}{2} \times 4.25\,ft = 181{,}413\ ft^3\ \ 6{,}719\ yd^3$$

C. Soils: Surface area of waste area @ 2 = 65,100 ft²

$$(65{,}100\,ft^2 \times 4.25\,ft) - 181{,}413\ ft^3 = 95{,}262\ ft^3 = 3{,}528\ yd^3$$

Elev 575→570

Waste:

$$\frac{41,052 ft^2 + 37,208 ft^2}{2} \times 5 ft = 195,650 ft^3 = 7246 yd^3$$

C Soils

$$(65,100 ft^2 \times 5 ft) - 195,650 ft^3 = 129,850 ft^3 = 4809 yd^3$$

Elev 570→565 565.5 for waste

Waste:

$$\frac{37,208 ft^2 + 33,364 ft^2}{2} \times 5 ft = 176,430 ft^3 = 6534 yd^3$$

C. Soils:

$$(65,100 ft^2 \times 5 ft) - 176,430 ft^3 = 149,070 ft^3 = 5521 yd^3$$

Elev 565→560, 560→555, 555→550

C. Soils:

$$65,100 ft^2 \times 5 ft = 325,500 ft^3 = 12,056 yd^3$$

Elev 550 → 548:

$$65,100 ft^2 \times 2 ft = 130,200 ft^3 = 4822 yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. 8 of _____

Chkd. By _____ Date _____ Proj. No. _____

Volume of Pit materials at various depths

Depth (ft)	Elevation (ft)	Cap (yd³)	Cap Cumulative	Water (yd³)	Water Cumulative	Waste (yd³)	Waste Cumulative	C. Soils (yd³)	C. Soils Cumulative
	580-579.25	1,247	1,247	0	0	0	0	561	561
	579.25-575	0	1,247	0	0	6719	6719	3528	4089
	575-570	0	1247	0	0	7246	13,965	4809	8898
	570-565	0	↓	0	0	5881	19,846	6174	15072
	565-560	0		0	0	0	↓	12,056	27,12
	560-555	0		0	0	0		12,056	39,18
	555-550	0		0	0	0		12,056	57,24
	550-548	0	1,247	0	0	0	19,846	4,822	56,06

Come back and check consistency between Table and Plans

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/14/91 Subject Fernald Operable Unit #1 Sheet No. 9 of ____
Chkd. By ____ Date ____ Waste Pit #3 Table - Vol vs Depth Proj. No. ____

Refs: 1) Pit calculations performed 11/20/90 (Berry Brown)
2) Weston Drawing 75X-5500-G-00113 Rev. 0.
3) IT Drawings 303317-D-C144, C-145, C-146

Top of Cap Elevation is approx 587 ft MSL

Top of Pit Elevation is approx 578 ft MSL
Bottom of Pit Elevation is approx 548 ft MSL
Great Miami Aquifer Elevation is approx 548 ft MSL

Volume vs Depth Calculations

Cap area assumed to = surface area of pit = 241,373 ft²

Surface area of waste area #2 = 317,983 ft²

Elev 587 → 585

make this 1 ft because of c/s inconsistency on cap depth. The cap may not be as thick as previously thought.

Cap materials:

241,373 ft² × 5 ft = 724,119 ft³ = ~~26,819~~ yd³
1 = 241,373 = 8940 yd³

Contaminated Soils:

(317,983 ft² × 2 ft) − 241,373 = ~~712,576~~ 394,593 ft³ = ~~26,392~~ 14,615 yd³

not all soil has been considered as contaminated in

Elev 585 → 580

Cap materials:

241,373 ft² × 5 ft = 1,206,865 ft³ = 44,699 yd³

C. Soils.

(317,983 ft² − 241,373 ft²) × 5 ft = 383,050 ft³ = 14,187 yd³

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. 10 of _____

Chkd. By _____ Date _____ Waste Pit #3 Table - Volume Depth Proj. No. _____

Elev 580-578

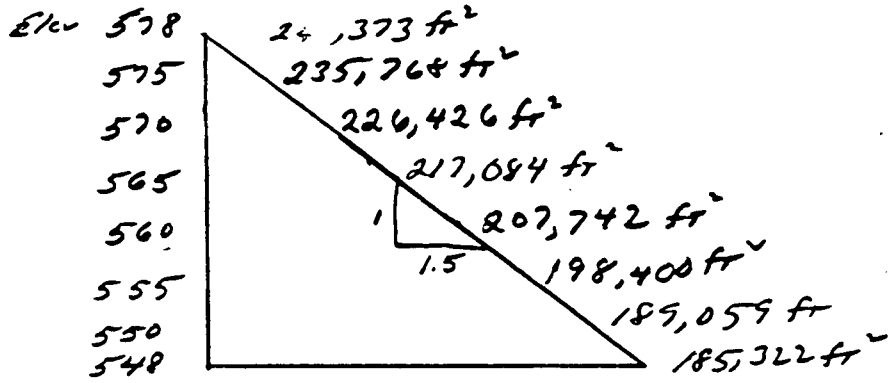
Cap Materials:

$$241,373\ ft^2 \times 2\ ft = 482,746\ ft^3 = 17,879\ yd^3$$

C. Soils:

$$(317,583\ ft^2 - 241,373\ ft^2) \times 2\ ft = 153,220\ ft^3 = 5675\ yd$$

Waste Pit elevation is approx. 578 ft



Area @ Elev 575:

$$\frac{241,373\ ft^2 - 185,322\ ft^2}{30} = \frac{x}{27} \rightarrow x = 50,446$$

$$50,446 + 185,322\ ft^2 = 235,768\ ft^2$$

Area @ Elev 570 = 226,426 ft² (calc. by same method as above)
" " " 565 = 217,084 ft²
" " " 560 = 207,742 ft²
" " " 555 = 198,400 ft²
" " " 550 = 189,059 ft²

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. 11 of _____

Chkd. By _____ Date _____ Waste Pit #3 Table - Volume Report Proj. No. _____

Elev 578-575

Waste:

$$\frac{241,373\ ft^2 + 235,768\ ft^2}{2} \times 3\ ft = 715,712\ ft^3 = 26,508\ yd^3$$

C. Soils:

$$(317,583\ ft^2 \times 3\ ft) - 715,712\ ft^3 = 238,237\ ft^3 = 8824\ yd^3$$

Elev 575-570

Waste:

$$\frac{235,768\ ft^2 + 226,426\ ft^2}{2} \times 5\ ft = 1,155,485\ ft^3 = 42,796\ yd^3$$

C. Soils:

$$(317,583\ ft^2 \times 5\ ft) - 1,155,485\ ft^3 = 434,430\ ft^3 = 16,090\ yd^3$$

Elev 570-565

Waste:

$$\frac{226,426\ ft^2 + 217,084\ ft^2}{2} \times 5\ ft = 1,108,775\ ft^3 = 41,066\ yd^3$$

C. Soils:

$$(317,583\ ft^2 \times 5\ ft) - 1,108,775\ ft^3 = 481,140\ ft^3 = 17,820\ yd^3$$

Elev 565 → 560

Waste:

$$\frac{217,084\ ft^2 + 207,742\ ft^2}{2} \times 5\ ft = 1,062,065\ ft^3 = 39,336\ yd^3$$

C. Soils.

$$(317,583\ ft^2 \times 5\ ft) - 1,062,065\ ft^3 = 527,850\ ft^3 = 19,550\ yd^3$$

Elev 560 - 555

Waste:

$$\frac{207,742\ ft^2 + 198,400\ ft^2}{2} \times 5\ ft = 1,015,355\ ft^3 = 37,606\ yd^3$$

C. Soils:

$$(317,583\ ft^2 \times 5\ ft) - 1,015,355\ ft^3 = 574,560\ ft^3 = 21,280\ yd^3$$

Elev 555 → 550

Waste.

$$\frac{198,400\ ft^2 + 189,059\ ft^2}{2} \times 5\ ft = 968,648\ ft^3 = 35,876\ yd^3$$

C. Soils:

$$(317,583\ ft^2 \times 5\ ft) - 968,648\ ft^3 = 621,267\ ft^3 = 23,010\ yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. 13 of _____

Chkd. By _____ Date _____ Waste Pit #3 Table - Vol vs. Depth Proj. No. _____

Elev 550 → 548

Waste:

$$\frac{189{,}059\ ft^2 + 185{,}322\ ft^2}{2} \times 2\ ft = 374{,}381\ ft^3 = 13{,}866\ yd^3$$

C. Soils:

$$(317{,}983\ ft^3 \times 2\ ft) - 374{,}381\ ft^3 = 261{,}585\ ft^3 = 9{,}688\ yd^3$$

Volume of Pit Materials at various depths

Depth (ft)	Elevation (ft)	Cap (yd³)	Cumulative	Water (yd³)	Cumulative	Waste (yd³)	Cumulative	C. Soils (yd³)	Cumulative
	587-585	17,879	17,879	0	0	0	0	14,675	14,675
	585-580	44,699	62,578	0	0	0	0	14,187	28,80[illegible]
	580-578	17,879	80,457	0	0	0	0	5,675	34,4[illegible]
	578-575	0		0	0	26508	26508	8,824	43,30[illegible]
	575-570	0		0	0	42,796	69,304	16,090	59,3[illegible]
	570-565	0		0	0	41,066	110,370	17,820	77,2[illegible]
	565-560	0		0	0	39,336	149,706	19,550	96,7[illegible]
	560-555	0		0	0	37,606	187,312	21,280	118,0[illegible]
	555-550	0		0	0	35,876	223,188	23,010	141,0[illegible]
	550-548	0	80,457	0	0	13,866	237,054	9,688	150,7[illegible]

Check:
Cap yd³ (ft³)
C. soils yd³ [illegible]

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/14/91 Subject Fernald Operable Unit #1 Sheet No. 14 of ____
Chkd. By ____ Date ____ Waste Pit #4 Table - Vol vs Depth Proj. No. 303317

Refs: 1) Pit calculations performed 11/20/90 (Barry Brown)
2) Weston Drawing 15X-5500-G-00113 Rev. 0
3) IT Drawings 303317-D-C144, C-145, C-146

Top of Cap Elevation is approx. 589 ft MSL
Elevation at Top of pit 584 ft
Elevation at bottom of pit = 560 ft
Elevation at top of Great Miami Aquifer = 548 ft

Volume vs Depth Calculations

Cap area assumed to = surface area of pit = 83,799 ft²

Surface area of waste area #4 = 151,900 ft²

Elev 589 → 585

Cap materials:

$$83{,}799\ ft^2 \times 4\ ft = 335{,}196\ ft^3 = 12{,}415\ yd^3$$

Contaminated Soils:

$$(151{,}900\ ft^2 \times 4\ ft) - 335{,}196\ ft^3 = 272{,}404\ ft^3 = 10{,}089\ yd^3$$

Elev 585-584

Cap Materials:

- Cap may extend .5 ft into cap

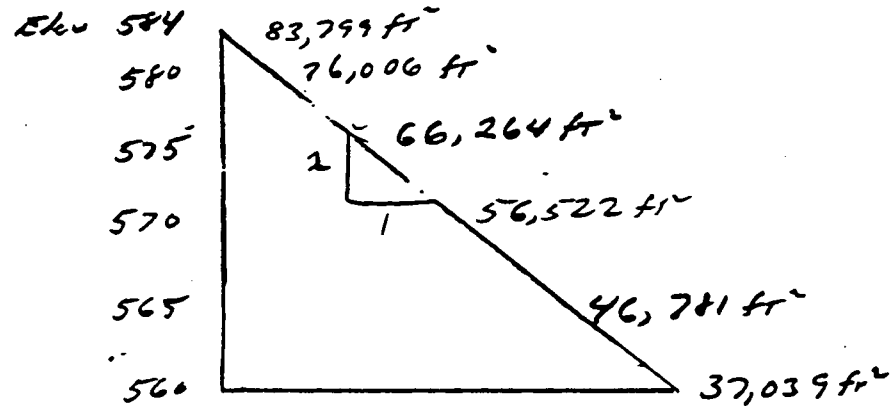
$83,799\ ft^2 \times 1\ ft = \cancel{83,799\ ft^3} = \cancel{3107}\ yd^3$

$1.5 = 125,698\ ft^3 = 4655$

C Soils:

$(151,900\ ft^2 \times 1\ ft) = \cancel{83,799\ ft^3}\ 125,698 = \cancel{68,701\ ft^3}\ 26,202 = \cancel{2,522}\ 970\ yd^3$

Waste Pit Elevation is approx 584 ft



Area @ Elev 580:

$$\frac{83,799\ ft^2 - 37,039\ ft^2}{24} = \frac{x}{20} \rightarrow x = 38,967$$

$38,967 + 37,039 = 76,006\ ft^2$

Area @ Elev 575 = 66,264 ft² (Calc. by same method as on previous page)
" " " 570 = 56,522 ft²
" " " 565 =
" " " 560 =

Elev 584-580

Waste:

$$\frac{83,799\,ft^2 + 76,006\,ft^2}{2} \times 4\,ft = 319,610\ ft^3 = 11,837\ yd^3$$

C Soils:

$$(151,900\,ft^2 \times 4\,ft) - 319,610\ ft^3 = 287,990\ ft^3 = 10,666\ yd^3$$

Elev 580-575

Waste:

$$\frac{76,006\,ft^2 + 66,264\,ft^2}{2} \times 5\,ft = 355,675\,ft^3 = 13,173\ yd^3$$

C Soils:

$$(151,900\,ft^2 \times 5\,ft) - 355,675\,ft^3 = 403,825\,ft^3 = 14,956\ yd^3$$

Elev 575-570

Waste:

$$\frac{66,264\,ft^2 + 56,522\,ft^2}{2} \times 5\,ft = 306,965\,ft^3 = 11,369\ yd^3$$

C Soils:

$$(151,900\,ft^2 \times 5\,ft) - 306,965\,ft^3 = 452,535\,ft^3 = 16,761\ yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. 17 of _____

Chkd. By _____ Date _____ Proj. No. _____

Elev 570-565

Waste:

$$\frac{56,522\,ft^2 + 46,781\,ft^2}{2} \times 5\,ft = 258,258\,ft^3 = 9,565\,yd^3$$

C. Soils:

$$(151,900\,ft^2 \times 5\,ft) - 258,258\,ft^3 = 501,242\,ft^3 = 18,565\,yd^3$$

Elev 565-560

Waste:

$$\frac{46,781\,ft^2 + 32,039\,ft^2}{2} \times 5\,ft = 209,550\,ft^3 = 7,761\,yd^3$$

C. Soils:

$$(151,900\,ft^2 \times 5\,ft) - 209,550\,ft^3 = 549,950\,ft^3 = 20,369\,yd^3$$

Elev 560-555, and 555-550

C. Soils

$$(151,900\,ft^2 \times 5\,ft) = 759,500\,ft^3 = 28,130\,yd^3$$

Elev 550-548

C. Soils:

$$151,900\,ft^2 \times 2\,ft = 303,800\,ft^3 = 11,252\,yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. 18 of _____

Chkd. By _____ Date _____ Waste Pit #4 Table - Vol vs. Depth Proj. No. _____

Depth (ft)	Elevation (ft)	Cap (yd³)		Water (yd³)		Waste (yd³)		C. Soils (yd	
			Cumulative		Cumulative		Cumulative		Cum
				0	0	0	0		
	589-585	12,415	12,415	0	0	0	0	10,089	10,0
	585-584	4,655	17,070	0	0	0	0	970	11,0
	584-580	0		0	0	11,837	11,837	10,666	21,7
	580-575	0		0	0	13,173	25,010	14,950	36,
	575-570	0		0	0	11,369	36,379	16,761	53,
	570-565	0		0	0	9,565	45,944	18,565	72,
	565-560	0		0	0	7,761	53,705	20,369	92,
	560-555	0		0	0	0		28,130	120
	555-550	0		0	0	0		28,130	148
	550-548	0	17,070	0	0	0	53,705	11,252	159,

INTERNATIONAL TECHNOLOGY CORPORATION

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By B. Brown Date 01/15/91 Subject Fernald Operable Unit #1 Sheet No. 19 of ____

Chkd. By ____ Date ____ Waste Pit #5 Table - Vol vs Depth Proj. No. 303317

Refs: 1) Pit calculations performed 11/20/90 (Barry Brown)
2) Weston Drawing 75X-5500-G-00113 Rev. 0
3) IT Drawings 303317-D-C144, C-145, C-146

Top of Pit Elevation is approx 590' → Avg Elevation is approx 588'
Top of Water Elevation is approx 589'
Top of Waste Elevation is approx 588'
Bottom of pit Elevation is approx 560'
Top of Aquifer Elevation is approx 548'

Volume vs Depth Calculations

Surface area of pit = 161,103 ft² @ Elevation 590'

Surface area of waste area #5 = 224,020 ft²

Approximately 1 foot of water stands on 100,000 ft² of the pit

Elev 589 - 588

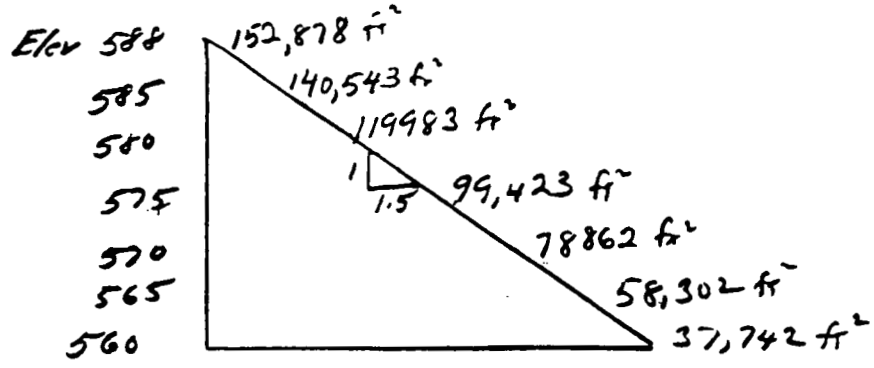
Surface Waste Water:

100,000 ft² x 1 ft = 100,000 ft³ = 3704 yd³

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. 20 of _____

Chkd. By _____ Date _____ Proj. No. _____



Pit Area @ Elevation 588

$$\frac{161,103\ ft^2 - 37,742\ ft^2}{30} = \frac{x}{28} \rightarrow x = 115,137$$

$$115,137 + 37,742 = 152,878\ ft^2$$

Pit Area @ Elev 585 = 140,543 ft²
Pit Area @ Elev 580 = 119,983 ft²
" " " " 575 = 99,423 ft²
" " " " 570 = 78,862 ft²
" " " " 565 = 58,302 ft²

Elev 588 - 585

Waste:

$$\frac{152,878\ ft^2 + 140,543\ ft^2}{2} \times 3\ ft = 440,132\ ft^3 = 16,301\ yd^3$$

Contaminated Soil:

$$(224,020\ ft^2 \times 3\ ft) - 440,132\ ft^3 = 231,928\ ft^3 = 8,590\ yd^3$$

$$8590 - 3704\ yd^3 = 4886\ yd^3$$

subtracting surface

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. 21 of _____

Chkd. By _____ Date _____ Proj. No. _____

Elev 585-580

Waste:

$\frac{140,543\ ft^2 + 119983\ ft^2}{2} \times 5ft = 651,315\ ft^3 = 24,123\ yd^3$

C. Soils

$(224,020\ ft^2 \times 5ft) - 651,315\ ft^3 = 468,785\ ft^3 = 17,362\ yd^3$

Elev 580-575

Waste:

$\frac{119,983\ ft^2 + 99,423\ ft^2}{2} \times 5ft = 548,515\ ft^3 = 20,315\ yd^3$

C. Soils.

$(224,020\ ft^2 \times 5ft) - 548,515\ ft^3 = 571,585\ ft^3 = 21,170\ yd^3$

Elev 575-570

Waste.

$\frac{99,423\ ft^2 + 78862\ ft^2}{2} \times 5ft = 445,712\ ft^3 = 16,508\ yd^3$

C Soils:

$(224,020\ ft^2 \times 5ft) - 445,712\ ft^3 = 674,388\ ft^3 = 24,977\ yd^3$

Elev 570-565

Waste:

$\frac{78,862\ ft^2 + 58,302}{2} \times 5ft = 342,910\ ft^3 = 12,700\ yd^3$

C. Soils:

$(224{,}020\ ft^2 \times 5ft) - 342{,}910\ ft^3 = 777{,}190\ ft^3 = 28{,}784\ yd^3$

Elev 565-560

Waste:

$\frac{58{,}302\ ft^2 + 37{,}742\ ft^2}{2} \times 5ft = 240{,}110\ ft^3 = 8{,}893\ yd^3$

C. Soils:

$(224{,}020\ ft^2 \times 5ft) - 240{,}110\ ft^3 = 879{,}990\ ft^3 = 32{,}592\ yd^3$

Elevs 560-555 and 555-550

C. Soils:

$224{,}020\ ft^2 \times 5\ ft = 1{,}120{,}100\ ft^3 = 41{,}485\ yd^3$

Elev 550-548

C. Soils:

$224{,}020\ ft^2 \times 2ft = 448{,}040\ ft^3 = 16{,}594\ yd^3$

INTERNATIONAL TECHNOLOGY CORPORATION

6328

By _____ Date _____ Subject _____ Sheet No. 23 of _____

Chkd. By _____ Date _____ Waste Pit #5 Table - Vol vs. Depth Proj. No. _____

Depth (ft)	Elevation (ft)	Cap (yd³)	Cumulative	Water (yd³)	Cumulative	Waste (yd³)	Cumulative	Soil (yd³)	Cumulative
	589-588	0	0	3,704	3704	0	0	0	0
	588-585	0	0	0		16,301	16,301	4,886	4,8
	585-580	0	0	0		24,123	40,424	17,362	22,
	580-575	0	0	0		20,315	60,739	21,170	43,
	575-570	0	0	0		16,508	77,247	24,977	68,
	570-565	0	0	0		12,700	89,947	28,784	97,
	565-560	0	0	0		8,893	98,840	32,592	129,
	560-555	0	0	0		0	↓	41,485	171,
	555-550	0	0	0		0	↓	41,485	212,
	550-548	0	0	0	3,704	0	98840	16,594	229,

INTERNATIONAL TECHNOLOGY CORPORATION

By S. Brown Date 01/15/91 Subject Fernald Operable Unit #1 Sheet No. 24 of ____
Chkd. By ____ Date ____ Waste Pit #6 Tables - Vol vs Depth Proj. No. ____

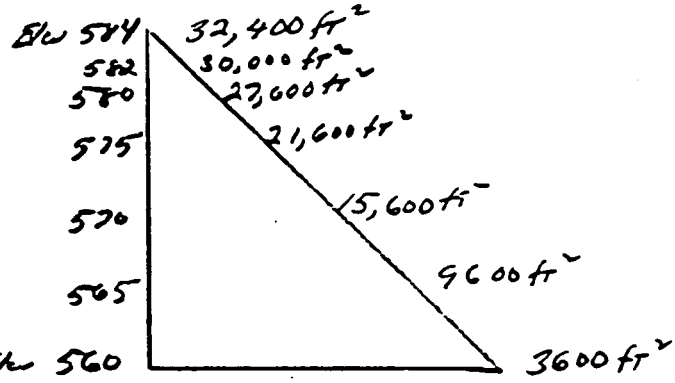
Refs: 1) Pit calculations performed 11/20/90 (Barry C Brown)
2) Weston Drawing 75X-5500-G-00113 Rev 0.
3) IT Drawing 303317-D-C144, C145, C146

Top of Pit Elevation is approx. = 584'
Top of Water Elevation is approx. = 582 (average)
Top of Waste elevation is approx. = 580
Bottom of Pit Elevation is approx = 560'
Top of Aquifer Elevation is approx = 548'

Volume vs Depth Calculations:

Surface area of waste pit = 32,400 ft²
Surface area of waste pit area = 71,610 ft²

Area calculations:



Area @ Elev 582:

$$\frac{32{,}400\ ft^2 - 3600\ ft^2}{24} = \frac{X}{22} \rightarrow X = 26400$$

26,400 + 3600 = 30,000 ft²

Area @ Elev 580 = 27,600 ft² (by same method as outlined on page ...

