6404 R-023-208 .7

SECONDARY CONTAINMENT FOR URANYL NITRATE HEXAHYDRATE TANKS IN PLAN 2/3 DIGESTION AREA

12/19/94

DOE-0320-95
DOE-FN OEPA
20
REPORT

6404

Department of Energy
Fernald Environmental Management Project
P. O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 648-3155

DEC 19 1994

DOE-0320-95

Mr. Thomas J. Schneider
Fernald Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Schneider:

SECONDARY CONTAINMENT FOR URANYL NITRATE HEXAHYDRATE TANKS IN PLANT 2/3 DIGESTION AREA

Reference: DOE-2386-94, J. R. Craig to M. W. Metcalf, "Response to Deficiencies Identified by the Ohio Environmental Protection After Review of the Uranyl Nitrate Hexahydrate Tank System," dated September 14, 1994

This letter provides details on the results of a recent evaluation of the secondary containment volume in the Digestion Area, along with plans for remedying the situation identified during the evaluation. This letter documents information discussed by Fernald Environmental Restoration Management Corporation (FERMCO), Department of Energy, Fernald Area Office (DOE-FN), and Ohio Environmental Protection Agency (OEPA) at the weekly Uranyl Nitrate Hexahydrate (UNH) Neutralization Project conference call on December 5, 1994.

In the referenced letter it was indicated that, after completion of necessary modifications, the secondary containment capacity in the Digestion Area would be more than adequate to contain the design capacity of the largest tank in the area as required by OAC 3745-66-93(E)(1)(d). It was also stated that after completion of the modifications, the containment would be filled with water to verify the containment capacity and to check for leaks.

The modifications identified in the referenced letter (removal of a temporary sill between the hot and cold sides of the building and installation of permanent diking at the roll-up door) were completed in late October 1994. In early November 1994, Tank F1-26 was filled with treated water to verify its hydraulic integrity. On November 27, 1994, the discharge valve on Tank F1-26 was opened and the water allowed to drain into the secondary containment area. It was necessary to delay the containment evaluation until November 27, 1994, due to seven-day-per-week construction activity occurring in the digestion area until that date.

Recycled and Recyclable

In estimating the containment volume, it had been assumed that liquid would collect relatively uniformly across the floor area of the building. When draining water onto the floor it became apparent that, while the floor sloped downward from the perimeter curbing to the four floor sumps and then rose again toward the center of the building, the floor is considerably higher in the middle than it is at the curbing. Therefore, water ponded in a "u" shaped pattern as depicted in Figure 1. After approximately 10,000 gallons of water had been drained into the containment, the water came to within 1/2 inch of overflowing the curb along the north wall of the building.

Tank F1-25 contains approximately 12,875 gallons of UNH solution. During neutralization, Tanks F1-25 and F1-26 will be used as dilution/neutralization tanks and, depending upon batch size, may at times hold up to 15,000 gallons. The current 10,000 gallon secondary containment volume is therefore, not adequate.

Several options for providing the necessary containment volume have been evaluated including raising the curbing in the digestion area and limiting the allowable batch size during neutralization. The selected option, however, is to connect the Digestion Area secondary containment to the CD Blend area secondary containment located directly to the north. The necessary modifications, depicted in the enclosed draft schematic (Figure 2), will be completed before the UNH transfer.

The three CD Blend tanks, each with a design capacity of 25,232 gallons, will be the largest tanks in the combined CD Blend/Digestion area secondary containment. As illustrated in the enclosed calculation, the required secondary containment volume is 32,465 gallons (largest tank = 25,232 gallons plus rainfall = 7,233 gallons); the modifications described above will provide a total containment volume of 40,000 gallons.

If you have any questions, comments, or concerns about the project please call Chris White at (513) 648-3077.

Sincerely,

Johnny Reising

for Jack R. Craig
Fernald Remedial Action
Project Manager

FN:White

Enclosures: As Stated

cc w/encs:

J. A. Saric, USEAPA-V, 5HRE-8J
P. E. Pardi, OEPA-Dayton
J. W. Reising, DOE-FN
C. A. White, DOE-FN
S. M. Beckman, FERMCO/65-2
D. J. Brettschneider, FERMCO/52-5
H. S. Gronas, FERMCO/51
T. D. Hagen, FERMCO/65-2
AR Cordinator, FERMCO
RCRA Operating Record, FERMCO/30

