U.S. DEPARTMENT OF ENERGY
WELDON SPRING SITE
REMEDIAL ACTION PROJECT
7295 Hwy. 94 South
St. Charles, Mo. 63304
(636) 441-8086 Fax: (636) 447-0803

U.S. DEPARTMENT OF ENERGY LETTER OF TRANSMITTAL

DATE: 10/15/02

ATTENTION: Distribution

RE: Attachment referenced in comment response A-93

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COPIES	DATE	NO.	DESCRIPTION
1			Attachment (WSSRAP Cell Total Activity Final Estimate) referenced in comment response A-93 in the U.S. DOE Responses to Comments (received by September 10, 2002) on the August 9, 2002 draft Long-Term Stewardship Plan for the Weldon Spring, Missouri, Site

Remarks:

Signed: Pamela Thompson
Pamela Thompson
Project Manager

Copy to:
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WSSRAP Cell Total Activity Final Estimate (calculated September 2002, Fleming) (Waste streams & occupied cell volumes from spreadsheet titled "cell waste volumes-8.23.02 with macros.xls")														
Waste Stream[a]	Volume (cy)	Mass (g)[2]	Radiological Profile[3]			Nuclide Activity (Ci)[4]							Total	% of Total
				U-238	U-234	U-235	Th-228	Th-230	Th-232	Ra-226	Ra-228	Rn-222[5]	Activity	if > 1%
Raffinate Pits Work Zone													(Ci)	
Raffinate processed through CSS Plant[1]	159990	1.49E+11	Raffinate	6.12E+01	6.12E+01	2.84E+00	8.95E+00	4.03E+03	4.78E+01	1.25E+02	9.10E+00	1.47E+02	4.49E+03	68.44%
Pit 4 residual sludge	2530	2.36E+09	Raffinate	9.68E-01	9.68E-01	4.48E-02	1.42E-01	6.37E+01	7.55E-01	1.98E+00	1.44E-01	2.33E+00	7.11E+01	1.08%
Pit 3 residual sludge	10277	9.59E+09	Raffinate	3.93E+00	3.93E+00	1.82E-01	5.75E-01	2.59E+02	3.07E+00	8.05E+00	5.85E-01	9.47E+00	2.89E+02	4.40%
Pit 3 soil	52366	6.74E+10	Raffinate pit soils	2.76E+00	2.76E+00	1.35E-01	4.04E-01	1.82E+02	2.16E+00	5.66E+00	4.11E-01	6.66E+00	2.03E+02	3.09%
Pit 4 soil	65650	8.45E+10	Raffinate pit soils	3.46E+00	3.46E+00	1.69E-01	5.07E-01	2.28E+02	2.70E+00	7.10E+00	5.15E-01	8.35E+00	2.54E+02	3.88%
Pits 1 & 2 soil	58198	7.49E+10	Raffinate pit soils	3.07E+00	3.07E+00	1.50E-01	4.49E-01	2.02E+02	2.40E+00	6.29E+00	4.57E-01	7.40E+00	2.26E+02	3.44%
Pit 1 Interceptor Trench	2947	3.79E+09	Site soils	3.94E-01	3.89E-01	2.20E-02	1.67E-02	4.13E-02	4.25E-02	1.86E-02	1.52E-02	1.86E-02	9.58E-01	
Pit 3 Overflow & Manhole	653	8.40E+08	Site soils	8.72E-02	8.62E-02	4.87E-03	3.70E-03	9.16E-03	9.41E-03	4.12E-03	3.36E-03	4.12E-03	2.12E-01	