" " " 575 = 21,600 ft²

" " " 570 = 15,600 ft²

" " " 565 = 9,600 ft²

Elev 584-582

Contaminated Soils:

$(71,610\ ft^2 - 32,400\ ft^2) \times 2\ ft = 78,420\ ft^3 = 2904\ yd^3$

Elev 582-580

Water:

$\frac{30,000\ ft^2 + 27,600\ ft^2}{2} \times 2\ ft = 57,600\ ft^3 = 2133\ yd^3$

say 2400 yd³

C. Soils:

$(71,610\ ft^2 \times 2\ ft) - 57,600\ ft^3 = 85,620\ ft^3 = 3171\ yd^3$

Elev 580-575

Waste:

$\frac{27,600\ ft^2 + 21,600\ ft^2}{2} \times 5\ ft = 123,000\ ft^3 = 4556\ yd^3$

C. Soils:

$(71,610\ ft^2 \times 5\ ft) - 123,000\ ft^3 = 235,050\ ft^3 = 8,706\ yd^3$

Elev 575-570

Waste:

$$\frac{21{,}600\,ft^2 + 15{,}600\,ft^2}{2} \times 5\,ft = 93{,}000\,ft^3 = 3444\,yd^3$$

C. Soils:

$$(71{,}610\,ft^2 \times 5\,ft) - 93{,}000\,ft^3 = 265{,}050\,ft^3 = 9817\,yd^3$$

Elev 570-565

Waste:

$$\frac{15{,}600\,ft^2 + 9{,}600\,ft^2}{2} \times 5\,ft = 63{,}000\,ft^3 = 2333\,yd^3$$

C. Soils:

$$(71{,}610\,ft^2 \times 5\,ft) - 63{,}000\,ft^3 = 295{,}050\,ft^3 = 10{,}928\,yd^3$$

Elev 565-560

Waste:

$$\frac{9{,}600\,ft^2 + 3600\,ft^2}{2} \times 5\,ft = 33{,}000\,ft^3 = 1{,}222\,yd^3$$

C. Soils:

$$(71{,}610\,ft^2 \times 5\,ft) - 33{,}000\,ft^3 = 325{,}050\,ft^3 = 12{,}039\,yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

6328

By _____ Date _____ Subject _____ Sheet No. 27 of _____

Chkd. By _____ Date _____ Waste Pit #6 Table - Vol vs Depth Proj. No. _____

Elev 560-555 and 555-550

C. Soils:

$71{,}610\ ft^2 \times 5\ ft = 358{,}050\ ft^3 = 13{,}261\ yd^3$

Elev 550-548

C. Soils:

$71{,}610\ ft^2 \times 2\ ft = 143{,}220\ ft^3 = 5304\ yd^3$

Depth (ft)	Elevation (ft)	Cap (yd³)		Water (yd³)		Waste (yd³)		C. Soils (yd³)	
			Cumulative		Cumulative		Cumulative		Cumulative
	584-582	0	0	0	0	0	0	2,904	2,904
	582-580			2,400	2,400	0	0	3,171	6,075
	580-575			0	2,400	4,556	4,556	8,706	14,781
	575-570					3,444	8,000	9,817	24,598
	570-565					2,333	10,333	10,928	35,526
	565-560					1,222	11,555	12,039	47,565
	560-555					0	11,555	13,261	60,826
	555-550					0	11,555	13,261	74,087
	550-548	0	0	0	2,400	0	11,555	5,304	79,391

INTERNATIONAL TECHNOLOGY CORPORATION

6328

By B Brown Date 01/16/91 Subject Fernald Operable Unit #1 Sheet No. 28 of ____

Chkd. By ____ Date ____ Burn pit Table - Vol vs. Depth Proj. No. 303317

Refs: 1) Pit calculations performed 11/20/90 (Barry C. Brown)
2) Weston Drawing 75X-5500-G-0013 Rev. 0
3) IT Drawings 303317-D-C144, C145, C146

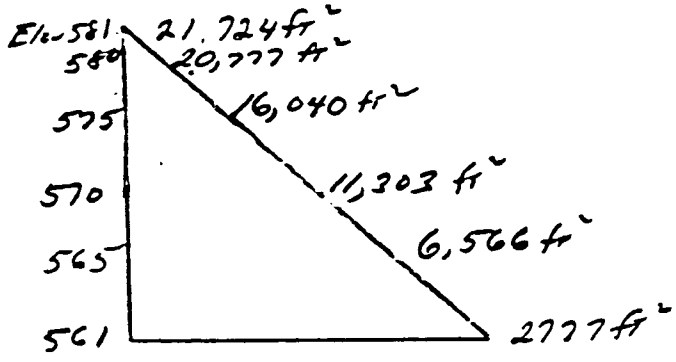
Top of Cap Elevation is approx = 582 ft
Top of Pit Elevation is approx = 581 ft (assumed)
Bottom of Pit Elevation is approx = 561 ft (assumed)
Top of Aquifer Elevation is approx = 548 ft

Volume vs. Depth Calculations

Surface area of waste pit = 21,724 ft² (@ Elev 582)
Surface area at Bottom of waste pit = 2,777 ft² (@ Elev 561) assumed

Surface area of waste area = surface area of waste pit = 21,724 ft²

Waste pit area calculations



Area @ Elev 580:

$$\frac{21{,}724\ ft^2 - 2777\ ft^2}{20} = \frac{x}{19} \rightarrow x = 18{,}000$$

18,000 + 2777 = 20,777 ft²

Area @ Elev 580 = 20,777 ft²
" " " 575 = 16,040 ft²
" " " 570 = 11,303 ft²
" " " 565 = 6,566 ft²

Elev 582-581

Cap:

$21,724\ ft^2 \times 1\ ft = 21,724\ ft^3 = 805\ yd^3$

Elev 581-580

Waste:

$\frac{21,724\ ft^2 + 20,777\ ft^2}{2} \times 1\ ft = 21,250\ ft^3 = 787\ yd^3$

C. Soils:

$(21,724\ ft^2 \times 1\ ft) - 21,250\ ft^3 = 474\ ft^3 = 18\ yd^3$

Elev 580-575

Waste:

$\frac{20,777\ ft^2 + 16,040\ ft^2}{2} \times 5\ ft = 92,042\ ft^3 = 3409\ yd^3$

C. Soils:

$(21,724\ ft^2 \times 5\ ft) - 92,042\ ft^3 = 16,578\ ft^3 = 614\ yd^3$

INTERNATIONAL TECHNOLOGY CORPORATION

6328

By _____ Date _____ Subject _____ Sheet No. 30 of _____

Chkd. By _____ Date _____ Proj. No. _____

Elev 575-570

Waste:

$$\frac{16,640\ ft^2 + 11,303\ ft^2}{2} \times 5\ ft = 68,358\ ft^3 = 2532\ yd^3$$

C. Soils:

$$(21,724\ ft^2 \times 5\ ft) - 68,358\ ft^3 = 40,262\ ft^3 = 1491\ yd^3$$

Elev 570-565

Waste:

$$\frac{11,303\ ft^2 + 6566\ ft^2}{2} \times 5\ ft = 44,672\ ft^3 = 1654\ yd^3$$

C. Soils:

$$(21,724\ ft^2 \times 5\ ft) - 44,672\ ft^3 = 63,548\ ft^3 = 2368\ yd^3$$

Elev 565-561

Waste:

$$\frac{6,566\ ft^2 + 2777\ ft^2}{2} \times 4\ ft = 18,686\ ft^3 = 692\ yd^3$$

C. Soils:

$$(21,724\ ft^2 \times 4\ ft) - 18,686\ ft^3 = 68,210\ ft^3 = 2526\ yd^3$$

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. 31 of _____

Chkd. By _____ Date _____ Proj. No. _____

Elev 561-560

C. Soils:

$21,724\ ft^2 \times 1\ ft = 21,724\ ft^3 = 805\ yd^3$

Elev: 560-555, and 555-550

C. Soils:

$21,724\ ft^2 \times 5\ ft = 108,620\ ft^3 = 4023\ yd^3$

Elev 550-548

C. Soils:

$21,724\ ft^2 \times 2\ ft = 43,448\ ft^3 = 1609\ yd^3$

Depth (ft)	Elevation (ft)	Cap (yd^3)	Cumulative	Water (yd^3)	Cumulative	Waste (yd^3)	Cumulative	C Soils (yd^3)	Cumulative
	582-581	805	805	0	0	0	0	0	0
	581-580	0	↓	↓	↓	787	787	18	18
	580-575	↓	↓	↓	↓	3,409	4,196	614	632
	575-570	↓	↓	↓	↓	2,532	6,728	1,491	2,123
	570-565	↓	↓	↓	↓	1,654	8,382	2,368	4,491
	565-561	↓	↓	↓	↓	692	9,074	2,526	7017
	561-560	↓	↓	↓	↓	0	↓	805	7822
	560-555	↓	↓	↓	↓	0	↓	4,023	11,845
	555-550	↓	↓	↓	↓	0	↓	4,023	15,868
	550-548	0	805	0	0	0	9,074	1,609	17,477

By B. Brown Date 01/16/91 Subject Fernald Operable Unit #1 Sheet No. 32 of ____
Chkd. By ____ Date ____ Clearwell Waste - Vol. vs Depth Proj. No. 303317

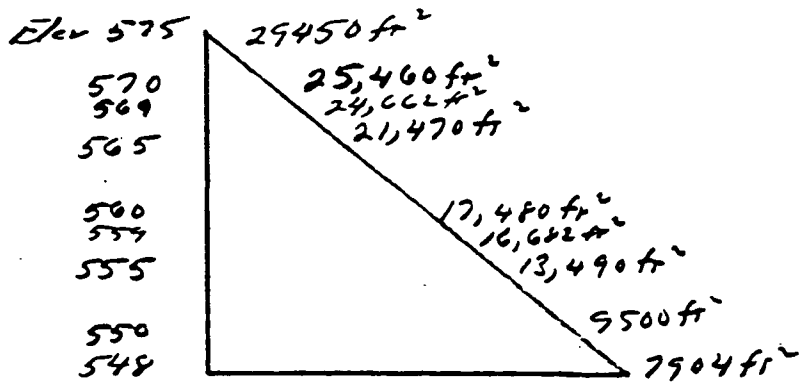
Refs: 1) Pit calculations performed 11/20/90 (Barry Brown)
2) Weston Drawing 75X-5500-G-00113 Rev. 0
3) IT Drawings 303317-D-C144, C145, C146

Top of Pit Elevation is approx = 575 ft MSL
Top of Surface Water Elev is approx = 569 ft Assuming 10 ft of water
Top of Waste Elev is approx = 559 ft
Bottom of Pit Elev is approx = 548 ft
Top of Aquifer Elev. is approx = 548 ft

Volume vs Depth Calculations

Surface area of waste pit = 29450 ft²
Surface area of Pit Bottom = 7,904 ft²
Surface area of waste area = 55,723 ft²

Clearwell area calculations:



Area @ Elev 570:

$$\frac{29450\ ft^2 - 7904\ ft^2}{27} = \frac{X}{22} \rightarrow X = 17,556$$

17,556 + 7904 = 25,460 ft²

INTERNATIONAL TECHNOLOGY CORPORATION

6328

By _____ Date _____ Subject _____ Sheet No. 33 of _____

Chkd. By _____ Date _____ Proj. No. _____

Area @ Elev 565 = 21,470 ft² 569 = 24,662 ft²

560 = 17,480 ft² 559 = 16,682 ft²

555 = 13,490 ft²

550 = 9,500 ft²

Elev 575-570

Air:

$$\frac{29,450\,ft^2 + 25,460\,ft^2}{2} \times 5\,ft = 137,275\,ft^3 = 5084\,yd^3$$

Contaminated soils:

$$(55,723\,ft^2 \times 5\,ft) - 137,275\,ft^3 = 141,340\,ft^3 = 5235\,yd^3$$

Elev 570-569

Air:

$$\frac{25,460\,ft^2 + 24,662\,ft^2}{2} \times 1\,ft = 25,061\,ft^3 = 928\,yd^3$$

C. Soils:

$$(55,723\,ft^2 \times 1\,ft) - 25,061\,ft^3 = 30,662\,ft^3 = 1,136\,yd^3$$

Elev 569-565

Water:

$$\frac{24,662\,ft^2 + 21,470\,ft^2}{2} \times 4\,ft = 92,264\,ft^3 = 3417\,yd^3$$

