5955 R-023-208 .6

RESPONSE TO THE DEFICIENCIES IDENTIFIED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY AFTER REVIEW OF URANYL NITRATE HEXAHYDRATE TANK SYSTEM

09/14/94

DOE-2386-94
DOE-FN OEPA
18
RESPONSE

5955

Department of Energy
Fernald Environmental Management Project
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6357

SEP 1 4 1994

DOE-2386-94

Mark W. Metcalf, Enviromental Specialist
Division of Hazardous Waste Management
Southwest District Office
40 South Main Street
Dayton, Ohio 45402-2086

Dear Mr. Metcalf:

RESPONSE TO THE DEFICIENCIES IDENTIFIED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY AFTER REVIEW OF THE URANYL NITRATE HEXAHYDRATE TANK SYSTEM

Reference: 1) Letter, M. W. Metcalf, OEPA, to J. P. Hamric, DOE-FN, "Uranyl Nitrate Hexahydrate Tank System Inspection Violation Letter," dated August 10, 1994.

2) Letter, W. J. Quaider, DOE-FN, to T. A. Winston, OEPA, "Submittal of Leak Repair Status for the Uranyl Nitrate Tank System," dated July 15, 1994.

3) Letter, DOE-0859-94, J. A. Rasile and J. P. Hamric to R. Fisher, "Response to Deficiencies Identified in December 9, 1993 Inspection of Uranyl Nitrate Tank System and Request for Additional Information," dated January 28, 1994.

This letter is in response to the deficiencies identified by the Ohio Environmental Protection Agency (OEPA)(Reference 1) after review of the Fernald Environmental Management Project's (FEMP) submittal of January 28, 1994, (Reference 3) and July 15, 1994, (Reference 2) regarding the Uranyl Nitrate Hexahydrate (UNH) Tank System. Also, as requested, additional information and clarification are being provided for certain items.

FEMP Response to Outstanding Deficiency:

1. OAC 3745-66-94(C) and OAC 3745-66-96(A)(B)&(E) Response to Leaks or Spills and Disposition of Leaking or Unfit-for-Use Tank Systems

As requested in Reference 1, additional information is being provided on the options considered to repair the new leak identified on the 1½-inch line at the base of Tank F1-301. As indicated in Reference 2, the FEMP has considered several options for repair of the leak.

Repair of all previously noted leaks had been accomplished using Plidco oversleeves. However, due to repair of other leaks on the same line, a Plidco oversleeve would not fit between the base of the tank and the next Plidco oversleeve. Each additional Plidco oversleeve adds considerable weight to the tank line. Placement of a larger Plidco over all leaks in the area would place undue stress on an already weakened line. The option of tightening the bolts as a repair consideration was eliminated due to the condition of the tank and line. The tightening action could result in damage to the line, thus causing the release of a larger amount of UNH material.

Transferring the contents of Tank F1-301 to an empty tank was considered. A transfer to an empty tank would require the empty tank first to be isolated, cleaned, and refurbished with new piping. Accomplishing this work would require diversion of manpower currently preparing for the UNH Neutralization Project and thereby delay the neutralization schedule. In addition, the act of pumping the material from one tank to another could actually increase the chance of a spill.

Alternatively, the use of shrink wrap to contain the leak is being evaluated. To date, the FEMP has not been able to identify a vendor who currently supplies the specific shrink wrap material selected for this service. The FEMP is, however, performing on-site testing to determine if a type of shrink wrap currently available on-site is resistant to the UNH material.
Tank F1-301 is inspected on a daily basis and is located in a permanent secondary containment area in the Hot Raffinate Building. The leak is minor in nature, with a leak rate of approximately one drop per minute. The material released from the tank is collected in a bucket and will be returned to the tank as necessary. Under the current work scheme and contingent upon weather conditions, the larger tanks containing the greatest volume of UNH material would be neutralized first. Thus, Tank F1-301 would be scheduled for neutralization during the latter part of the processing cycle. Neutralization of Tank F1-301 can occur earlier, if determined necessary.