Pit 4 Intermediate Dike	8073	1.04E+10	Site soils	1.08E+00	1.07E+00	6.03E-02	4.57E-02	1.13E-01	1.16E-01	5.09E-02	4.16E-02	5.09E-02	2.62E+00	
Interceptor Trench east of Pit 3	1978	2.55E+09	Site soils	2.64E-01	2.61E-01	1.48E-02	1.12E-02	2.77E-02	2.85E-02	1.25E-02	1.02E-02	1.25E-02	6.43E-01	
TSA Work Zone														
Quarry soils stockpiles	99332	1.28E+11	TSA bulk waste	2.53E+01	2.53E+01	1.16E+00	1.23E+01	4.19E+01	3.29E+00	1.39E+01	1.23E+01	1.39E+01	1.50E+02	2.28%
Nitro soils pile	25100	3.23E+10	TSA bulk waste	6.40E+00	6.40E+00	2.94E-01	3.11E+00	1.06E+01	8.30E-01	3.52E+00	3.11E+00	3.52E+00	3.78E+01	
B-25 boxes	180	2.32E+08	TSA non-filter cake	7.41E-01	7.41E-01	3.48E-02	2.23E-02	5.33E+00	1.99E+01	2.50E-02	2.23E-02	2.50E-02	2.69E+01	
20 cy rolloffs	2925	3.76E+09	TSA non-filter cake	1.20E+01	1.20E+01	5.65E-01	3.63E-01	8.66E+01	3.24E+02	4.07E-01	3.63E-01	4.07E-01	4.37E+02	6.65%
SWTP filter cake	800	7.65E+08	TSA filter cake	1.19E+00	1.19E+00	5.58E-02	6.12E-04	4.48E-02	8.72E-03	4.82E-03	4.05E-03	4.82E-12	2.50E+00	
TSA in-situ soil	26540	3.42E+10	Site soils	3.55E+00	3.50E+00	1.98E-01	1.50E-01	3.72E-01	3.83E-01	1.67E-01	1.37E-01	1.67E-01	8.63E+00	
TSA Transfer Station underlying soil	137	1.76E+08	Site soils	1.83E-02	1.81E-02	1.02E-03	7.76E-04	1.92E-03	1.97E-03	8.64E-04	7.05E-04	8.64E-04	4.45E-02	
TSA Equalization Basin sediment	774	9.96E+08	Site soils	1.03E-01	1.02E-01	5.78E-03	4.38E-03	1.09E-02	1.12E-02	4.88E-03	3.98E-03	4.88E-03	2.52E-01	
Ash Pond Work Zone														
Soil stockpile	426737	5.49E+11	Site soils	5.70E+01	5.64E+01	3.19E+00	2.42E+00	5.99E+00	6.15E+00	2.69E+00	2.20E+00	2.69E+00	1.39E+02	2.11%
Vicinity Properties	10575	1.36E+10	Site soils	1.41E+00	1.40E+00	7.89E-02	5.99E-02	1.48E-01	1.52E-01	6.67E-02	5.44E-02	6.67E-02	3.44E+00	
Soils stockpiled from Pit 4 excavations	47478	6.11E+10	Site soils	6.34E+00	6.27E+00	3.54E-01	2.69E-01	6.66E-01	6.84E-01	2.99E-01	2.44E-01	2.99E-01	1.54E+01	
Soils from VP 9 cleanup	2680	3.45E+09	Site soils	3.58E-01	3.54E-01	2.00E-02	1.52E-02	3.76E-02	3.86E-02	1.69E-02	1.38E-02	1.69E-02	8.71E-01	
In-situ soil	108461	1.40E+11	Site soils	1.45E+01	1.43E+01	8.10E-01	6.14E-01	1.52E+00	1.56E+00	6.84E-01	5.58E-01	6.84E-01	3.52E+01	
Sedimentation basin sediments	785	1.01E+09	Site soils	1.05E-01	1.04E-01	5.86E-03	4.45E-03	1.10E-02	1.13E-02	4.95E-03	4.04E-03	4.95E-03	2.55E-01	
Soil under DHO equip parking area	11469	1.48E+10	Site soils	1.53E+00	1.51E+00	8.56E-02	6.50E-02	1.61E-01	1.65E-01	7.23E-02	5.90E-02	7.23E-02	3.73E+00	