FIGURE 1

DIGESTION TANK AREA

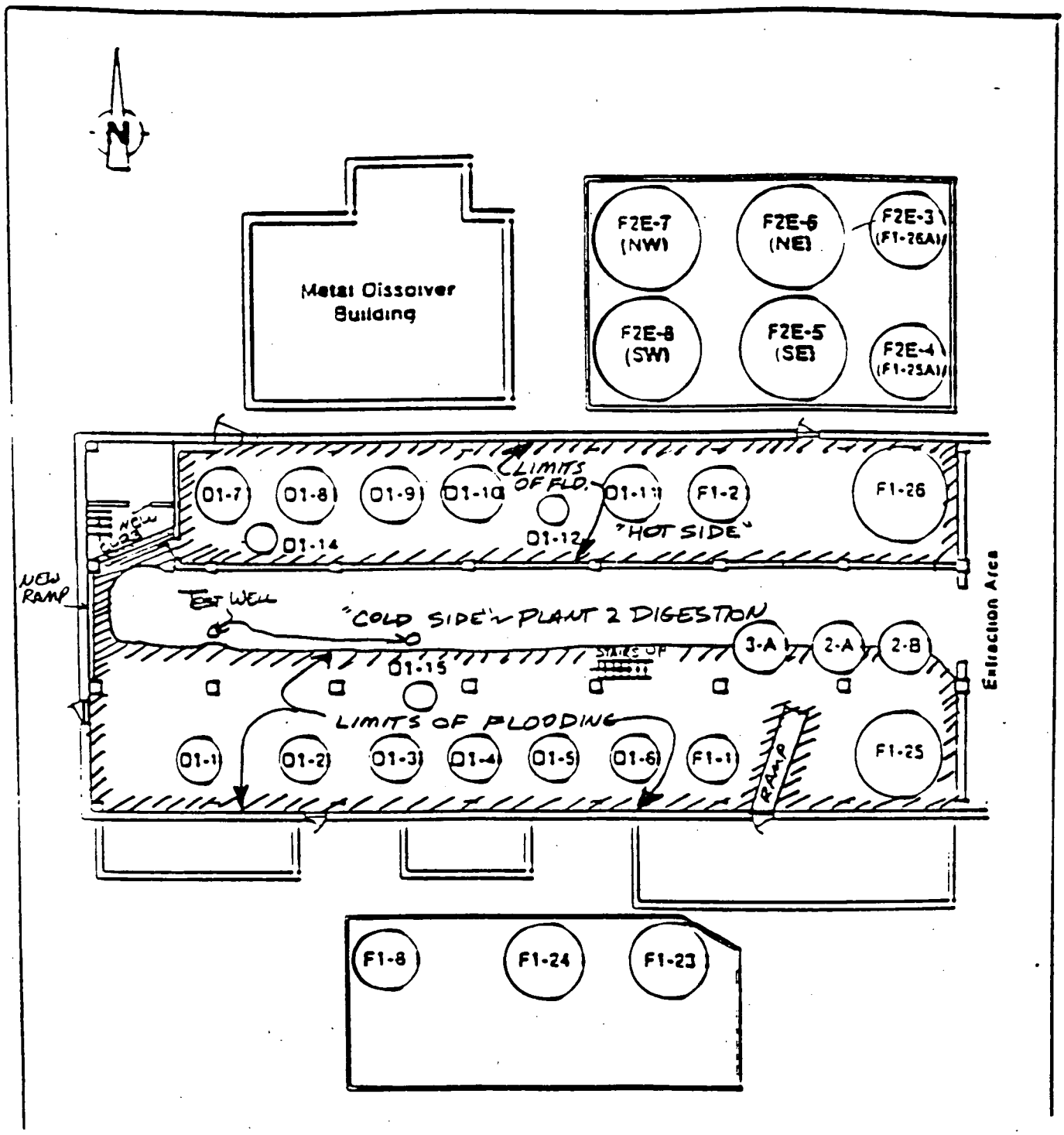

Figure1
Digestion Area Tanks - D1-1, D1-7, D1-10, F1-1, F1-25, F1-26
CD Blend Tanks - SE (F2E-5), NE (F2E-6), SW (F2E-8)

FIGURE 2

DRAFT SCHEMATIC OF SECONDARY CONTAINMENT MODIFICATIONS

PRELIMINARY

6404

SUBJECT: SECONDARY CONTAINMENT ADDITION BETWEEN PLANT 2/3 & CD BLEND

BY: TOM CRAWFORD

REV. 0A

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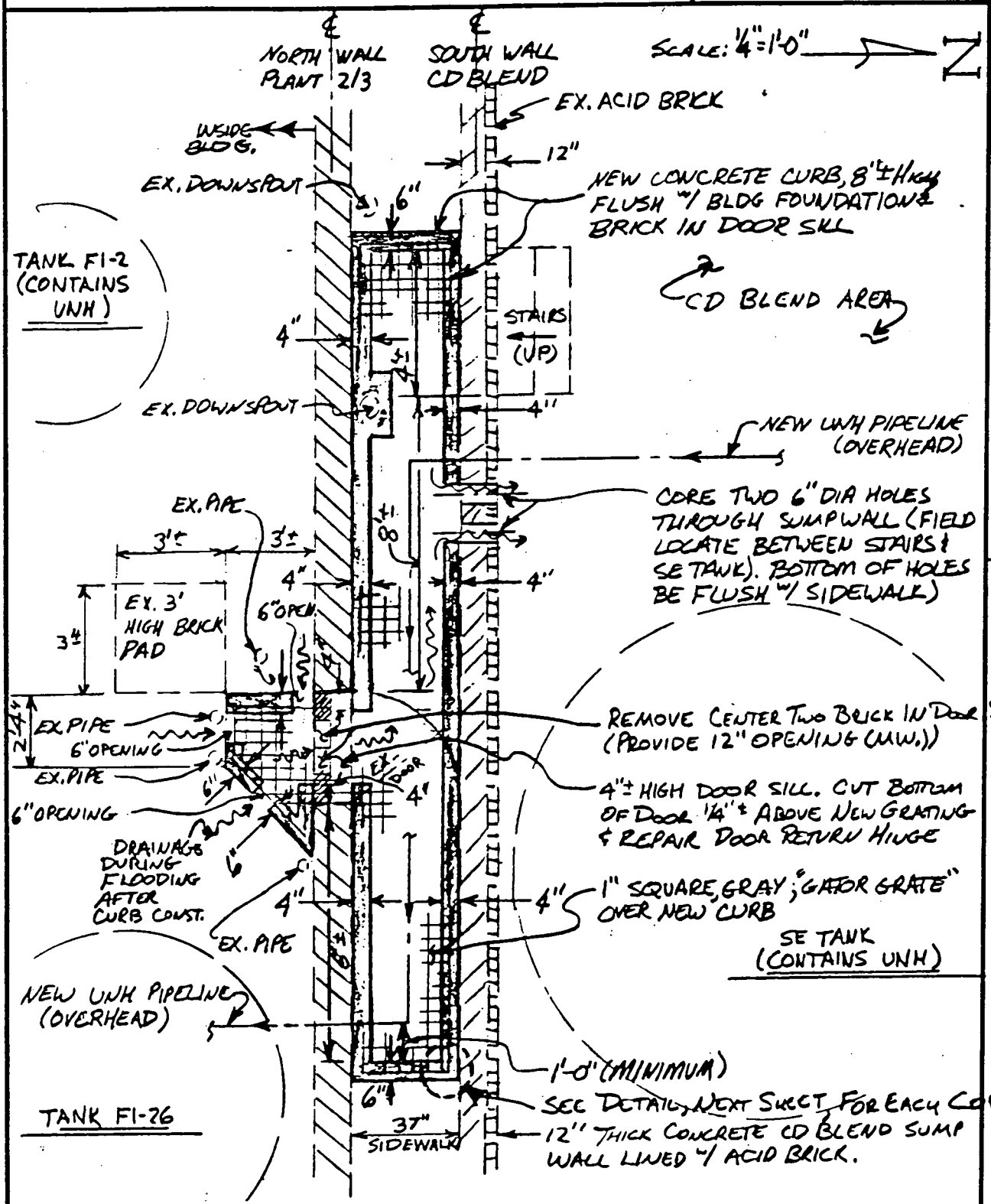
BOOK:

PAGE: 1

DATE: 12/8/94



NOTE:

FS-F-2671 (REV. 4/27/93)

PRELIMINARY

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SUBJECT: SECONDARY CONTAINMENT ADDITION BETWEEN PLANT 2/3 & CD BLEND BY: TOM CRAWFORD