FEMP Response to Noted Deficiencies Based on 1-28-94 Submittal:

1) OAC 3745-66-93(E)(1)(d) Secondary Containment

The secondary containment area capacity for the Digestion tanks will be increased by removing the temporary stainless steel 6" sills between the hot and cold sides of the Digestion Area of Plant 2/3. This will bring the total capacity of the digestion containment to about 31,500 gallons. The design capacity of the largest tank, Tank F1-25, is 23,543 gallons. Work orders have been written to provide permanent diking (raised ramp) for the roll-up door at the west end of Plant 2/3. Until the permanent diking (raised ramp) is installed, a temporary metal piece will be sealed against the roll-up door entry. Further, please be informed this secondary containment area will be filled with water to verify the capacity of the area, and to provide a leak check.

Enclosed are calculations providing documentation to support the volume capacity for the Hot Raffinate area. The Hot Raffinate area has two separate containment areas. Tanks F1-301, F1-302, and F1-303 are contained in one area and Tank F1-308 is housed in the second area.

2) OAC 3745-66-93(C)(2) Foundation Load Support

Attached are foundation load support calculations for Hazardous Waste Management Units (HWMU) 46, 47, 48, 49, and 50 demonstrating that the secondary containment systems have acceptable foundations.

3) OAC 3745-66-91(A)(B) Independent Assessment of the Tank System

OEPA has stated that the non-independent assessment of these tanks will be accepted contingent upon UNH treatment in accordance with the current schedule.

4) OAC 3745-66-93(I)(2) Annual Assessment of Tank Systems

OEPA has stated that the non-independent assessment of these tanks will be accepted contingent upon UNH treatment in accordance with the schedule.

FEMP Response to General comments:

1) (a) Secondary Containment Calculations for HWMUs 47 and 48 indicated that the walls needed to be raised by 6 or 9 inches to provide adequate secondary containment or that they have already been raised by 6 or 9 inches. Clarify the current status of the containment system for HWMUs 47 and 48.

Previous calculations dated July, 1987, which were provided for HWMUs 47 and 48 were rewritten in December, 1993, to reflect the actual height of the secondary containment walls after they were raised by the recommended heights. Enclosed are the December, 1993, calculations which reflect the raised wall heights. These calculations account for displacement factors and the 25-year/24-hour rainfall and show that the containment volumes are greater than the contents of each of the largest tanks. The largest tanks for HWMUs 47 and 48 contain a volume of 21,740 gallons (Tank F2E-8, SW) and 9,231 gallons (Tank F3E-223) of UNH, respectively.

2) Four Inactive Ground Water Monitoring Wells located within the secondary containment area in the Plant 2/3 digestion area. Provide information regarding what actions have been undertaken to provide for permanent isolation of these wells from the secondary containment system.

The four "inactive" groundwater monitoring wells are of ground-flush construction and are part of the FEMP Groundwater Monitoring Program. The monitoring wells were constructed to prevent surface and spill runoff from infiltrating the monitoring well, to discourage unauthorized entry into the well, and to protect the well from accidental damage or vandalism. The monitoring wells contain expansion plugs that are secured into the casing at all times. These expansion plugs provide a water-tight condition in the well casing itself. In addition, the wells are provided with a well lid which serves as a protective cover.

Currently, the FEMP plans to plug and abandon the wells. A Scope-of-Work has been drafted to plug and abandon the wells in the Plant 2/3 digestion area and will be finalized upon receipt of comments on the CRU5 Draft RI. If RI

comments require no additional sampling of these wells for further characterization of the till, the plan to plug and abandon will be initiated.

If you have any questions regarding this information or require additional information, please contact Wally J. Quaider, (513) 648-3137 or Ed Skintik, (513) 648-3151.