C. Soils:

$$(55723\,ft^2 \times 4\,ft) - 92,264\,ft^3 = 130,628\,ft^3 = 4,838\,yd^3$$

Elev 565-560

Water:

$$\frac{21,470 ft^2 + 17,480 ft^2}{2} \times 5 ft = 97,375 ft^3 = 3606 yd^3$$

C. Soils:

$$(55,723 ft^2 \times 5 ft) - 97,375 ft^3 = 181,240 ft^3 = 6713 yd^3$$

Elev 560-559

Water:

$$\frac{17,480 ft^2 + 16,682 ft^2}{2} \times 1 ft = 17,081 ft^3 = 633 yd^3$$

C. Soils:

$$(55,723 ft^2 \times 1 ft) - 17,081 ft^3 = 38,642 ft^3 = 1,431 yd^3$$

Elev 559-555

Water:

$$\frac{16,682 ft^2 + 13,490 ft^2}{2} \times 4 ft = 60,344 ft^3 = 2235 yd^3$$

C. Soils.

$$(55,723 ft^2 \times 4 ft) - 60,344 ft^3 = 162,548 ft^3 = 6,020 yd^3$$

Elev 555-550

Waste:

$$\frac{13{,}490\,ft^2 + 9500\,ft^2}{2} \times 5\,ft = 57{,}475\,ft^3 = 2{,}129\,yd^3$$

C. Soils.

$$(55{,}723\,ft^3 \times 5\,ft) - 57{,}475\,ft^3 = 221{,}140\,ft^3 = 8{,}190\,yd^3$$

Elev 550-548

Waste.

$$\frac{9500\,ft^2 + 7904\,ft^2}{2} \times 2\,ft = 17{,}404\,ft^3 = 645\,yd^3$$

C. Soils:

$$(55{,}723\,ft^3 \times 2\,ft) - 17{,}404\,ft^3 = 94{,}042\,ft^3 = 3{,}483\,yd^3$$

Depth (ft)	Elevation (ft)	Cap (yd³)		Water (yd³)		Waste (yd³)		C. Soils (yd³)	
			Cumulative		Cumulative		Cumulative		Cumulati
	575-570	0	0	0	0	0	0	5235	5,235
	570-569			0	0	0	0	1,136	6,371
	569-565			3,417	3,417	0	0	4,838	11,209
	565-560			3,606	7,023	0	0	6,713	17,92
	560-559			633	7,656	0	0	1,431	19,35
	559-555			0	7,656	2,235	2,235	6,020	25,37
	555-550			0	7,656	2,129	4,364	8,190	33,56
	550-548	0	0	0	7,656	645	5,009	3,483	37,04

PIT NO.	APPROXIMATE DESIGN DEPTH (ft.)	WASTE (cu. yd.)	PIT BOUNDARY AREA ($ft.^2$)	WATER (cu. yd.)	CAP (cu. yd.)	SOILS[b] (cu. yd.)	TOTAL (cu. yd.)	CAP THICKNESS RANGE (ft.)	ESTIMATED LINER THICKNESS (ft.)
1	20.0	46,415	112,220	—	3,063	83,523	133,001	0.5–1.5	4.5' CLAY LINED
2	17.8	25,724	65,100	—	2,494	48,938	77,156	0.5–2.0	4' CLAY LINED
3	38	300,267	317,983	—	8,940	150,102	459,309	0.75–8.0	1' CLAY LINED
4	29.5	66,013	151,900	—	3,104	161,546	230,663	1.0–6.0	2' CLAY LINED
5	30	98,841	224,020	3,704 (748,060 gal)	—	229,336	331,881	NO CAP	60 MIL EPDM ELASTOMERIC MEMBRANE
6	24	11,556	71,610	2,133 (430,781 gal)	—	79,480	93,169	NO CAP	60 MIL EPDM ELASTOMERIC MEMBRANE
BURN PIT	30	13,802	21,724	—	805	13,554	28,161	0.0–4.0	NO LINER
CLEAR WELL	27	5,008	55,723	7,656 (1,546,265 gal)	—	37,047	49,711	NO CAP	1' CLAY LINED
TOTALS	N/A	567,626	1,020,280	13,493	18,406	803,526	1,403,051	N/A	N/A

a – CALCULATIONS OBTAINED FROM RECENT AS WELL AS HISTORIC DATA AS SUPPLIED BY WMCO, WESTON, AND DAMES & MOORE.

b – SOIL VOLUMES HAVE BEEN CALCULATED AS THOSE SOILS OUTSIDE THE PIT LINER SURROUNDING THE RESPECTIVE PIT. SOIL VOLUME CALCULATIONS INCLUDE THOSE SOILS WHICH EXTEND IN DEPTH TO THE GREAT MIAMI AQUIFER (APPROX. ELEVATION IS 548 ft. MSL).

SUMMARY OF FMPC PIT INFORMATION[a]

INTERNATIONAL TECHNOLOGY CORPORATION

OU1 Waste Volume 6838

IT CORPORATION
SOUTHERN REGION
ENVIRONMENTAL ENGINEERING AND SERVICES
KNOXVILLE, TENNESSEE

CALCULATION CHECK SHEET

Project Name Fernald Project Number 313327

Charge Number 313327.10.04.01

Calculation Subject P.T Volume Calculation Total Number of Pages 27

Originator _____ Date _____

Checker [illegible] Date 3-16-92

Originator's Initials or N/A	Checker's Initials or N/A	
		1. **Format** - Includes IT Calculation Form, project number, name, page number, date, originator's initals, and checker's initals and date (once check is final) on every page.
		2. **Statement of Calculational Intent and Assumptions**
		3. **Design Bases** - Includes regulatory, performance, and operational requirements, design criteria, input parameters from the supporting data (see Number 7), and any applicable design codes.
		4. **Calculation Approach/Method** - Includes any modeling or theory used as well as the calculational method.
		5. **Numerical Results**
		6. **Calculation Summary**
		7. **Supporting Data**

PRELIMINARY

- Literature References
- Field and/or Laboratory Data
- Computer Runs from a Verified Program
- Other References (specify)

Comments _____

FERNALD PIT CALCULATION
FORMULA CHECK LIST [illegible] 3-10-92
QA/QC PERFORMED BY KEITH CURTIS 3-10-92

82693/27	=	3,063
112220*(580-548)/27	=	133,001
(20/27)*(82693+42627)/2	=	46,415
133001-3063-46415	=	83,523
112220/27	=	4,156
4156-3063	=	1,093
82693*(579/575)	=	83,268
4*(82693+74680)/54	=	11,657
112220*(4)/27	=	16,625
16625-11657	=	4,968
82693-(9*(82693-42627))/20	=	64,663
(74680+64663)*5/2/27	=	12,902
112220*5/27	=	20,781
20781-12902	=	7,879
82693-(82693-42627)*14/20	=	54,647
(64663+54647)*5/2/27	=	11,047
54647*5/27	=	10,120
20781-11047	=	9,734
82693-(82693-42627)*19/20	=	44,630
(54647+44630)*5/2/27	=	9,192
20781-9192	=	11,589
82693-(82693-42627)*20/20	=	42,627
(44630+42627)*1/2/27	=	1,616
112220*1/27	=	4,156
4156-1616	=	2,540
112220*4/27	=	16,625
112220*5/27	=	20,781
112220*2/27	=	8,313
44896*1.5/27	=	2,494
65100*(580-548)/27	=	77,156
(44896+33364)/2*17.75/27	=	25,724
77156-2494-25724	=	48,938
65100*1.5/27	=	3,617
3617-2494	=	1,123
44896-(44896-33364)*3.5/17.75	=	42,622
(44896+42622)*3.5/2/27	=	5,672
65100*3.5/27	=	8,439
8439-5672	=	2,767
44896-(44896-33364)*8.5/17.75	=	39,374
(42622+39374)*5/2/27	=	7,592
65100*5/27	=	12,056
12056-7592	=	4,464
44896-(44896-33364)*13.5/17.75	=	36,125
(39374+36125)*5/2/27	=	6,991
65100*5/27	=	12,056
12056-6991	=	5,065
(36125+33364)*4.25/2/27	=	5,469
65100*4.25/27	=	10,247
10247-5469	=	4,778
65100*0.75/27	=	1,808

PRELIMINARY

FERNALD PIT CALCULATION
FORMULA CHECK LIST
QA/QC PERFORMED BY KEITH CURTIS 3-10-92

6328

65100*5/27	=	12,056
65100*2/27	=	4,822
241373/27	=	8,940
317983*((587-548)/27)	=	459,309
(241373+185322)/2*38/27	=	300,267
459309-300267-8940	=	150,102
317983/27	=	11,777
11777-8940	=	2,837
241373-(241373-185322)/38	=	239,898
(241373+239898)/2/27	=	8,912
11777-8912	=	2,865
241373-(241373-185322)*6/38	=	232,523
(239898+232523)*5/2/27	=	43,743
317983*5/27	=	58,886
58886-43743	=	15,143
241373-(241373-185322)*11/38	=	225,148
(232523+225148)*5/2/27	=	42,377
58886-42377	=	16,509
241373-(241373-185322)*16/38	=	217,773
(225148+217773)*5/2/27	=	41,011
58886-41011	=	17,875
241373-(241373-185322)*21/38	=	210,397
(217773+210397)*5/2/27	=	39,645
58886-39645	=	19,241
39645-1366	=	38,279
58886-38279	=	20,607
38279-1366	=	36,913
58886-36913	=	21,973
36913-1366	=	35,547
58886-35547	=	23,339
241373-(241373-185322)*36/38	=	188,272
(188272+185322)*2/2/27	=	13,837
317983*2/27	=	23,554
23554-13837	=	9,717
83799/27	=	3,104
151900/27-3104	=	2,522
151900*((589-548)/27)	=	230,663
(83799+37039)/2*29.5/27	=	66,013
230663-3104-66013	=	161,546
83799-(83799-37039)*3/29.5	=	79,044
(83799+79044)*3/2/27	=	9,047
151900*3/27	=	16,878
16878-9047	=	7,831
83799-(83799-37039)*8/29.5	=	71,118
(79044+71118)/2/27*5	=	13,904
151900*5/27	=	28,130
28130-13904	=	14,226
83799-(83799-37039)*13/29.5	=	63,193
(71118+63193)*5/2/27	=	12,436
28130-12436	=	15,694

PRELIMINARY

FERNALD PIT CALCULATION
FORMULA CHECK LIST
QA/QC PERFORMED BY KEITH CURTIS 3-10-92

6328

83799-(83799-37039)*18/29.5	=	55,267
(63193+55267)*5/2/27	=	10,969
28130-10969	=	17,161
83799-(83799-37039)*23/29.5	=	47,342
(55267+47342)*5/2/27	=	9,501
28130-9501	=	18,629
83799-(83799-37039)*28/29.5	=	39,417
(47342+39417)*5/2/27	=	8,033
28130-8033	=	20,097
(39417+37039)*1.5/2/27	=	2,124
151900*1.5/27	=	8,439
8439-2124	=	6,315
151900*3.5/27	=	19,691
151900*5/27	=	28,130
151900*2/27	=	11,252
21724/27	=	805
(21724+3120)*30/2/27	=	13,802
(21724)*(582-548)/27	=	27,356
27356-13802	=	13,554
21724-(21724-3120)/30	=	21,104
(21724+21104)/2/27	=	793
21724/27	=	805
805-793	=	12
21724-(21724-3120)*6/30	=	18,003
(21104+18003)*5/2/27	=	3,621
21724*5/27	=	4,023
4023-3621	=	402
21724-(21724-3120)*11/30	=	14,903
(18003+14903)*5/2/27	=	3,047
4023-3047	=	976
21724-(21724-3120)*16/30	=	11,802
(14903+11802)*5/2/27	=	2,473
4023-2473	=	1,550
21724-(21724-3120)*21/30	=	8,701
(11802+8701)*5/2/27	=	1,898
4023-1898	=	2,125
21724-(21724-3120)*26/30	=	5,601
(8701+5601)*5/2/27	=	1,324
4023-1324	=	2,699
(5601+3120)*4/2/27	=	646
21724*4/27	=	3,218
3218-646	=	2,572
21724/27	=	805
21724*2/27	=	1,609

PRELIMINARY

SCALE:

0 80 160 240 FEET

PRELIMINARY

6328

SUMMARY OF FMPC PIT INFORMATION[a]

NO.	APPROXIMATE DESIGN DEPTH (ft.)	WASTE (cu. yd.)	PIT BOUNDARY AREA (ft.^{2})	WATER (cu. yd.)	CAP (cu. yd.)	SOILS[b] (cu. yd.)	TOTAL (cu. yd.)	CAP THICKNESS RANGE (ft.)	ESTIMATED LINER THICKNESS (ft.)
	20.0	46,415	112,220	—	3,063	83,523	133,001	0.5–1.5	4.5' CLAY LINED
	17.8	25,724	65,100	—	2,494	48,938	77,156	0.5–2.0	4' CLAY LINED
2	38	300,267	317,983	—	8,940	150,102	459,309	0.75–8.0	1' CLAY LINED
	29.5	66,013	151,900	—	3,104	161,546	230,663	1.0–6.0	2' CLAY LINED
	30	98,841	224,020	3,704 (748,060 gal)	—	229,336	331,881	NO CAP	60 MIL EPDM ELASTOMERIC M
	24	11,556	71,610	~~2,400~~ 2,132 ~~(484,784 GAL)~~ 430,786 GAL	—	79,480 ~~79,467~~	93,169 ~~93,123~~	NO CAP	60 MIL EPDM ELSATOMERIC M
6	30	13,802	21,724		805	13,554	27,356	0.0–4.0	NO LINER
IN PIT	27	5,008	55,723	7,656 (1,546,265 gal)	—	37,047	49,711	NO CAP	1' CLAY LINED
R WELL								N/A	N/A
TALS	N/A	567,626	1,020,280	1349 ~~13,760~~	18,406	~~803,513~~ 803,526	1,400,100		

CALCULATIONS OBTAINED FROM RECENT AS WELL AS HISTORIC DATA AS SUPPLIED BY WMCO, WESTON, AND DAMES & MOORE.