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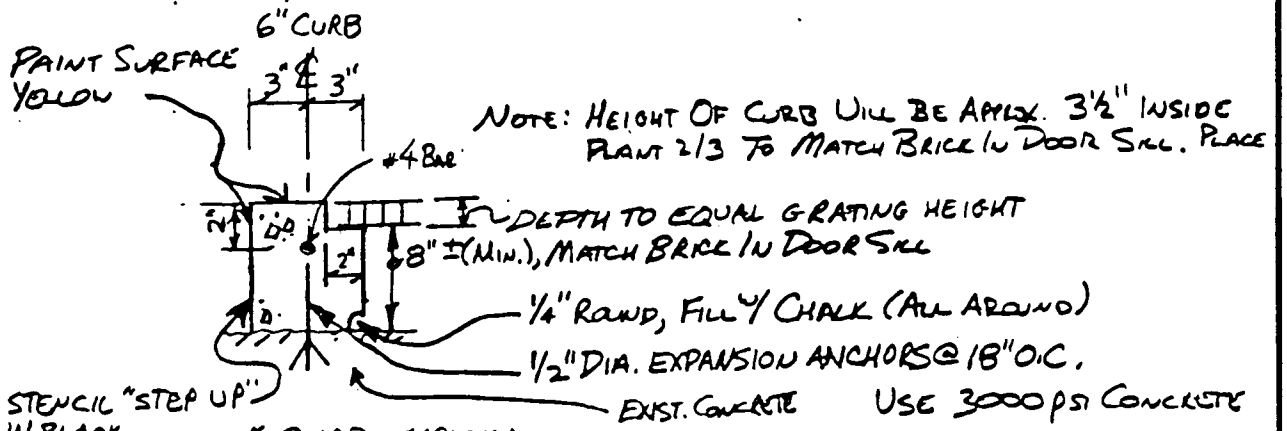
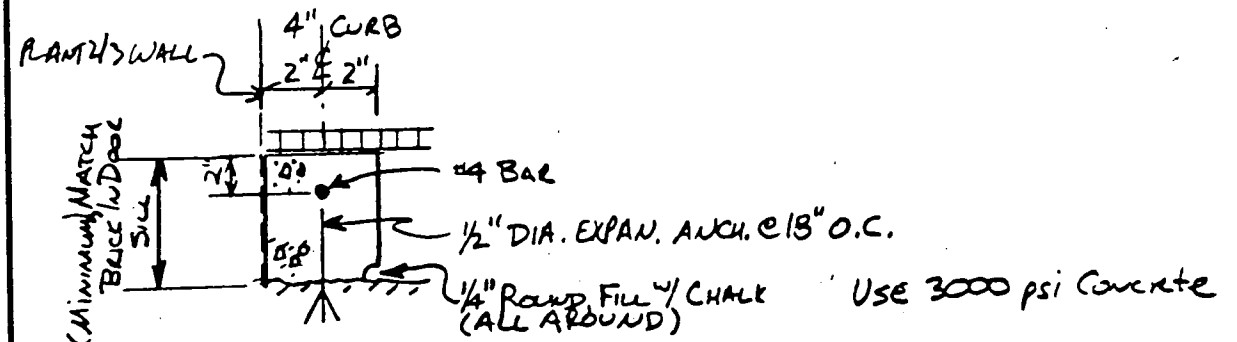
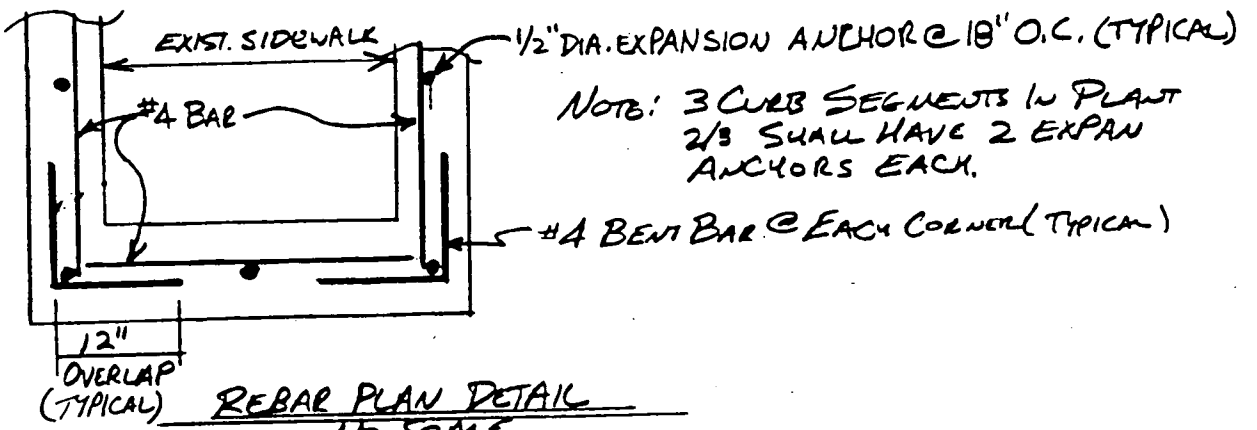


6" CURB TYPICAL SECTION (NO SCALE)



4" CURB TYPICAL SECTION (NO SCALE)



REBAR PLAN DETAIL NO SCALE

NOTE:

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SECONDARY CONTAINMENT CALCULATIONS

UNCONTROLLED COPY 6404

SUBJECT: EXTENDING PLANT 2/3 DIGESTION SECONDARY CONTAINMENT VOLUME

CALCS: T. CRAWFORD
CHECKED: J.C.J. 12/1/94

BOOK:
PAGE: 1/10
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CONCLUSION

BY COMBINING PLANT 2/3 DIGESTION AREA W/ CD BLEND AREA, COMBINED AREA IS ADEQUATE TO CONTAIN THE LARGEST TANK (FI-25) + 25YR-24HR STORM (4.9")

OVERVIEW (SUMMARY)

FLOODING (SEE PAGE 7)

PRESENT CONDITION:

PLANT 2/3 CONTAINMENT VOLUME FROM 11/25/94	= 10,000 GAL
LARGEST TANK (FI-25)	= -23,543 GAL
SECOND. CONT. VOL REMAINING	= -13,543 GAL (INADEQUATE)

PRESENT CONDITION:

CD BLEND CONTAINMENT VOLUME	= 39,799
LARGEST TANK (SE, NE, OR SW)	= -25,232
RAINFALL ALLOWANCE	= - 7233
SEC. CONT. VOL. REMAIN.	+ 7334 GAL (OK)

PROPOSED CONDITION:

COMBINED CONTAINMENT VOLUME	= 40,059
LARGEST TANK (SE, NE, OR SW)	= -25232
RAINFALL ALLOWANCE	= - 7233
SEC. CONT. VOL REMAIN.	= + 7594 GAL (OK)

PROBLEM STATEMENT & SOLUTION

SECONDARY CONTAINMENT VOLUME FOR 2/3 DIGESTION IS DEFICIENT BY 13,543 GAL. BY COMBINING IT W/ CD BLEND, CD BLEND LOSES 6.6" OF CONTAINMENT DEPTH (9740 GAL) HOWEVER GAINS 10,000 GAL. FROM 2/3 DIGESTION. COMBINED CONTAINMENT VOLUME = 40,059 GAL.