Sincerely,

for Jack R. Craig
Acting Director, DOE-FN

FN:Skintik

Enclosures: As Stated

cc w/enc:

AR Coordinator, FERMCO
RCRA Operating Record, FERMCO

cc w/o enc:

K. L. Alkema, FERMCO/65-2
S. M. Beckman, FERMCO/65-2
S. W. Frank, FERMCO/73
N. A. Frink, FERMCO/46
M. J. Galper, FERMCO/51
D. M. Garrett, FERMCO/73
S. K. Holliday, FERMCO/69
T. N. Huey, FERMCO/73
L. B. Ko, FERMCO/16-3
K. R. Kolthoff, FERMCO/76
D. Paine, FERMCO/30
E. R. Schmidt,FERMCO/65-2
K. A. Chaney, EM-423, QO
J. J. Fiore, EM-42, QO
L. Stevenson, OEPA/DHWM-CO
P. E. Pardi, OEPA/Dayton
G. E. Mitchell, OEPA/Dayton
J. H. Trygier, DOE-FN
C. A. White, DOE-FN

ENCLOSURE A

Secondary Containment
Volume Capacity Calculations
for Hot Raffinate Building

Westinghouse Materials Company of Ohio
PO Box 398704
Cincinnati, Ohio 45239
(513) 738 6200

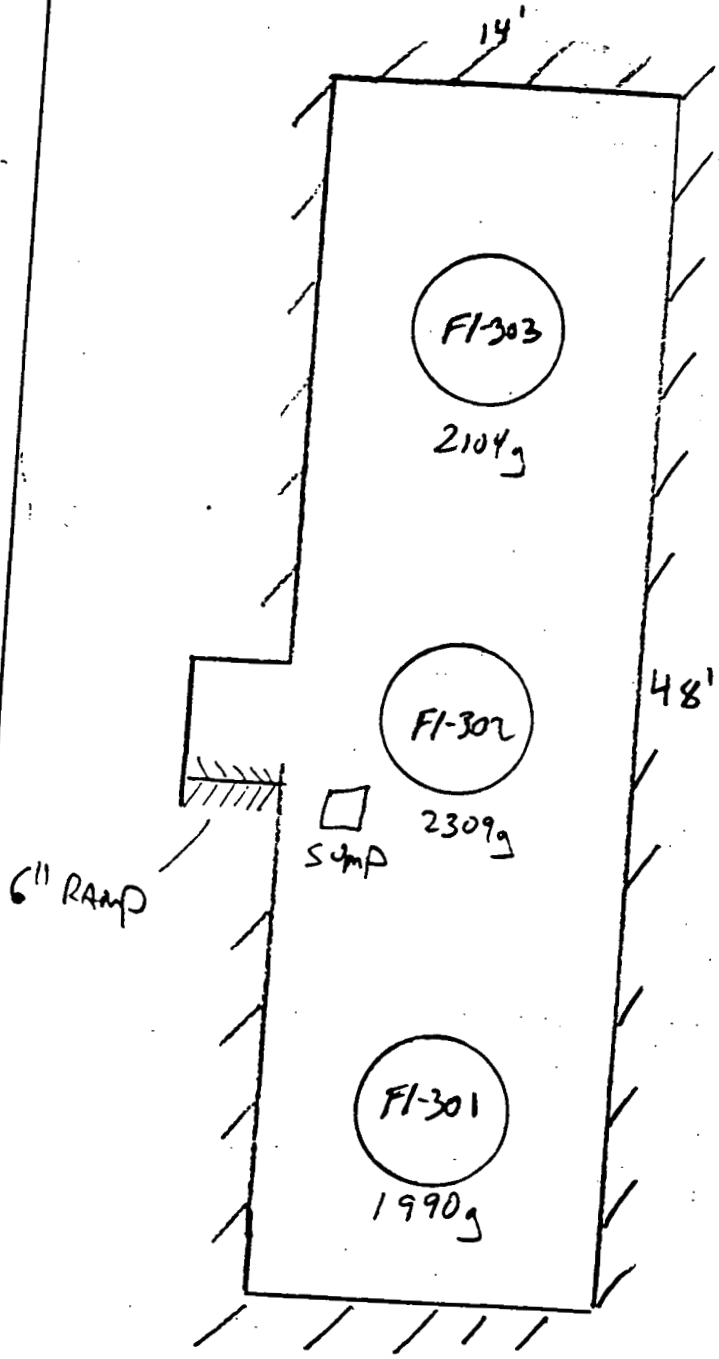
5955

ENGINEERING CALCULATION

PROJECT NUMBER:	UNH
BY:	GREG COTTEN
DATE:	9/1/94
PAGE:	1 OF 1
REVISED:	