SOIL VOLUMES HAVE BEEN CALCULATED AS THOSE SOILS OUTSIDE THE PIT LINER SURROUNDING THE RESPECTIVE PIT.

SOIL VOLUME CALCULATIONS INCLUDE THOSE SOILS WHICH EXTEND IN DEPTH TO THE GREAT MIAMI AQUIFER (APPROX. ELEVATION IS 548 ft MSL).

28,161 ✓

Total with this is ~~1,403~~ 1,403,0

000041

CALCULATION WORKSHEET

6328

ORIGINATOR Ray Mc DATE 1-14-92 SHEET 1 OF 77

CALC. NO. _____ REV. NO. _____ DATE _____ CHECKED _____

PROJECT Fernald O.U. # 1 TASK NO. _____

SUBJECT Waste Pit # 1

O.U. # 1 Waste Pit # 1

PRELIMINARY

Ref.: 1.) USAEC DWG NO. 8-3002, Index Code 08C5500G0864, Scale 1" = 50'
2.) Penn Drilling Co's. Boring Number 1765, 1766 & 1768 Reports
3.) Calculations of 11/90 and 1/91 By Barry Brown of I.T.

From above mentioned calculations and Weston Dwg. Index Code 75X5500G00113 the top of cap is at apprx. 580'

From Boring Reports referenced above, Bottom of pit # 1 @ $580' - \frac{(22+20+21)}{3} =$ 559' EL

From Table 1-1 of Task # 12 For O.U. # 1, Aquifer at 543' EL.

Surface Area Computations using planimeter on dwg. 8-3002 above, referenced calculations and Table 1-1 of Task # 12 For O.U. # 1

Surface area of pit # 1 = 82,693 $ft.^2$
Bottom area of pit # 1 = 42,627 $ft.^2$

From previous calculations referenced above and Penn Drilling Co. Reports, the cap ranges from 0'-6" to 1'-6", ∴ use cap thickness equals 1'-0"

Pit # 1 Area Volume Calculations

Ave. Depth of pit # 1 = $\frac{(22+20+21)}{3} - 1$ = 20 ft

Area including and surrounding Pit # 3 = 112,220 $ft.^2$

Surface Area = 82,693 ft^2

Base Area = 42,627 ft^2

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-14-92 SHEET 2 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #1

Cap Volume = $(82{,}693\ ft^2 \times 1\ ft)\left(\frac{yds^3}{27\ ft^3}\right) = 3063\ yds^3$.

Assumption: Soil may be excavated to aquifer due to contaminated soil

Volume of Waste Pit # 1 Area, Surface to aquifer = $112{,}220\left(\frac{580-548}{27}\right)$
$= 133{,}001\ yds^3$.

Total Volume of Waste Pit # 1 using average end area method:

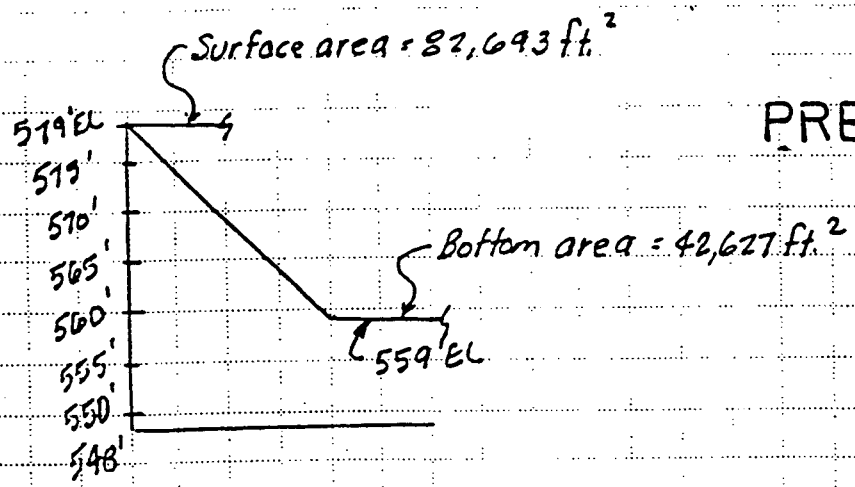
Total Volume of Waste Pit # 1 = $\left(\frac{82{,}693 + 42{,}627}{2}\right)(20)\left(\frac{1}{27}\right) = 46{,}415\ yds^3$

Volume of possible contaminated Soils = Volume of waste pit # 1 area
− Cap Volume − Volume of waste pit # 1 = 133,001 − 3063 − 46,415
$= 83{,}523\ yds^3$.

<u>Intermediate Elevation Volume Calculation, Volume vs. Depth Calcs.</u>

Total Volume of Pit # 1 Area Between 580' EL THRU 579' EL = $\frac{112220(1)}{27} = 4156\ yds^3$.

Possible contaminated Soils Between 580' EL & 579' EL = 4156 − 3063
$= 1093\ yds^3$.



PRELIMINARY

CALCULATION WORKSHEET

ORIGINATOR Ray Ms DATE 1-14-92 SHEET 3 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit #1

PRELIMINARY

Area @ 575'EL, By Proportioning $= 82{,}693 - \frac{(82{,}693 - 42{,}627)(4)}{20}$
$= 74680 \text{ ft.}^2$

Pit #1
Waste Volume Between 579'EL. & 575'EL. $= \frac{(82693 + 74680)}{2(27)}(4')$
$= 11{,}657 \text{ yds.}^3$

Area surrounding and including
Pit #1, Volume Between 579'EL. & 575'EL. $= \frac{112220(4)}{27} = 16{,}625 \text{ yds.}^3$

Contaminated Soil in Area around Pit #1
Volume Between 579'EL & 575'EL $= 16{,}625 - 11{,}657 = 4968 \text{ yds.}^3$

Area @ 570'EL $= 82{,}693 - \frac{(82{,}693 - 42{,}627)(9)}{20} = 64{,}663 \text{ ft.}^2$

Pit #1
Waste Volume Between 575'EL & 570'EL $= \frac{(74{,}680 + 64{,}663)(5)}{2(27)}$
$= 12{,}902 \text{ yds.}^3$

Area surrounding and including
Pit #1, Volume Between 575'EL. & 570'EL. $= \frac{112{,}220(5)}{27} = 20{,}781 \text{ yds.}^3$

Contaminated Soil in Area around Pit #1
Volume Between 575'EL & 570'EL $= 20{,}781 - 12{,}902 = 7879 \text{ yds.}^3$

Area @ 565'EL $= 82{,}693 - \frac{(82{,}693 - 42{,}627)(14)}{20} = 54{,}647 \text{ ft.}^2$

Pit #1
Waste Volume Between 570'EL & 565'EL $= \frac{(64{,}663 + 54{,}647)(5)}{2(27)}$
$= 11{,}047 \text{ yds.}^3$

Area surrounding and including
Pit #1, Volume Between 570'EL & 565'EL: $20{,}781 \text{ yds}^3$

Contaminated Soil in Area around Pit #1
Volume Between 570'EL & 565'EL $= 20{,}781 - 11{,}047 = 9734 \text{ yds.}^3$

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-15-92 SHEET 4 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #1

Area @ 560'EL. Pit #1 = $82{,}693 - \frac{(82{,}693 - 42{,}627)(19)}{20} = 44{,}630\ ft.^2$

Waste Volume Between 565'EL & 560'EL = $\frac{(54{,}647 + 44{,}630)(5)}{2(27)}$ = 9192 yds.^{3}

Area surrounding and including Pit #1, Volume Between 565'EL & 560'EL = 20,781 yds.^{3}

Contaminated Soil in Area around Pit #1 Volume Between 565'EL & 560'EL = 20,781 - 9192 = 11,589 yds.^{3}

Area @ 559'EL Pit #1 = $82{,}693 - \frac{(82{,}693 - 42{,}627)(20)}{20} = 42{,}627\ ft.^2$

Waste Volume Between 560'EL & 559'EL = $\frac{(44{,}630 + 42{,}627)(1)}{2(27)}$ = 1616 yds.^{3}

Area surrounding and including Pit #1, Volume Between 560'EL & 559'EL = $\frac{112{,}220(1)}{27}$ = 4156 yds.^{3}

Contaminated Soil in Area around Pit #1 Volume Between 560'EL & 559'EL = 4,156 - 1,616 = 2,540 yds.^{3}

PRELIMINARY

Contaminated soil Between 559'EL & 555'EL = $\frac{112{,}220(4)}{27}$ = 16,625 yds.^{3}

Contaminated Soil Between 555'EL & 550'EL = $\frac{112{,}220(5)}{27}$ = 20,781 yds.^{3}

Contaminated Soil Between 550'EL & 548'EL = $\frac{112{,}220(2)}{27}$ = 8,313 yds.^{3}

CALCULATION WORKSHEET

6328

ORIGINATOR Ray Mc DATE 1-15.92 SHEET 5 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #1

Volume of Pit Waste and Contaminated Soils of Area #1 At Various Depths

PRELIMINARY

Depth (Ft.)	Elevation (Ft.)	Cap Volume (Yds³)	Cap Volume (Σ Yds³)	Water Volume (Yds³)	Water Volume (Σ Yds³)	Volume of Pit #1 Waste (Yds³)	Volume of Pit #1 Waste (Σ Yds³)	Volume of Contaminated Soils (Yds³)	Volume of Contaminated Soils (Σ Yds³)
0-1.0	580-579	3063	3063	—	—	—	—	1093	1093
1.0-5.0	579-575	—		—	—	11657	11657	4968	6061
5.0-10.0	575-570	—		—	—	12902	24559	7879	13940
10.0-15.0	570-565	—		—	—	11047	35606	9734	23674
15.0-20.0	565-560	—		—	—	9192	44798	11589	35263
20.0-21.0	560-559	—		—	—	1616	46414	2540	37803
21.0-25.0	559-555	—		—	—	—		16625	54428
25.0-30.0	555-550	—		—	—	—		20781	75209
30.0-32.0	550-548	—	3063	—	—	—	46414	8313	83522

CALCULATION WORKSHEET

6328

ORIGINATOR Ray Mc DATE 1-8-92 SHEET 6 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit #2

O.U. #1 Waste Pit #2

PRELIMINARY

Ref: 1.) USAEC DWG NO. 8-4069, Index Code 21A-5500-G-00233 (1986)
2.) Penn Drilling Co.'s Boring Number 1768 and 1769 Reports
3.) Calculations of 11/90 and 1/91 By Barry Brown of I.T.