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NOTE:

FS-F-2671 (REV. 4/27/93)

SUBJECT: EXTENDING PLANT 2/3 DIGESTION SECONDARY CONTAINMENT

CALCS: T. CRAWFORD
CHECKED: J.C.J. 12/7/94

BOOK:
PAGE: 2/10
DATE: 12/7/94

VOLUME COMPARISON BETWEEN CD BLEND & 2/3 DIGESTION

CD BLEND AREA

LARGEST TANK (DESIGN VOLUME, SEE PAGE 4) = 25,232 GAL

25-YR, 24-HR STORM = 4.9" (SPILL PREVENTION CONTROL & COUNTERMEASURES)

∴ RAINFALL ALLOWANCE = $61.5' \times 38.5' \times (4.9' \times \frac{1'}{12}) \times 7.48 \frac{GAL}{CF}$ 7233 GAL

REQUIRED SECONDARY CONTAINMENT VOLUME = 32,465 GAL

ACTUAL SECONDARY CONTAINMENT VOLUME (PAGE 8) = 39,799 GAL

39,799 GAL > 32,465 GAL ∴ OK

2/3 DIGESTION

LARGEST TANK (F1-25, SEE PAGE 4) = 23,543 GAL

REQUIRED SEC. CONT. VOLUME = 23,543 GAL

ACTUAL SEC. CONT. VOLUME, (SEE PAGES 5, 6 & 7) = 10,000 GAL

10,000 GAL < 23,543 GAL ∴ NO GOOD

7.5 GALS/IN

COMBINED CD BLEND W/ 2/3 DIGESTION

FROM SURVEY (PAGES 8, 9, & 10)

TOP OF LOWEST POINT IN CD BLEND IS T/BRICK, POINT #22 (PAGE 9) = 49.90'

TOP OF LOWEST POINT IN 2/3 DIGESTION IS T/BRICK @ DOOR SILL, POINT #6 (PG 9) = 49.35' ← CONTROLLING ELEVATION

DEPTH OF VOLUME LOST IN CD BLEND WHEN CD BLEND & 2/3 COMBINED = 0.55' ≈ 6.6"

CD BLEND VOLUME LOST: $7.48 \frac{GAL}{CF} \cdot (61.5' \times 38.5' \times [6.6'' \times \frac{1'}{12''}]$ (2317 GAL) = 9740 GAL

CD BLEND VOLUME REMAINING: 39,799 − 9740 GAL = 30,059 GAL

NOTE:

FS-F-2671 (REV. 4/27/93)

SUBJECT: EXTENDING PLANT 2/3 DIGESTION SECONDARY CONTAINMENT

CALCS: T. CRAWFORD
CHECKED: J. C. J. 12/7/94

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COMBINED CD BLEND & 2/3 DIGESTION (CONTINUED)

LARGEST TANK IN COMBINED AREA IS THEN F2E-5
(SE CD BLEND, or NE or SW CD BLEND) = 25,232 GAL

RAINFALL (4.9", 25-YR, 24 HR STORM) = + 7233 GAL

REQUIRED SECONDARY CONTAINMENT VOLUME = 32,465 GAL

CALCULATED COMBINED SECOND CONT. VOL:
CD BLEND VOLUME + 2/3 DIGESTION = TOTAL VOLUME
(LESS 6.6" DEPTH)

30,059 GAL + 10,000 GAL = 40,059 GAL

40,059 GAL > 32,465 GAL OK

NOTE:

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From UNH Removal Action Workplan

UNH PROCESSING SYSTEM TANKS
TABLE 2

Date: June 1, 1994

TANK ID NUMBER	TANK LOCATION	TANK CONTENTS	Capacity (gallons)	Volume (gal.)	U (g/l)	Norm.	U-235 (%)	Be (ppm)	Cr (ppm)	Pb (ppm)	Hg (ppm)
D1-1	Digestion	Zernlo UNH	3,507	3,150	135	4.02	0.955	79.0	465.5	17.67	1.00
D1-7	Digestion	Organic/Water	3,625	3,218	*	*	0.790	*	*	*	*
D1-10	Digestion	UNH	3,625	2,648	154	4.65	1.290	99.3	1003.0	24.07	5.52
F1-1	Digestion	UNH Crystals	3,421	1,825	173	0.84	0.962	412.5	344.3	84.59	2.86
F1-25	Digestion	UNH	23,543	12,875	133	1.38	0.994	139.7	139.7	30.00	2.04
F1-26	Digestion	Zernlo UNH	23,008	1,454	85	2.42	0.950	51.8	280.7	18.66	0.51
F1-301	Hot Raffinate	UNH/Solids	3,066	1,990	60	0.59	0.872	140.3	83.5	19.45	2.22
F1-302	Hot Raffinate	UNH/Solids	3,066	2,309	13	0.20	0.960	28.4	26.4	4.71	0.34
F1-303	Hot Raffinate	UNH/Solids	3,066	2,104	19	1.57	0.801	41.5	93.9	8.25	3.14
F1-308	Hot Raffinate	UNH	2,107	1,894	30	2.27	1.000	81.6	248.9	11.38	1.98
F2E-5 (SE)	CD Blend (Outside)	Evap. UNH	25,232	23,645	122	0.42	1.018	****	****	****	****
F2E-6 (NE)	CD Blend (Outside)	WMD UNH	25,232	21,423	202	0.53	0.952	11.6	2.6	3.48	0.00
F2E-8 (SW)	CD Blend (Outside)	Evap. UNH	25,232	21,740	57	1.50	0.997	7.8	1.8	1.07	0.43
F2-605	NFS Storage (Outside)	Evap. UNH	25,458	23,463	59	1.60	0.989	94.6	59.4	17.21	0.72
F2-606	NFS Storage (Outside)	Evap. UNH	25,470	23,427	55	1.04	1.010	96.8	49.4	15.70	0.71
F2-607	NFS Storage (Outside)	Evap. UNH	25,450	22,726	36	0.94	1.090	181.9	69.4	18.36	1.13
F2-608	NFS Storage (Outside)	Evap. UNH	25,458	19,996	68	1.48	1.000	151.5	147.5	18.19	1.01
F3E-220	Denitration **	Scrubber UNH	3,500	2,036	20	3.54	0.995	<2.0	10.6	3.47	0.24
F3E-223	OK Liquor (Outside)	Pure UNH	28,759	9,231	341	0.19	0.993	<2.0	0.8	0.30	0.22
F43-203	Plant 8	Neutral. UNH	10.080	5,432	20	0.0***	0.99	****	****	****	****
F43-203A	Plant 8	Sump Water	5,278	4,232	.01	0.0***	0.99	****	****	****	****

* Tank D1-7 is layered Organic/Water with varying Uranium Concentration
** Tank F3E-220 was not part of the original project
*** Content Pb is > 7.0 (Neutralized UNH from previous process)
**** Results not available