SUBJECT: HWMU # 50 (Location 1)

HOT RAFFINATE OIL RADS FI-301, 302 + 303



N ↑

Sq Ft = 14' × 48' = 672 Ft²

Ave Dike Depth 7" ⇒ 392 Ft³

Vol FI-302 2309g

7.48 g/Ft³

309 Ft³ Liquid

392 − 309 = **83 Ft³ Excess**

83 Ft³ − 39.2 (10%) =

44 Ft³ Safety Margin (329 gal)

Assumptions:

1) pump pads & other structural Are less than 10% OF calculated volume
2) Ave dike depth is assumed - based on visual interpretation
3) Dike is physically SOUND

TT = WALL

1 BLOCK = 2 FEET

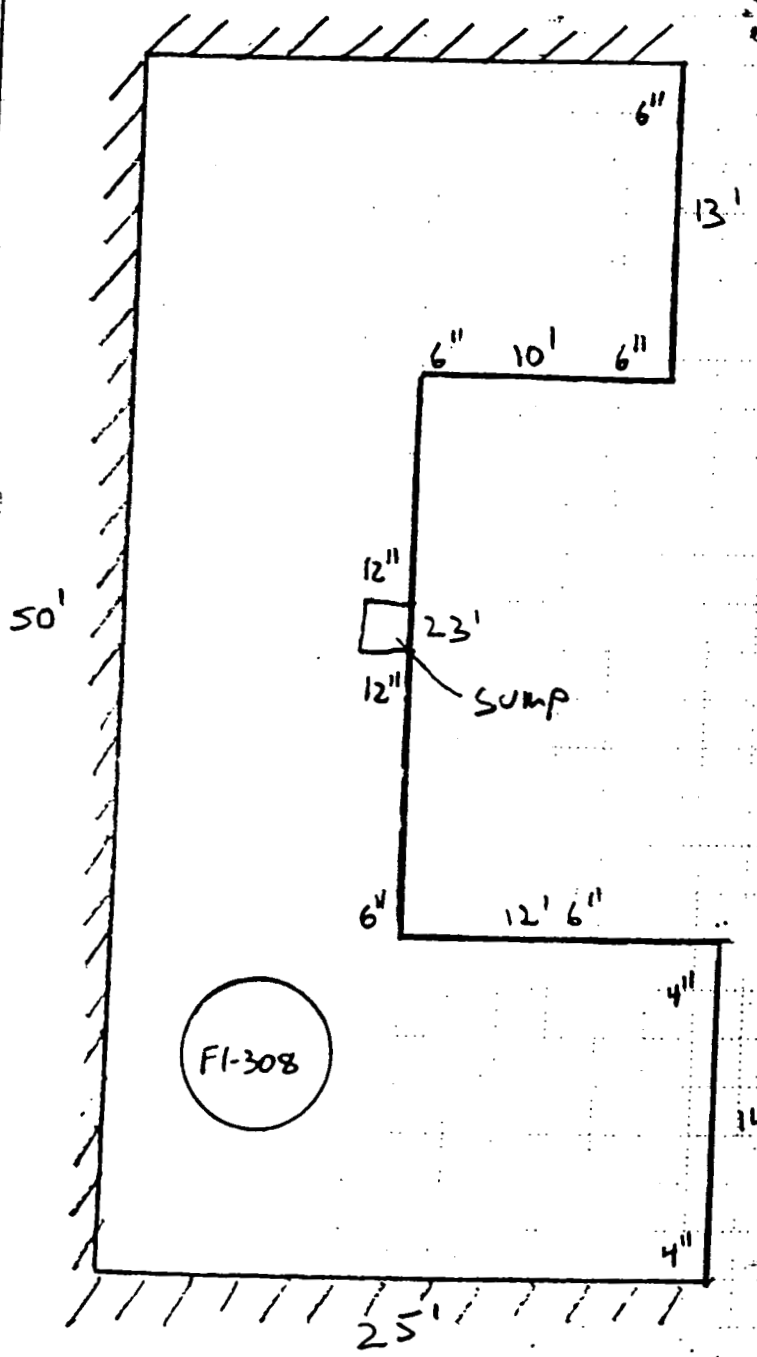
Westinghouse Materials Company of Ohio
PO Box 398704
Cincinnati, Ohio 45239
(513) 738 6200