From topography map for area top of cap is at an elev of appr. 590'
From Boring Report #1769 Bottom of Pit apprx. $590' - \left(\frac{17+21.5}{2}\right) = 560.75'$ EL
From Table 1-1 of Task #12 for O.U #1, Aquifer at 548 'EL

Surface Area Computations using planimeter on dwg. 8-4069 above, Referenced calculations and Table 1-1 of Task #12 for O.U. #1

Top surface area of pit # 2 = 44,896 ft^2
Bottom surface area of pit # 2 = 33,364 ft^2

Penn Drilling Co.'s Borings Indicate cap depths of 1 & 2 ft and above referenced calculations mentioned CIS Borings indicated cap depths of 6" to 12", i.e., use 1.5 ft; $\left(\frac{1+2}{2} = 1.5'\right)$

Liner penetrated at depths of 17ft. and 21.5 ft per Penn Drilling Co.'s Reports while CIS had depths of 12' and 15' per previously mentioned calculations. Penn's depths are to be used.

Pit #2 Area Volume Calculations

Ave. Depth of Pit = $\frac{(17+21.5)}{2} - 1.5 = 17.75$ ft.

Area including and surrounding Pit #2 = 65,100 ft^2

Surface Area of Pit # 2 = 44,896 ft^2

Base Area of Pit # 2 = 33,364 ft^2

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-8-92 SHEET 7 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit # 2

PRELIMINARY

Cap Volume = $(44{,}896\ ft^2 \times 1.5\ ft)\left(\frac{yds^3}{27\ ft^3}\right) = 2494\ yds^3$

ASSUMPTION: SOIL MAY BE excavated to aquifer due to contaminated soil

Volume of Waste Pit # 2 Area, Surface to Aquifer : $65100\ ft^2 \left(\frac{580ft. - 548ft}{27\ ft^3/yds^3}\right)$

$= 77156\ yds^3$

Total Volume of Waste in Pit # 2 using Average End Area Method:

Total Volume of Waste in Pit # 2 = $\frac{(44{,}896 + 33{,}364)}{2}(17.75)\left(\frac{1}{27}\right)$

$= 25{,}724\ yds^3$

Volume of Possible Contaminated Soils = Volume of Waste Pit # 2 Area - Cap Volume - Volume of Waste in Pit # 2 = 77156 - 2494 - 25724

$= 48938\ yds^3$

Intermediate Elevation Volume Calculations, Volume vs. Depth Calcs.

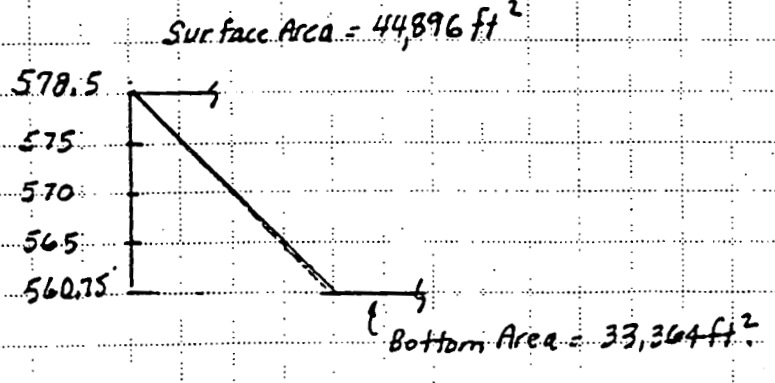
Total Volume of Pit # 2 Area @ 580'EL THRU 578.5'EL = $65100(1.5)\left(\frac{1}{27}\right)$

$= 3617\ yds^3$

Contaminated soil Between 580'EL. & 578.5'EL = $3617\ yds^3 - 2494\ yds^3$

$= 1123\ yds^3$

Waste Volume Calculations For Pit # 2



CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-8-92 SHEET 8 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Waste Pit # 2

PRELIMINARY

Area @ 575' EL., By Proportioning $= 44{,}896 - \frac{(44{,}896-33{,}364)(3.5)}{17.75}$
$= 42622\ ft^2$

Pit # 2 -
Waste Volume Between 578.5' EL. & 575' EL. $= \frac{(44{,}896+42622)}{2(27)}(3.5)$
$= 5672\ yds^3$

Area surrounding and including
Pit # 2, Volume Between 578.5' EL & 575' EL $= \frac{65100(3.5)}{27}$
$= 8439\ yds^3$

Contaminated Soil in Area around Pit # 2
Volume Between 578.5' EL & 575' EL $= 8439 - 5672 = 2767\ yds^3$

Area @ 570' EL. $= 44896 - \frac{(44896-33364)(8.5)}{17.75} = 39374\ ft^2$

Pit # 2 -
Waste Volume Between 575' EL. & 570' EL $= \frac{(42622+39374)(5)}{(2)(27)}$
$= 7592\ yds^3$

Area surrounding and including
Pit # 2 Volume Between 575' EL. & 570' EL $= \frac{(65100)(5)}{27} = 12056\ yds^3$

Contaminated Soil in Area around Pit # 2
Volume Between 575' EL & 570' EL $= 12056 - 7592 = 4464\ yds^3$

Area @ 565' EL $= 44896 - \frac{(44896-33364)(13.5)}{17.75} = 36125\ ft^2$

Pit # 2 -
Waste Volume Between 570' EL & 565' EL $= \frac{(39374+36125)(5)}{2(27)} = 6991\ yds^3$

Area surrounding and including
Pit # 2 Volume Between 570' EL & 565' EL $= \frac{(65000)(5)}{27} = 12056\ yds^3$

Contaminated Soil in Area around Pit # 2
Volume Between 570' EL. & 565' EL. $= 12056 - 6991 = 5065\ yds^3$

CALCULATION WORKSHEET

6328

ORIGINATOR Ray MS DATE 1-9-92 SHEET 9 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit #2

PRELIMINARY

Area @ 560.75' EL. = 33364 ft^2
Pit #2 -
Waste Volume Between 565' EL & 560.75' EL: $\frac{(36125+33364)(4.25)}{2(27)}$
= 5469 yds^3

Area Surrounding and including
Pit #2 Volume Between 565' EL & 560.75' EL = $\frac{(65100)(4.25)}{27}$ = 10247 yds^3

Contaminated Soil in Area around Pit #2
Volume Between 565' EL & 560.75' EL = 10247 − 5469 = 4778 yds^3

From previous calculations of 1/91 by Barry Brown, liner is approx 4.5 ft THICK, Consider as part of Pit #2 Area contaminated Soil

Contaminated Soil Between 560.75' EL. & 560' EL = $\frac{65100(.75)}{27}$
= 1808 yds^3

Contaminated Soil Between 560' EL. & 555' EL., ALSO
Between 555' EL. & 550' EL = $\frac{65100(5)}{27}$
= 12056 yds^3

Contaminated Soil Between 550' EL. & 548' EL = $\frac{65100(2)}{27}$
= 4822 yds^3

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-9-92 SHEET 10 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #7

Volume of Pit Waste and Contaminated Soils of Area #2 At Various Depths

PRELIMINARY

Depth (Ft.)	Elevation (Ft.)	Cap Volume (Yds³)	Cap Volume (ΣYds³)	Water Volume (Yds³)	Water Volume (ΣYds³)	Volume of Pit #2 Waste (Yds³)	Volume of Pit #2 Waste (ΣYds³)	Volume of Contaminated Soils (Yds³)	Volume of Contaminated Soils (ΣYds³)
0-1.5	580-578.5	2494	2494	—	—	—	—	1123	1123
1.5-5.0	578.5-575	—		—	—	5672	5672	2767	3890
5.0-10.0	575-570	—		—	—	7592	13264	4464	8354
10.0-15.0	570-565	—		—	—	6991	20255	5065	13419
15.0-19.25	565-560.75	—		—	—	5469	25724	4778	18197
19.25-20.0	560.75-560	—		—	—	—		1808	20005
20.0-25.0	560-555	—		—	—	—		12056	32061
25.0-30.0	555-550	—		—	—	—		12056	44117
30.0-32.0	550-548	—	2494	—	—	—	25724	4822	48939

CALCULATION WORKSHEET

ORIGINATOR Ray McC DATE 1-10-92 SHEET 11 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Waste Pit # 3

O.U. # 1 Waste Pit # 3 PRELIMINARY

Ref: 1.) USAEC DWG. NO. 8-4151, Index No. 21X-5500-G-00234
2.) Penn Drilling Co.'s Boring Number 1770, 1771 & 1772 Reports
3.) Calculations of 11/90 and 1/91 By Barry Brown of I.T.

From topography map* for area, top of cap at an elev. of apprx. 587'
From above referenced borings top of pit ave. is 587'-1' = 586' EL.
From above referenced borings bottom of pit ave is 587-39 = 548' EL.
* Weston Dwg. Index Code 75X-5500-G-00113
Surface Area Computations using planimeter on dwg. 8-4151 above, Referenced calculations and Table 1-1 of Task # 12 For O.U. # 1

Top Surface area of pit # 3 = 241,373 ft.^{2}
Bottom Surface area of pit # 3 = 185,322 ft.^{2}

Pit # 3 Area Volume Calculations

Ave. Depth of Pit = 586' - 548' = 38 ft.

Area including and surrounding Pit # 3 = 317,983 ft.^{2}

Surface area of pit # 3 = 241,373 ft.^{2}

Bottom area of pit # 3 = 185,322 ft.^{2}

Cap Volume = $(241{,}373)(1)(\frac{1}{27})$ = 8940 yds^3

Volume of Waste Pit # 3 Area to Aquifer = $317{,}983\left(\frac{587-548}{27}\right)$
= 459,309 yds^3

Volume of waste Pit # 3 = $\left(\frac{241{,}373+185{,}322}{2}\right)(38)(\frac{1}{27})$ = 300,267 yds^3

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-10-92 SHEET 12 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit # 3

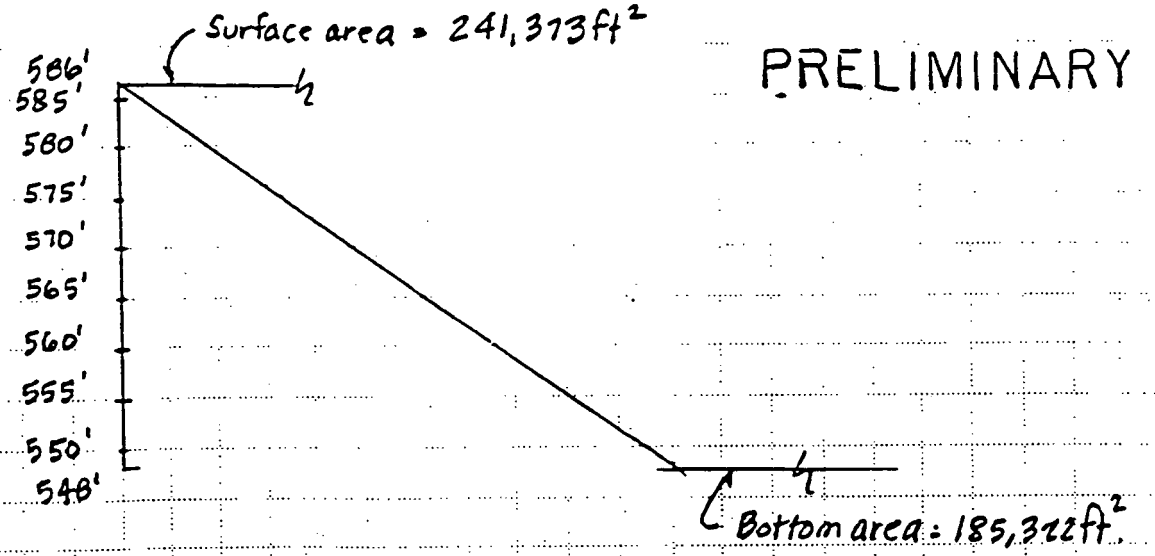
Volume of Possible Contaminated Soils = 459,309 - 300,267 - 8940
= 150,102 yds^3

Intermediate Elevation Volume Calculations, Volume Vs. Depth Calcs.