SUBJECT: EXTENDING PLANT 2/3 DIGESTION SECONDARY CONTAINMENT
CALCS: T. CRAWFORD
CHECKED: J.C.J. 12/7/94

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APPROX. AREA & VOLUME FLOODED IN PLANT 2/3 DIGESTION ON 11/25/94

SEE PAGES 6 & 7 FOR APPROX AREA OF FLOODING

HOT SIDE AREA FLOODING:
125' LONG ± × 20' WIDE ± = 2500 ☐

COLD SIDE AREA FLOODING
145' LONG ± × 20' WIDE ± = 2900 ☐

5400 ☐

PER DARRELL KIRBY, PLANT 2/3 FACILITY OWNER, FLOODING BEGAN IN HOT SIDE OF DIGESTION AREA. AS AREA FILLED, THE WATER LEVEL REACHED THE WEST DOOR, AND FLOWED OVER TO THE COLD SIDE BY FOLLOWING THE NEW CURB & NEW RAMP TO THE SOUTH WALL. AS THE WATER LEVEL INCREASED IN THE HOT SIDE, THE LEVEL IN THE COLD SIDE CORRESPONDING INCREASED BY GROWING IN AREA TOWARDS THE NORTH WHERE TEST WELLS ARE LOCATED. THE FLOODING TEST WAS CONCLUDED BEFORE THE TEST WELLS WERE COVERED BY WATER AS INSTRUCTED BY TIM HUEY, OPERATIONS MANAGER. THE TEST WELLS WERE PREVIOUSLY SEALED AND WATER PROOFED BY THE UNH PROJECT UNTIL CONFIRMATION GIVEN BY ALAN LYDIC, GROUNDWATER MONITORING. AT TEST CONCLUSION, THE WATER LEVEL WAS WITHIN 1/2" TO THE TOP OF THE DOOR CONTAINMENT SILL BRICK & CURB ON THE NORTH WALL OF CD BLEND. TOTAL WATER USED IN FLOODING = 10000 GALLONS

THEREFORE, USING A UNIFORM WATER DEPTH OF 3" (DOOR SILL BRICKS ARE 3 1/2" TALL, THEREFORE 3 1/2" − 1/2" = 3" AS MINIMUM) & TOTAL AREA FLOODED AS 5400 ☐:

$5400\,☐ \times (3'' \times \frac{1'}{12''}) = 1350$ CF
1350 CF $\times 7.48 \frac{GAL}{CF} = 10098$ GAL ≅ 10,000 GAL

COMPARES WELL!

SO: IF FLOODING TEST CONTINUED WHICH WOULD HAVE RESULTED IN FLOODING REACHING THE TEST WELLS BY AN ADDITIONAL 1/2" DEPTH OF WATER, UNTIL TOP OF DOOR SILL BRICK REACHED:
CONSERVATIVELY, USE ABOVE AREA:

$5400\,☐ \times (1/2'' \times \frac{1'}{12''}) = 225$ CF
225 CF $\times 7.48 \frac{GAL}{CF} = 1698$ GALLONS OF ADDITIONAL CAPACITY

NOTE:

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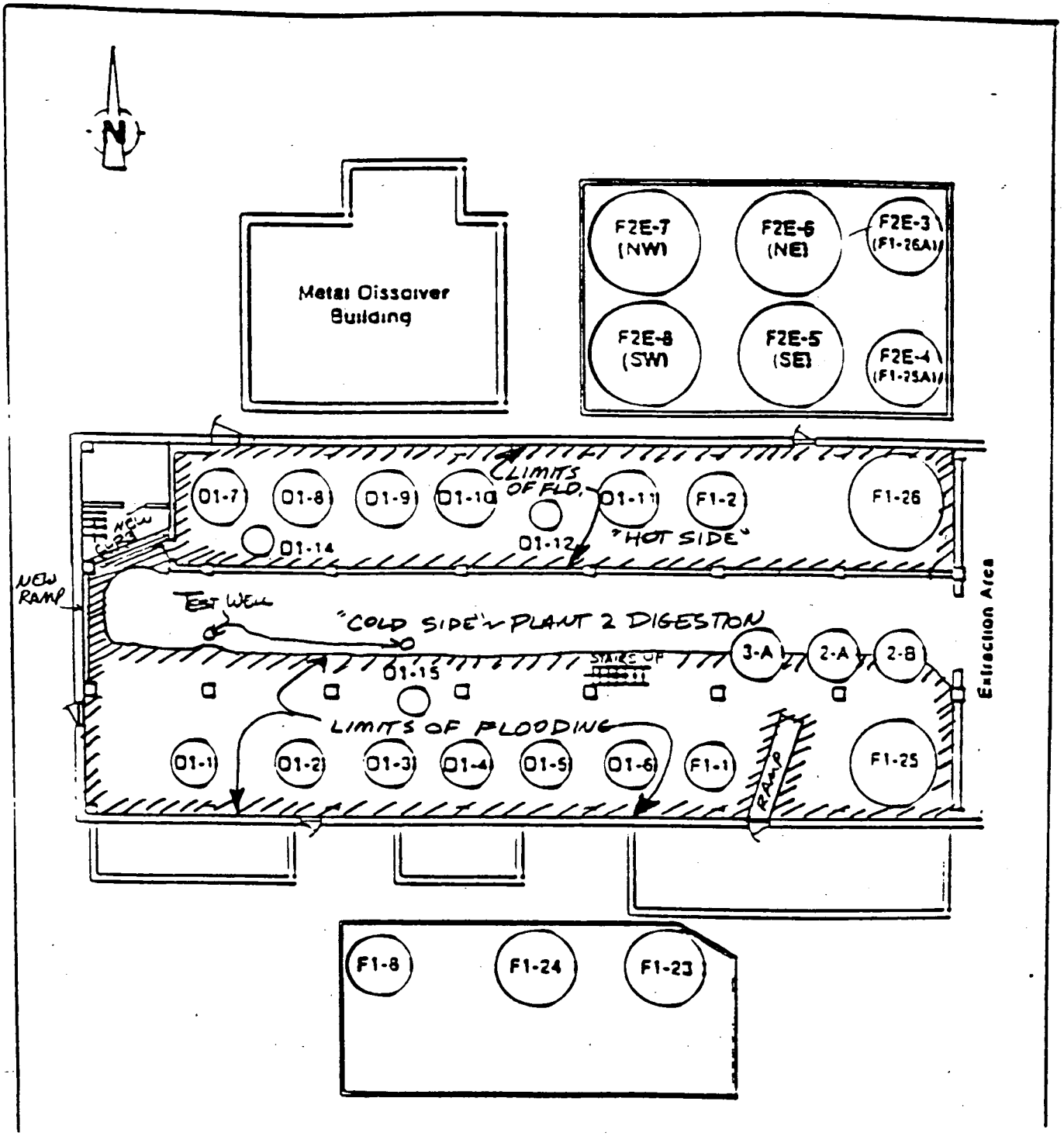