5955

ENGINEERING CALCULATION

PROJECT NUMBER: UNH
BY: GREG COTTON
DATE: 9/1/94
PAGE: 1 OF 1
REVISED:

SUBJECT: HWMU #50 (Location 2)
HOT RAFFINATE DIKE AROUND F1-308



SQ FT ⇒ 13 x 22.5 = 292.5
12 x 23 = 276
14 x 25 = 350

TOTAL ≈ 918.5 FT²

Ave Dike Depth 7" ⇒ 536 FT³

Vol F1-308 1894 g
7.48 g/FT³

253 FT³ req'd

536 − 253 = 283 FT³ excess

283 FT³ − 53.6 (10%) =

229 FT³ Safety margin (1713 gal)

Assumptions
1) pump pads + other structural are less than 10% of calculated volume
2) Ave Dike depth assumed based on visual interpretation
3) Dike is physically sound

= Wall

= Dike

1 Block = 2 Feet

ENCLOSURE B

Load Support Calculations
UNH Tank System

Ohio EPA Response Letter
(Letter# OP:94-0919)

Fernald Environmental
FERMCO
Restoration Management Corporation

INTEROFFICE MEMORANDUM

To:	Debra Faulkner, RP	**Date:**	September 8, 1994
Location:	Fernald, MS 16-2	**Reference:**	RES 2359
From:	SK Surinder Kumar, ENG	**FERMCO #:**	M:ENG:(FDE):94-0182
Location:	Springdale, MS 81-3	**Client:**	DOE DE-AC05-92OR21972
Extension:	648-6122	**Subject:**	Tank Foundation Calculations

c: File Record Storage Copy 106.4.12.2
S. W. Frank
R. P. Heck
T. Huey
R. C. Worsley

Based on my field inspection of secondary containment system for Hazardous Waste Management Unit (HWMU) No. 46, 47, 48, 49 and 50 (see table 1, attached) in connection with the UNH Tank System inspection, the following observations were made:

HWMU No. 46: (Ref. Dwg. No.s 00X-4445-G-01724, 00X-4445-S-01727, 02A-5500-S-02333 through 02337)

This HWMU is located south of Plant 1 Ore Silos, has an approximate diked area of 59' X 52' (3068 sq. ft.) and contains tank numbers F2-605, 606, 607 and F2-608. The diked area was upgraded for leaks per Dwg. No. 00X-4445-S-01727 (Refer Dike No. 7 on the drawing.) The base for the secondary containment system consists of 6-1/2" thick concrete pad (min. 28-day compressive strength of 3500 psi) with 6" X 6" X 6/6 welded wire fabric over 4" granular fill. Assuming maximum quantity of UNH in tank no. F2-605 as approximately 23,463 gallons (see table 2, attached) with the UNH material inside the tank weighing about 11.68 pounds/gallon (assuming specific gravity of UNH as 1.4), the maximum loading on the concrete pad would be about

$$\frac{23{,}463 \times 11.68}{3068} = 89 \ psf$$

which is less than the capacity of the 6-1/2" concrete slab on ground (approximately 500 psf).