Total Volume of Pit #3 Area @ 587'EL THRU 586'EL $\frac{317,983(1)}{27}$ = 11,777 yds.^{3}

Contaminated Soil Between 587'EL & 586'EL. = 11,777 - 8940 = 2837 yds^3

Waste Volume Calculations For Pit # 3



PRELIMINARY

Area @ 585'EL. = 241,373 - $\frac{(241,373 - 185,322)(1)}{38'}$ = 239,898 ft^2

Pit # 3
Waste Volume Between 586'EL. & 585'EL. = $\frac{(241373 + 239898)(1)}{2(27)}$
= 8912 yds.^{3}

Area surrounding and including Pit # 3
Volume Between 586'EL. & 585'EL. = $\frac{317983(1)}{27}$ = 11,777 yds^3

[illegible] O.U. #3 [illegible] = 11,777 - 8912 = 2865

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-10-92 SHEET 13 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U #1 TASK NO. ____

SUBJECT Waste Pit #3

Area @ 580' EL = $241{,}373 - \frac{(241373-185322)(6)}{38} = 232{,}523$ ft.^{2}

Pit #3 PRELIMINARY

Waste Volume Between 585' EL & 580' EL = $\frac{(239898+232523)(5)}{2(27)}$

= 43,743 yds.^{3}

Area surrounding and including Pit #3

Volume Between 585' EL. & 580' EL. = $\frac{317983(5)}{27}$ = 58,886 yds.^{3}

Contaminated Soil in area of Pit #3 Between 585' EL. & 580' EL.

58,886 - 43,743 = 15,143 yds.^{3}

Area @ 575' EL. = $241{,}373 - \frac{(241{,}373-185322)(11)}{38} = 225{,}148$ ft.^{2}

Pit #3

Waste Volume Between 580' EL. & 575' EL. = $\frac{(232523+225148)(5)}{2(27)}$

= 42,377 yds.^{3}

Area surrounding and including Pit #3

Volume Between 580' EL & 575' EL. = 58,886 yds^3

Contaminated Soil in area of Pit #3 Between 580' EL. & 575' EL.

= 58,886 - 42,377

= 16,509 yds.^{3}

Area @ 570' EL = $241{,}373 - \frac{(241{,}373-185322)(16)}{38} = 217{,}773$ ft.^{2}

Pit #3

Waste Volume Between 575' EL & 570' EL = $\frac{(225148+217773)(5)}{2(27)}$

= 41,011 yds.^{3}

Area surrounding and including Pit #3

Volume Between 575' EL. & 570' EL. = 58,886 yds.^{3}

Contaminated Soil in area of Pit #3 Between 575' EL & 570' EL.

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-10-92 SHEET 14 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. # 1 TASK NO.

SUBJECT Waste Pit # 3

Area @ 565' EL. = $241,373 - \frac{(241,373 - 185322)(21)}{38}$ = 210,397 ft².

Pit # 3
Waste Volume Between 570' EL. & 565' EL. = $\frac{(217773 + 210397)(5)}{2(27)}$
= 39,645 yds.³

Area Surrounding and including Pit # 3
Volume Between 570' EL & 565' EL = 58,886 yds³.

Contaminated Soil in area of Pit # 3 Between 570' EL. & 565' EL.
= 58,886 - 39,645
= 19,241 yds³.

PRELIMINARY

By incrementing or changes in previous calculations the following volumes will be determined for indicated elevations.

Waste Pit # 3 Volume Between 565' EL & 560' EL
= 39,645 - 1366
= 38,279 yds³.

Contaminated Soil Between 565' EL. & 560' EL
= 58,886 - 38,279
= 20,607 yds³.

Waste Pit # 3 Volume Between 560' EL & 555' EL.
= 38279 - 1366
= 36913 yds³.

Contaminated Soil Between 560' EL. & 555' EL.
= 58,886 - 36,913
= 21,973 yds³.

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-10-92 SHEET 15 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #3

Waste Pit #3 Volume Between 555'EL & 550'EL.

= 36,913 - 1,366

= 35,547 yds^3

PRELIMINARY

Contaminated Soil Between 555' EL. & 550'EL.

= 58,886 - 35,547

= 23,339 yds^3.

Area @ 550'EL. = $241,373 - \frac{(241,373-185,322)(36)}{38}$ = 188272 ft.^{2}

Pit #3

Waste Volume Between 550'EL. & 548'EL. = $\frac{(188272+185322)(2)}{2(27)}$

= 13837 yds^3.

Area Surrounding and including Pit #3

Volume Between 550'EL. & 548'EL. = $\frac{317483(2)}{27}$ = 23554 yds^3.

Contaminated Soil in area of Pit #3 Between 550'EL. & 548'EL.

= 23554 - 13837

= 9717 yds^3.

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-10-92 SHEET 16 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. #1 TASK NO.

SUBJECT Waste Pit #3

Volume of Pit Waste and Contaminated Soils of Area #3 At Various Depths

PRELIMINARY

Depth	Elevation	Cap Volume		Water Volume		Volume of Pit #3 Waste		Volume of Contaminated Soils	
(Ft.)	(Ft.)	(Yds^3)	(ΣYds^3)	(Yds^3)	(ΣYds^3)	(Yds^3)	(ΣYds^3)	(Yds.)	(ΣYds^3)
0-1.0	587-586	8940	8940	—	—	—	—	2837	2837
1.0-2.0	586-585	—		—	—	8912	8912	2865	5702
2.0-7.0	585-580	—		—	—	43743	52655	15143	20845
7.0-12.0	580-575	—		—	—	42377	95032	16509	37354
12.0-17.0	575-570	—		—	—	41011	136043	17875	55229
17.0-22.0	570-565	—		—	—	39645	175688	19241	74470
22.0-27.0	565-560	—		—	—	38279	213967	20607	95077
27.0-32.0	560-555	—		—	—	36913	250880	21973	117050
32.0-37.0	555-550	—		—	—	35547	286427	23339	140389
37.0-39.0	550-548	—	8940	—	—	13837	300264	9717	150106

CALCULATION WORKSHEET

ORIGINATOR Ray McS DATE 1-10-92 SHEET 17 OF ____
CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____
PROJECT Fernald O.U. #1 TASK NO. ____
SUBJECT Waste Pit # 4

O.U. #1 Pit # 4

PRELIMINARY

Ref: 1.) USAEC DWG. NO. 8-4274, Index Code 21A-5500-G-00235
2.) Penn Drilling Co.'s Boring Number 1773, 1774 & 1775 Reports
3.) Calculations of 11/90 and 1/91 By Barry Brown of I.T.

From topography map* for area, top of cap at an elev. of apprx. 589'
From above referenced borings top of pit ave. is. 589'-1' = 588' EL.
From above referenced borings bottom of pit ave. is 589'-30.5' = 558.5' EL
* Weston Dwg. Index Code 75X-5500-G-00113
Surface Area Computations using planimeter on dwg. No. 8-4274 above, Referenced calculations and Table 1-1 of Task # 12 For O.U. #1

Top Surface area of pit # 4 = 83799 ft.^{2}
Bottom Surface area of pit # 4 = 37039 ft.^{2}

Pit # 4 Area Volume Calculations

Area including and surrounding Pit # 4 = 151,900 ft.^{2}

Top Surface area of Pit # 4 = 83,799 ft.^{2}

Bottom surface area of Pit # 4 = 37,039 ft^2

Cap Volume = $83799(1)(\frac{1}{27}) = 3104$ yds.^{3}, Contaminated Soils Surrounding Cap = $151900(1)(\frac{1}{27}) - 3104 = 2522$ yds^3
Volume of Waste Pit # 4 Area to Aquifer = $151900\left(\frac{589-548}{27}\right)$
$= 230,663$ yds^3.

Volume of Waste Pit # 4 = $\left(\frac{83799+37039}{2}\right)(29.5)(\frac{1}{27}) = 66,013$ yds.^{3}

Volume of Possible Contaminated Soils = 230,663 - 3104 - 66,013

CALCULATION WORKSHEET

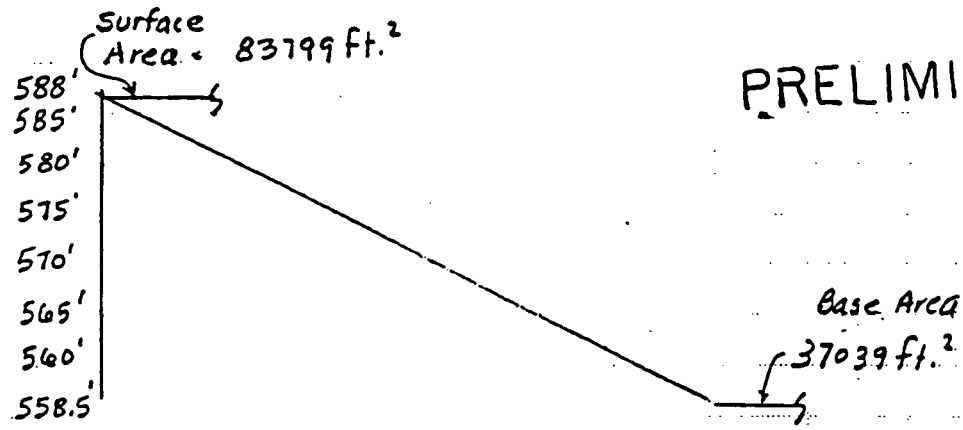
ORIGINATOR Ray Mc DATE 1-11-92 SHEET 18 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Waste Pit # 4

Intermediate Elevation Volume Calculations, Volume Vs. Depth Calcs.



PRELIMINARY

$$\text{Area @ } 585'\text{EL.} = 83799 - \frac{(83799 - 37039)(3)}{29.5}$$
$$= 79044 \text{ ft.}^2$$

Pit # 4

$$\text{Waste Volume Between } 588'\text{EL \& } 585'\text{EL.} = \frac{(83799 + 79044)(3)}{2(27)}$$
$$= 9047 \text{ yds.}^3$$

Area surrounding and including Pit # 4

$$\text{Volume Between } 588'\text{EL \& } 585'\text{EL} = 151900\left(\tfrac{3}{27}\right) = 16878 \text{ yds.}^3$$

Contaminated Soil in area of Pit # 4 Between 588'EL & 585'EL.

$$= 16{,}878 - 9047$$
$$= 7{,}831 \text{ yds}^3$$

CALCULATION WORKSHEET

ORIGINATOR Ray Ms DATE 1-11-92 SHEET 19 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald D.U. #1 TASK NO. ____

SUBJECT Waste Pit #4

Area @ 580'EL. = $83799 - \frac{(83799-37039)(8)}{29.5} = 71,118$ yds^3.

PRELIMINARY

Pit #4

Waste Volume Between 585'EL & 580'EL = $\frac{(79044+71118)(5)}{2(27)}$

= 13,904 yds.^{3}

Area surrounding and including Pit #4

Volume Between 585'EL & 580'EL. = $151900(\frac{5}{27}) = 28,130$ yds^3.

Contaminated Soil in area of Pit #4

Volume Between 585'EL. & 580'EL. = 28,130 - 13,904 = 14,226 yds^3.

Area @ 575'EL. = $83799 - \frac{(83799-37039)(13)}{29.5} = 63,193$ ft.^{2}

Pit #4

Waste Volume Between 580'EL & 575'EL = $\frac{(71118+63193)(5)}{2(27)}$

= 12436 yds.^{3}

Area surrounding and including Pit #4

Volume Between 580'EL & 575'EL = 28,130 yds.^{3}

Contaminated Soil in area of Pit #4

Volume Between 580'EL & 575'EL. = 28,130 - 12436 = 15694 yds.^{3}

Area @ 570'EL. = $83799 - \frac{(83799-37039)(18)}{29.5} = 55,267$ ft.^{2}

Pit #4

Waste Volume Between 575'EL & 570'EL. = $\frac{(63,193+55,267)(5)}{2(27)}$

= 10,969 yds.^{3}

Area surrounding and including Pit #4

Volume Between 575'EL & 570'EL = 28,130 yds.^{3}.