Figure 4
Digestion Area Tanks - D1-1, D1-7, D1-10, F1-1, F1-25, F1-26
CD Blend Tanks - SE (F2E-5), NE (F2E-6), SW (F2E-8)

7/10

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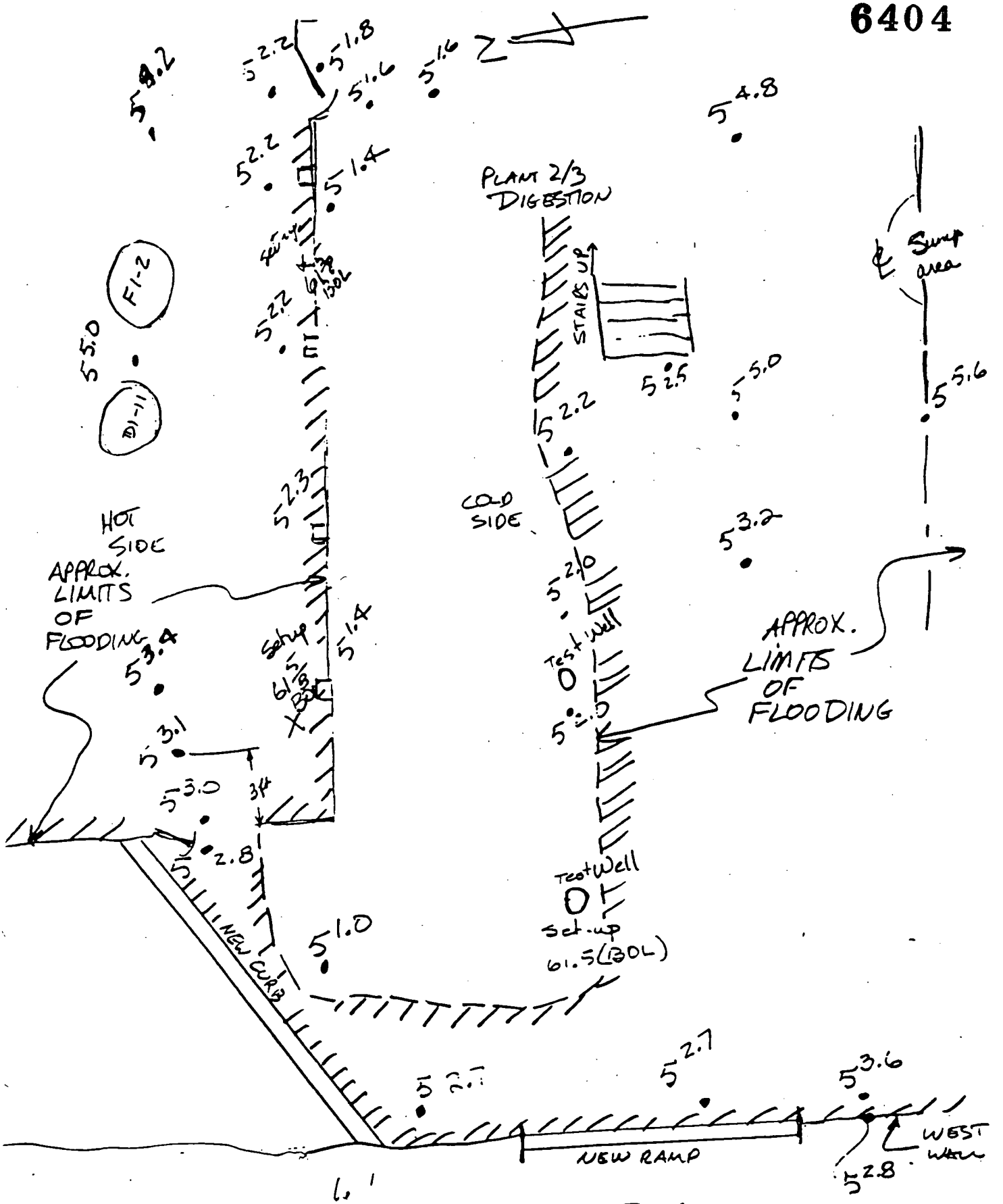

SURVEY PROVIDED BY CONSTRUCTION

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SUBJECT: EXTENDING PLANT 2/3 DIGESTION SECONDARY VOLUME

CALCS: T. CRAWFORD
CHECKED: J. C. J. 12/7/94

BOOK:
PAGE: 8/10
DATE: 12/5/94

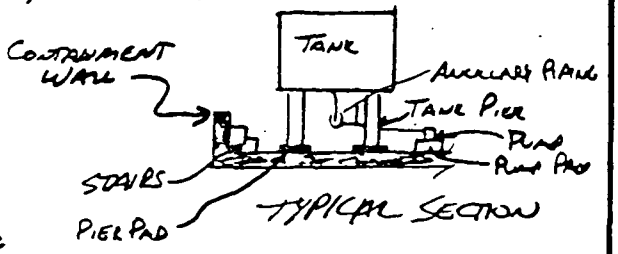
EXISTING CD BLEND CONTAINMENT VOLUME (Page 9 & 10)

LENGTH = FIELD MEASURED @ 61.5'
WIDTH = FIELD MEASURED @ 38.5'
DEPTH = FIELD SURVEYED, VARIES FROM 2.55' TO 2.90' ∴ USE 2.55'
(2.75' DEPTH BASED ON T/BRICK #22 @ 49.90' – SUMP FLR #13 @ 47.35' = 2.55')

6 TANKS EXIST, HOWEVER BOTTOM OF TANKS ARE ABOVE TOP OF CONTAINMENT WALL (SUPPORTED BY TANK PIERS, 2 PER TANK):

CONTAINMENT VOLUME IS DISPLACED BY
1. PIERS & PADS
2. PUMPS & PADS
3. STAIRS
4. ANCILLARY PIPING

FROM PAGE 10 FIELD MEASUREMENTS)



TOTAL VOLUME	= 61.5' × 38.5' × 2.55'	= 6038	CF
(+) SUMP VOLUME	= 5.75' × 3.4' × 4'	= 78	
(–) PIERS			
#1 TO #8	= 8×[18.5' × (2.75'–.25) × 1']	= 370	
#9 TO #12	= 4×[14.1' × (2.75'–.25) × 1']	= 141	
(–) PIER PADS			
#1 TO #8	= 8×(19.0' × 0.25' × 1.5')	= 57	
#9 TO #12	= 4×(14.7' × 0.25' × 1.5')	= 22	
(–) PUMPS ON:			
PAD 1	= 2×(4.8' × 1.8' × 1.25')	= 22	
PAD 2	= 2×(4.8' × 1.8' × 1.25')	= 22	
PAD 3	= 1×(4.25' × 1.75' × 1.25')	= 9	
PAD 4	= 1×(4.25' × 1.75' × 1.25')	= 9	
(–) PUMP PADS			
1	= 6.8' × 5.5' × 0.9'	= 34	
2	= 6.8' × 5.5' × 0.9'	= 34	
3	= 2.75' × 5.5' × 0.7'	= 10	
4	= 2.75' × 5.5' × 0.7'	= 10	
(–) STAIRS			
1	= USE STAIR 2 RESULTS	= 12	
2	= {[(19"+18")×9"×42"]/1728"/'} + (19"×9"×42")/1728"/'	= 12	
3	= USE STAIR 2 RESULTS	= 12	
4	= {[(36"+13")×10"×28"]/1728"/'} + (36"×7"×28")/1728"/'	= 12	
(–) ANCILLARY PIPING			
6"Ø ~ 50LF	= ¼π(6"/12"/')² × 50'	= 10	
		5318	CF