HWMU No. 47: (Ref. Dwg. Nos. 00X-4445-G-01724, 00X-4445-S-01726, 02A-7000-S-

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Restoration Management Corporation

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00576, 02A-7000-S-00586, 02A-7000-S-00587 & 02A-7000-S-00599)

This HWMU is located North of Plant 2/3, has an approximately dike area of 61' - 6" X 38' - 6" (2368 sq. ft.) and contains tank numbers F2E-3 through F2E-8 with only tanks F2E-5, F2E-6 and F2E-8 containing UNH. The diked area was upgraded for leaks per Dwg. No. 00X-4445-S-01726 (Ref. Dike No. 4 on the dwg.). The base for the secondary containment system consists of 1'-3" thick concrete slab (Min. compressive strength of 3000 psi) with #7 bars as main reinforcing and #4 @ 10" O.C. T & B as temperature reinforcing, over 6" compacted gravel underfill. Assuming maximum quantity of UNH in Tank No.F2E-5 (SE) as approximately 23,645 gallons with the UNH material inside the tank weighing about 11.68 pounds/gallon, the maximum loading on the base would be about

$$\frac{23,645 \; X \; 11.68}{2368} = 117 \; psf$$

which is less than the capacity of the 1' - 3" thick concrete slab, on ground.

HWMU No. 48: (Ref. Dwg. Nos. 00X-4445-G-01724, 00X-4445-S-01726, 02C-7000-S-00855, 02C-7000-S-00856 and 02C-7000-S-00859)

The HWMU is located southeast of Plant 2/3, has an approximate dike area of 53'-3" x 44' (2343 sq. ft.) and contains tank numbers F3E-222 thru F3E-225 with only tank F3E-223 containing UNH. The diked area was upgraded for leaks per Drawing No. 00X-4445-S-01726 (Ref. dike no. 1 on the dwg.). The base for the secondary containment system consists of 1'-3" thick concrete slab (min. compressive strength of 3000 psi) over 6" compacted gravel underfill with reinforcing details as shown on Drawing No. 02C-7000-S-00856. Assuming max. quantity of UNH in tank F3E-223 as approximately 9,231 gallons with the UNH material inside the tank weighing about 11.68 lbs/galloon, the max. loading on the base would be about

$$\frac{9,231 \; X \; 11.68}{2343} = 46 \; psf$$

which is less than the capacity of the 1'-3" concrete slab on ground.

HWMU No. 49: (Ref. Dwg. Nos. 02X-5500-A-03342, 02X-1450-S-00006, 02X-1450-S-00015, 02A-3115-S-01079 & 02A-3115-S-01081)

This HUMU is located inside Ore Refinery Plant 2A with tanks D1-7, D1-10 & F1-26 containing UNH being on the North side and enclosed by a dike approximately

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INTEROFFICE MEMORANDUM

125' x 20' (2500 sq. ft.) and tanks D1-1, F1-1 & F1-25 on the South side between Cols. 1-8 and Cols. A-D. The base for the secondary containment system consists of 6" thick concrete slab (min. compressive strength of 2500 psi) on ground (min. bearing value of 3000 psf) with 6"x6"x4/4 welded wire fabric (see general specifications for Plain and Reinforced Concrete Work, Revision 1, dated March 16, 1955, page 21). Assuming max. quantity of UNH in tank no. D1-7 (North side) as approximately 3,218 gallons with the UNH material inside the tank weighing about 11.68 lbs/gallon, the max. loading on the base would be about

$$\frac{3,218 \; X \; 11.68}{2500} = 15 \; psf$$

which is less then the capacity of the 6" concrete slab on ground (approximately 500 psf). Similarly, it can be shown that the base slab on the South side for tanks D1-1, F1-1 & F1-25 is adequate to provide support for the secondary containment system.