Contaminated Soil in area of Pit #4

Volume Between 575'EL & 570'EL = 28130 - 10969

CALCULATION WORKSHEET

ORIGINATOR Ray Ms DATE 1-11-92 SHEET 20 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U #1 TASK NO. ____

SUBJECT Waste Pit # 4

Area @ 565' EL. = $83799 - \frac{(83799-37039)(23)}{29.5} = 47{,}342\ ft.^2$

Pit # 4

Waste Volume Between 570' EL & 565' EL. = $\frac{(55267+47342)(5)}{2(27)}$

$= 9501\ yds.^3$

Area surrounding and including Pit # 4 PRELIMINARY

Volume Between 570' EL. & 565' EL = $28{,}130\ yds^3$

Contaminated soils in area of Pit # 4

Volume Between 570' EL & 565' EL. = $28130 - 9501 = 18{,}629\ yds^3$

Area @ 560' EL. = $83799 - \frac{(83799-37039)(28)}{29.5} = 39{,}417\ ft.^2$

Pit # 4

Waste Volume Between 565' EL & 560' EL = $\frac{(47342+39417)(5)}{2(27)}$

$= 8033\ yds.^3$

Area surrounding and including Pit # 4

Volume Between 565' EL & 560 EL. = $28{,}130\ yds^3$

Contaminated soils in area of Pit # 4

Volume Between 565' EL & 560' EL = $28130 - 8033 = 20{,}097\ yds^3$

Pit # 4

Waste Volume Between 560' EL & 558.5' EL = $\frac{(39417+37039)(1.5)}{2(27)}$

$= 2124\ yds^3$

Area surrounding and including Pit # 4

Volume Between 560' EL & 558.5' EL = $\frac{151900(1.5)}{27}$

$= 8439\ yds^3$

Contaminated Soils in area of Pit # 4

Volume Between 560' EL & 558.5' EL. = $8439 - 2124$

$= 6315\ yds^3.$

CALCULATION WORKSHEET

ORIGINATOR Ray McC DATE 1-11-92 SHEET 21 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Waste Pit #4

Contaminated Soils Between 558.5'EL & 555'EL = $\frac{151900(3.5)}{27}$
= 19,691 yds.^{3}

Contaminated Soil Between 555'EL & 550'EL = $\frac{151900(5)}{27}$
= 28,130 yds.^{3}

Contaminated Soil Between 550'EL & 548'EL = $\frac{151900(2)}{27}$
= 11,252 yds^3.

PRELIMINARY

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-11-92 SHEET 22 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. # 1 TASK NO.

SUBJECT Waste Pit # 4

Volume of Pit Waste and Contaminated Soils of Area # 4 At Various Depths

PRELIMINARY

Depth (Ft.)	Elev. (Ft.)	Cap Volume (Yds^3)	Cap Volume (ΣYds^3)	Water Volume (Yds^3)	Water Volume (ΣYds^3)	Volume of Pit # 4 Waste (Yds^3)	Volume of Pit # 4 Waste (ΣYds^3)	Volume of Contaminated Soil (Yds^3)	Volume of Contaminated Soil (ΣYds^3)
0-1.0	589'-588'	3104	3104	—	—	—	—	2522	2522
1.0-4.0	588'-585'	—		—	—	9047	9047	7831	10353
4.0-9.0	585'-580'	—		—	—	13904	22951	14226	24579
9.0-14.0	580'-575'	—		—	—	12436	35387	15694	40273
14.0-19.0	575'-570'	—		—	—	10969	46356	17161	57434
19.0-24.0	570'-565'	—		—	—	9501	55857	18629	76063
24.0-29.0	565'-560'	—		—	—	8033	63890	20097	96160
29.0-30.5	560'-558.5'	—		—	—	2124	66014	6315	102475
30.5-34.0	558.5'-555'	—		—	—	—		19691	122166
34.0-39.0	555'-550	—		—	—	—		28130	150296
39.0-41.0	550-548	—	3104	—	—	—	66014	11252	161548

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-15-92 SHEET 23 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Burn Pit

O.U. #1 Burn Pit

PRELIMINARY

Ref.: 1.) USAEC DWG. NO. 8-4274, Index Code 21A-5500-G-00235
2.) Penn Drilling Co.'s Boring Number 1776 & 1777 Reports
3.) Calculations of 11/90 and 1/91 By Barry Brown of I.T.

From topography map* for area, top of cap at an elev. of apprx. 582'EL
From previous calcs top of pit is at apprx. 581'EL.
From above referenced borings bottom of pit ave. is 582'-31' = 551'EL
* Weston Dwg Index Code 75X-5500-G-00113
Surface area of Burn Pit using planimeter on dwg. No. 8-4274, Referenced calculations and Table 1-1 of Task #12 for O.U. #1

Top Surface of burn pit = 21,724 ft.^{2}
Bottom Surface of burn pit = 3,120 ft.^{2}

Burn Pit Area Calculations

Top Surface area of burnpit = 21,724 ft.^{2}
Bottom surface area of burnpit = 3,120 ft^2.

Cap Volume = $21{,}724(1)(\frac{1}{27}) = 805$ yds^3.

Contaminated Soils Surrounding Cap = 0 ft^2

Volume of Burn Pit = $\frac{(21{,}724 + 3{,}120)}{2(27)}(30) = 13802$ yds^3.

Volume of Burn Pit area = $\frac{(21{,}724)(582-548)}{27} = 27{,}356$ yds.^{3}

Volume of contaminated soils = 27,356 - 13802
= 13,554 yds^3

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-15-92 SHEET 24 OF ____

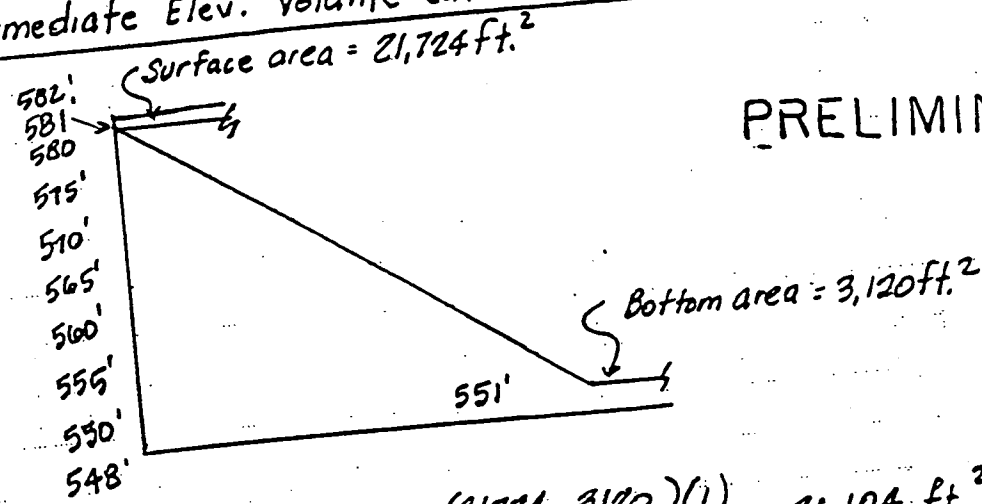
CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Burn Pit

Intermediate Elev. Volume Calculations, Volume Vs. Depth Calcs.

PRELIMINARY



Area @ 580' = $21724 - \frac{(21724-3120)(1)}{30} = 21,104$ ft.²

Burn Pit

Waste Volume Between 581'EL & 580'EL = $\frac{(21,724+21,104)(1)}{2(27)}$

= 793 yds³

Area surrounding and including burn pit, Volume Between 581'EL & 580'EL = $\frac{(21,724)(1)}{27} = 805$ yds³

Contaminated Soil in area of Burn Pit Between 581'EL & 580'E

= 805 - 793

= 12 yds³

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-15-92 SHEET 25 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. #1 TASK NO. ____

SUBJECT Burn Pit

Area @ 575' EL Burn Pit $= 21{,}724 - \frac{(21{,}724-3120)(6)}{30} = 18{,}003\ ft.^2$

Waste Volume Between 580' EL & 575' EL $= \frac{(21{,}104+18{,}003)(5)}{2(27)}$
$= 3621\ yds^3.$

Area surrounding and including burn pit,
Volume Between 580' EL & 575' EL. $= \frac{(21{,}724)(5)}{27} = 4023\ yds^3.$

Contaminated Soil in area of Burn Pit between 580' EL & 575' EL
$= 4023 - 3621$
$= 402\ yds^3.$

PRELIMINARY

Area @ 570' EL Burn Pit $= 21{,}724 - \frac{(21{,}724-3120)(11)}{30} = 14{,}903\ ft.^2$

Waste Volume Between 575' EL & 570' EL $= \frac{(18{,}003+14{,}903)(5)}{2(27)}$
$= 3047\ yds.^3$

Area surrounding and including burn pit,
Volume Between 575' EL & 570' EL $= 4023\ yds.^3$

Contaminated Soil in area of Burn Pit between 575' EL & 570' EL.
$= 4023 - 3047$
$= 976\ yds^3.$

Area @ 565' EL Burn Pit $= 21{,}724 - \frac{(21{,}724-3120)(16)}{30} = 11{,}802\ ft^2$

Waste Volume Between 570' EL & 565' EL $= \frac{(14903+11802)(5)}{2(27)}$
$= 2473\ yds^3.$

Area surrounding and including burn pit
Volume Between 570' EL & 565' EL. $= 4023\ yds^3$

Contaminated Soil in area of Burn Pit between 570' EL & 565' EL
$= 4023 - 2473$
$= 1550\ yds^3$

CALCULATION WORKSHEET

ORIGINATOR Ray Mc DATE 1-15-92 SHEET 26 OF ____

CALC. NO. ____ REV. NO. ____ DATE ____ CHECKED ____

PROJECT Fernald O.U. # 1 TASK NO. ____

SUBJECT Burn Pit

Area @ 560'EL = $21,724 - \frac{(21,724-3120)(21)}{30} = 8701\ ft.^2$

Burn Pit

Waste Volume Between 565'EL & 560'EL = $\frac{(11802+8701)(5)}{2(27)}$

$= 1898\ yds^3$

Area surrounding and including burn pit,

Volume Between 565'EL & 560'EL = $4023\ yds^3$

Contaminated Soil in area of burn pit between 565'EL & 560'EL.

$= 4023 - 1898$

$= 2125\ yds^3$

PRELIMINARY

Area @ 555'EL = $21,724 - \frac{(21,724-3120)(26)}{30} = 5601\ ft.^2$

Burn Pit

Waste Volume Between 560'EL & 555'EL = $\frac{(8701+5601)(5)}{2(27)}$

$= 1324\ yds^3$

Area surrounding and including burn pit,

Volume Between 560'EL & 555'EL = $4023\ yds^3$.

Contaminated Soil in area of burn pit between 560'EL & 555'EL.

$= 4023 - 1324$

$= 2699\ yds^3$

Burn Pit Waste Volume Between 555'EL & 551'EL = $\frac{(5601+3120)(4)}{2(27)}$

$= 646\ yds^3$

Area surrounding and including burn pit,

Volume Between 555'EL & 551'EL = $\frac{(21724)(4)}{27} = 3218\ yds^3$.

Contaminated Soil in area of burn pit between 555'EL & 551'EL.

$= 3218 - 646$

$= 2572\ yds^3$

Contaminated Soil in area of burn pit between 551'EL & 550'EL = $\frac{(21724)(1)}{27}$

$= 805\ yds^3$

[illegible] between 550'EL & 549'EL = $(21724)(2)$ [illegible]

CALCULATION WORKSHEET

6328

ORIGINATOR Ray Mc DATE 1-16-92 SHEET 27 OF

CALC. NO. REV. NO. DATE CHECKED

PROJECT Fernald O.U. # 1 TASK NO.

SUBJECT Burn Pit

Volume of Pit Waste and Contaminated Soils of Burn Pit Area At Various Depths

PRELIMINARY

Depth (Ft.)	Elev. (Ft.)	Cap Volume (Yds^3)	Cap Volume (ΣYds^3)	Water Volume (Yds^3)	Water Volume (ΣYds^3)	Volume of Burn Pit Waste (Yds^3)	Volume of Burn Pit Waste (ΣYds^3)	Volume of Contaminated Soils (Yds^3)	Volume of Contaminated Soils (ΣYds^3)
0-1.0	582-581	805	805	—	—	—	—	—	—
1.0-2.0	581-580	—		—	—	793	793	12	12
2.0-7.0	580-575	—		—	—	3621	4414	402	414
7.0-12.0	575-570	—		—	—	3047	7461	976	1390
12.0-17.0	570-565	—		—	—	2473	9934	1550	2940
17.0-22.0	565-560	—		—	—	1898	11832	2125	5065
22.0-27.0	560-555	—		—	—	1324	13156	2699	7764
27.0-31.0	555-551	—		—	—	646	13802	2572	10336
31.0-32.0	551-550	—		—	—	—		805	11141
32.0-34.0	550-548	—	805	—	—	—	13802	1610	12751