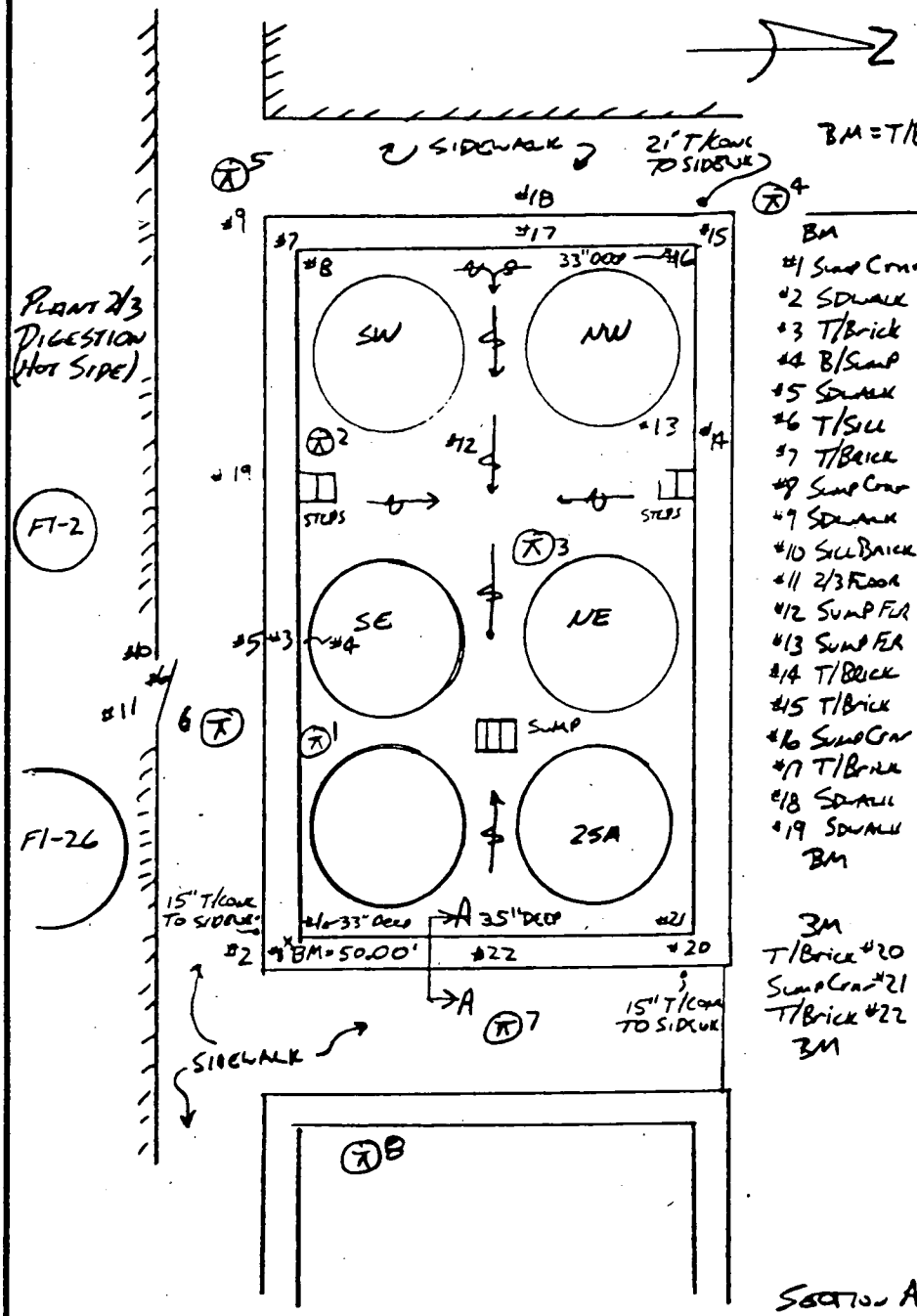
5318 CF × 7.48 GAL/CF = 39,779 GALLONS OF SECONDARY CONTAINMENT AVAILABLE IN CD BLEND

NOTE:

FS-F-2671 (REV. 4/27/93)

SUBJECT: PLANT 2/3 ~ CD BLEND AREA SURVEY
SURVEY BY TOM CRAWFORD, P.E
MARTIN ENDERLE

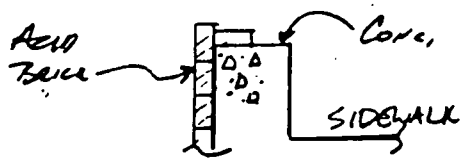
BOOK:
PAGE: 9/10
DATE: 12/2/94



ARBITRARILY SET @ BM = T/BRICK @ SE 2" CONTAIN. WALL = 50.00'