HWMU No. 50: (Ref. Dwg. Nos. 02X-5500-A-03350, 02X-1450-S-00058 & 02X-1450-S-00059)

This HWMU is located inside Hot Raffinate Building 3E with tanks F1-301, F1-302 and F1-303 containing UNH being on the East side and enclosed by reinforced concrete walls on four sides (between Cols. 5 & 6 and Cols. A-D) approximately 52'x15' = 780 sq. ft. in area and tank F1-308 located between Cols. 3 & 4 and Cols. A & B and bounded by reinforced concrete walls all around. The base for the secondary containment system consists of 7" thick concrete slab (min. compressive strength of 2500 psi) on ground with 6"x6"x4/4 welded wire fabric (min., assumed). Assuming max. quantity of UNH in tank no. F1-302 (East side) as approximately 2309 gallons with the UNH material inside the tank weighing about 11.68 lbs/gallon, the max. loading on the base slab would be about

$$\frac{2,309 \; X \; 11.68}{780} = 35 \; psf$$

which is less than the capacity of the 7" concrete slab on ground (approximately 800 psf). Similarly, it can be shown that the base slab for the tank F1-308 is adequate to provide support for the secondary containment system.

The secondary containment areas for HWMU's #46, 47, 48, 49 & 50 were built around 1950's using the applicable codes prevalent at the time and in accordance with

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FERMCO
Restoration Management Corporation

INTEROFFICE MEMORANDUM

good engineering practices (Ref. Structural Design Criteria by Catalytic Construction Company, Rev. 2, dated 8/8/51). The HWMU's are monitored for any leaks and, in my opinion, the secondary containment systems are placed on a foundation/base capable of providing support and resistance to pressure gradients above and below the system and capable of preventing failure due to settlement, compression or uplift as required per 40CFR265.193(c) and OAC 3745-55-93(c).

Any additional comments or questions pertaining to this subject may be directed to me at 648-6122.

SK:bec
Attachment

TABLE 1

HWMU Number	Tank Numbers	Location	Tank Construction
HWMU #10 (NAR System)	F3E-220	Southwest corner of Denitration Area	Aboveground, cylindrical, horizontal, stainless steel (SS304L)
HWMU # 48	F3E-223	Southeast of Plant 2/3 (Outdoors)	Aboveground, vertical, cylindrical, stainless steel (SS304L) tanks
HWMU # 47	SE F2E-5	North of Plant 2/3 (Outdoors)	Aboveground, vertical, cylindrical, stainless steel (304L) tanks
	NE F2E-6		
	SW F2E-8		
HWMU # 46	F2-605	NFS Storage Area (Outdoors)	Aboveground, cylindrical, horizontally-mounted, insulated, stainless steel (304L) tanks
	F2-606		
	F2-607		
	F2-608		
HWMU # 50	F1-301	Raffinate Building - 2 Locations Inside	Aboveground, vertical, cylindrical, stainless steel (304L) tanks Tank F1-308 is made of SS 347.
	F1-302		
	F1-303		
	F1-308		
HWMU # 49	D1-1	Digestion Area - 2 Locations Inside	Aboveground, vertical, cylindrical, stainless steel (304L) tanks
	D1-7		
	D1-10		
	F1-1		
	F1-25		
	F1-26		

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 (%)	Ba (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 Ph is > 7.0. (Neutralized UNH from previous process)
**** Results not available

ENCLOSURE C

Secondary Containment
Calculations for HWMUs 47 & 48
Dated December 17, 1993

Ohio EPA Response Letter
(Letter# OP:94-0919)

FORM 110

HWMU #48

5955

Job USDE

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

File No. 2903-35 Sheet No. 1

Location

Checked by Date

Subject RET. BASINS

Computed by Date 12/12/93

BASIN NO. 1 (DWG. 00X-4445-S-01726 S-1

53'-3" x 44'-0" x 3'-9" INSIDE DIM.