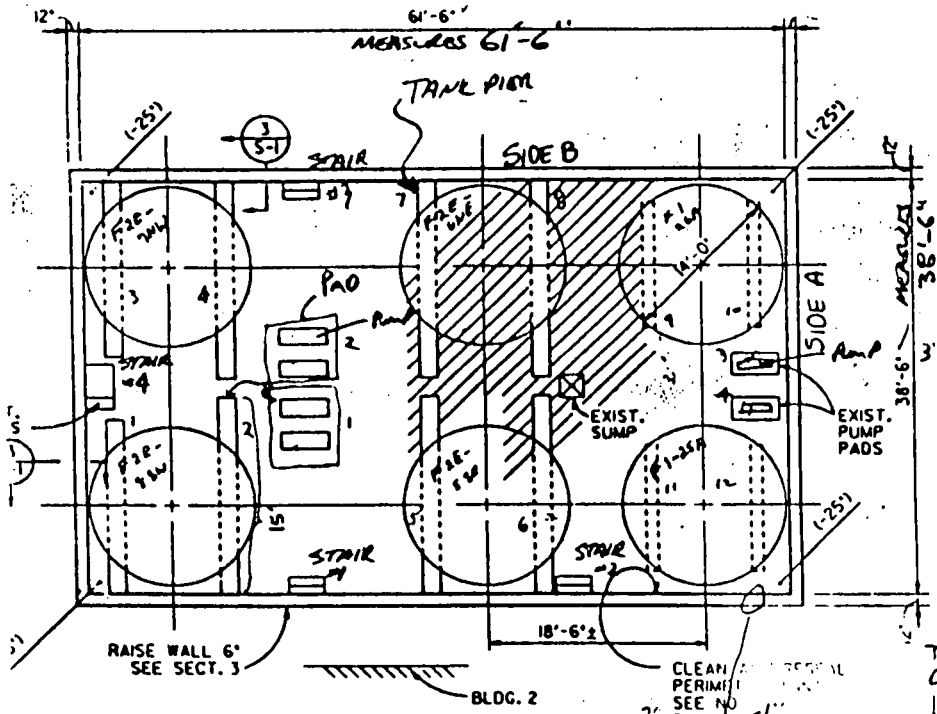
	FS	BS	ELEV	HI
BM		2.35	50.00	52.35
#1 Sump Conc	5.10		47.25	
#2 SIDEWALK	3.60		48.75	
#3 T/Brick	2.30		50.05	
#4 B/Sump	5.00		47.35	
#5 SIDEWALK	3.35		49.00	
#6 T/SILL	3.00	3.00	49.35	52.35
#7 T/BRICK	2.35		50.00	
#8 Sump Conc	5.05		47.30	
#9 SIDEWALK	3.65		48.70	
#10 SILL BRICK	2.75		49.60	
#11 2/3 FLOOR	3.00		49.35	
#12 SUMP FLR	5.25	5.15	47.10	52.25
#13 SUMP FLR	4.90		47.35	
#14 T/BRICK	2.25	3.10	50.00	53.10
#15 T/BRICK	3.10		50.00	
#16 SUMP CONC	5.80		47.30	
#17 T/BRICK	3.00	3.90	50.10	54.00
#18 SIDEWALK	5.50		47.60	
#19 SIDEWALK	5.10	5.15	48.90	54.05
BM	3.95		50.10	ERR +0.1
BM		3.65		53.65
T/Brick #20	3.10		50.55	
Sump Conc #21	NOT CHECKED			
T/Brick #22	3.75	3.05	49.90	52.95
BM	3.00		49.95	ERR -0.05

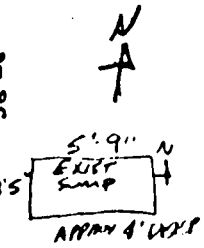
SECTION A-A (TYP.)

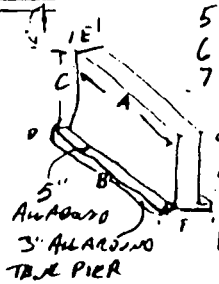


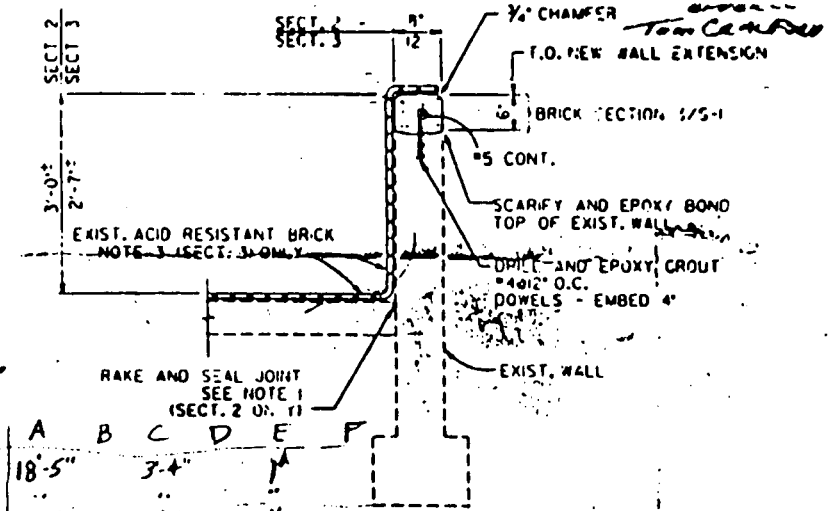
NOTE:

FS-F-2671 (REV. 4/27/93)









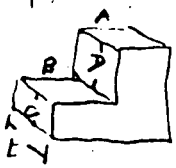
SECTION 2/S-1 3/S-1

SCALE: 3/4"=1'-0"

TANK PIERS

	A	B	C	D	E	F
1	18'-5"		3'-4"		1'	
2	"		"		"	
3	18'-5"		3'-7"		1'	
4	"		"		"	
5	18'-4"		3'-6"		1'	
6	"		"		"	
7	18'-2		3'-6"		1'	
8	"		"		"	
9	14'-1"		3'-4"		1'	
10	"		3'-4"		1'	
11	"		"		"	
12	"		"		"	

STAIRS

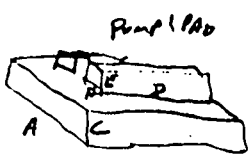


CD Bucks

DIKE NO. 4

SCALE: 1/8"=1'-0"

STEPS	A	B	C	D	E
1	13"	13"	10"	10"	31"
2	19"	18"	9"	9"	42"
3	17"	17"	7"	7"	33"
4	36"	13"	10"	7"	28"



Assume Pumps As Box

PAD	A	B	C	D (2x)	E (2x)	F (2x)
1	6'-10"	5'-5"	7"	4'-10"	1'-10"	1'-3"
2	6'-10"	5'-5"	7"	"	"	"
3	2'-9"	5'-5"	8"	4'-3"	1'-9"	1'-3"
4	"	"	"	"	"	"

1. P... C... TO... R...

2. WA... R... W... AR...

3. ACID... CLE... JOIN... FIRM... AND T...

...TER JOINTS ...WITH CHEMICAL

...UND CRACKS, SEAL CRACK ...COAT SCARIFIED ...FINISH SURFACE.

...ACID RESISTANT BRICK ...T JOINTS ...TO ...RE-MORTAR JOINTS

4. DETERIORATED CONCRETE
WHERE CONCRETE HAS DETERIORATED FLOOR, PUMP PADS AND TANK SUPP... SOUND CONCRETE 1/4" TO 1/2" DEEP... TO SCARIFIED SURFACE AND REFINISH WITH CONCRETE.

5. RED SHALE ACID RESISTANT BRICK S...
APPLY ASPHALT MEMBRANE WITH FIBE... (ASPHALT IMPREGNATED FIBERGLASS ... SHALE BRICK 1 3/8" TK. WITH COVE BASE SECTION AT TOP OF WALL IN SILICATE

6. ELEVATIONS INDICATED THUS (-30') ARE ... OF EXISTING DIKE WALLS.

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