BOT. OF VERT. TKS. 8" ± BELOW TOP

4-16' ϕ TKS., 1 @ 70000 g, 3 @ 29,000 g = 157000 g

BASIN CAPACITY REQ'D. —

a. $\frac{0.1 \times 157000}{7.48}$ = 2099 C.F

OR

b. 70000/7.48 = 9358 CF

c. STORM WATER = 53.25 x 44 x 0.33 = 773

TOTAL CAP. REQ'D = 9358 + 773 = 10131 CF

BASIN CAPACITY —

53.25 x 44.0 x 3.75 + $\frac{44}{2}$ x 0.42 x 53.25 = 9278 CF

- PIERS 10' x 1' x 3' x 8 = - 240

- Pumps (INCL. PADS) 5' x 5' x 1.33' x 1 = - 33

- TANKS $\frac{3.14 \times 16^2 \times 0.67 \times 3}{4}$ = - 404

NET CAPACITY = 8601 c

10131 - 8601 / 53.25 x 44 = 0.65'

BASIN SIDES RAISED 9" (DWG. 00X-4445-S-01726

MODIFIED CAPACITY = 53.25 x 44 x 4.5 + $\frac{44}{2}$ x 0.42 x 53.25 = 11,035 c

- PIERS AND PUMPS = - 273

- TKS $\frac{3.14 \times 16^2 \times 1.42 \times 3}{4}$ = 856

9906 c

$\frac{10131 - 9906}{53.25 \times 44.0}$ = 0.096 = 1 1/8" (DEFICIT)

FORM 110

HWMU # 47

Job USDE — A. M. KINNEY, INC. CONSULTING ENGINEERS CINCINNATI, OHIO — File No 2903-35 Sheet No. 2

Location

Subject RET. BASINS — Checked by — Date

Computed by — Date 12/15/93

BASIN NO.4 (DWG. 00X-4445-S-01726 S1

61'-6" x 38'-6" x 2'-1"

BOT. OF VERT. 2'-6" ABOVE TOP OF WALL

6TKS, 4 x 25,265g + 2 x 14203g = 129,466g

BASIN CAP. REQ'D —

a. 0.1 x 129466 / 7.48 = 1731 CF

b. 25265 / 7.48 = 3378 CF

c. STORM WATER

61.5 x 38.5 x 0.33 = 781 CF

TOT. CAP. REQ'D. = 3378 + 781 = 4159 CF

BASIN CAPACITY —

61.5 x 38.5 x 2.08	= 4925 CF
- PUMPS, (6 x 2 x 4 x 0.7)	= - 34
4 x 1 x 1.7 x 3 + 1 x 0.7 x 3	= - 23
- PIERS, 4 x 1.75 x 2.58 x 15.0	= - 271
- WALLS, 4 x 1.75 x 2.58 x 37.5	= - 677
NET CAPACITY	= 3920 CF

$$\frac{4159 - 3920}{61.5 \times 38.5} = 0.10'$$

BASIN WALLS RAISED 6 IN.

FORM 110

HWMU #46

Job USDE

Location

Subject RET. BASINS

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

File No. 2903-35 Sheet No. 3

Checked by Date

Computed by Date 12/15/83

BASIN NO.7 (Dwg. 00X-4445-S01727 S-2
61'-4" X 53'-8" X 1'-7"
4 HORIZ. TKS. WITH BOT. 2'-8" ABOVE BASE
BASIN SET INTO HILL, SIDE WALLS SLOPE
UPWARD 2'-9"± FROM MID-WIDTH
4 HORIZ TKS., 10'-6"ϕ @ 24,634g EACH

BASIN CAPACITY REQ'D

a. 0.1 x 4 x 24634 / 7.48 = 1318 CF

b. 24634 / 7.48 = 3294

C. STORM WATER = 61.33 x 53.67 x 0.33 = 1086

TOTAL CAPACITY REQ'D = 3294 + 1086 = 4380 CF

BASIN CAPACITY —

61.33 x 53.67 x 1.58	= +5201 CF
+ 10.0 x 61.33 x 0.55	= + 337
- PIERS 8 x 1.0 x 1.58 x 10.5	= - 133
NET CAPACITY	= 5405 CF

BASIN CAPACITY IF TILE LINING IS ADDED —

61.08 x 53.42 x 1.47	= 4797
+ 9.75 x 61.08 x 0.55	= + 328
- 8 x 1.25 x 1.58 x 10.75	= - 170
	4955 CF

4955 > 4380 ∴
BASIN HT. IS SATISFACTORY