Nitro soils	370	4.76E+08	Site soils	4.94E-02	4.89E-02	2.76E-03	2.10E-03	5.19E-03	5.33E-03	2.33E-03	1.90E-03	2.33E-03	1.20E-01	
Soil under cell footprint	7720	9.94E+09	Site soils	1.03E+00	1.02E+00	5.76E-02	4.37E-02	1.08E-01	1.11E-01	4.87E-02	3.97E-02	4.87E-02	2.51E+00	
MSA Work Zone														
SWTP filter cake	715	6.83E+08	MSA filter cake	6.18E+01	6.18E+01	2.84E+00	2.88E-03	4.00E-02	7.79E-03	1.20E-01	4.44E-02	1.20E-01	1.27E+02	1.93%
13 cy rolloffs	338	4.35E+08	MSA containerized waste	2.28E+00	8.61E-02	5.66E-03	1.31E-03	6.96E-03	1.22E-02	1.31E-03	0	1.31E-03	2.39E+00	
4 cy rolloffs	180	2.32E+08	MSA containerized waste	1.21E+00	4.59E-02	3.01E-03	6.95E-04	3.71E-03	6.49E-03	6.95E-04	0	6.95E-04	1.28E+00	
20 cy rolloffs	1670	2.15E+09	MSA containerized waste	1.13E+01	4.26E-01	2.79E-02	6.45E-03	3.44E-02	6.02E-02	6.45E-03	0	6.45E-03	1.18E+01	
Drums	352	4.53E+08	MSA containerized waste	2.37E+00	8.97E-02	5.89E-03	1.36E-03	7.25E-03	1.27E-02	1.36E-03	0	1.36E-03	2.49E+00	
Waste Piles	13622	NA	MSA waste piles	6.16E-02	6.16E-02	2.89E-03	0	0	0	0	0	0	1.26E-01	
MSA in-situ soil	4856	6.25E+09		6.49E-01	6.41E-01	3.63E-02	2.75E-02	6.81E-02	7.00E-02	3.06E-02	2.50E-02	3.06E-02	1.58E+00	
Frog Pond Work Zone														
In-situ soil	15722	2.02E+10	Site soils	2.10E+00	2.08E+00	1.17E-01	8.90E-02	2.21E-01	2.27E-01	9.92E-02	8.09E-02	9.92E-02	5.11E+00	
Sediments	2291	2.95E+09	Site soils	3.06E-01	3.03E-01	1.71E-02	1.30E-02	3.21E-02	3.30E-02	1.44E-02	1.18E-02	1.44E-02	7.45E-01	
Soil under sediments	2068	2.66E+09	Site soils	2.76E-01	2.73E-01	1.54E-02	1.17E-02	2.90E-02	2.98E-02	1.30E-02	1.06E-02	1.30E-02	6.72E-01	
Frog Pond Outlet	473	6.09E+08	Site soils	6.32E-02	6.25E-02	3.53E-03	2.68E-03	6.64E-03	6.82E-03	2.98E-03	2.44E-03	2.98E-03	1.54E-01	
SWTP & Bldg 434 Work Zones														
Soil excavated from these zones	7047	9.07E+09	Site soils	9.41E-01	9.31E-01	5.26E-02	3.99E-02	9.89E-02	1.02E-01	4.44E-02	3.63E-02	4.44E-02	2.29E+00	
Sediments - Train 1	155	1.99E+08	Site soils	2.07E-02	2.05E-02	1.16E-03	8.78E-04	2.17E-03	2.23E-03	9.78E-04	7.98E-04	9.78E-04	5.04E-02	
Sediments - Train 2	52	6.69E+07	Site soils	6.95E-03	6.87E-03	3.88E-04	2.94E-04	7.30E-04	7.50E-04	3.28E-04	2.68E-04	3.28E-04	1.69E-02	
CSS Plant Work Zone														
In-situ soil	3638	4.68E+09	Site soils	4.86E-01	4.80E-01	2.72E-02	2.06E-02	5.10E-02	5.24E-02	2.29E-02	1.87E-02	2.29E-02	1.18E+00	
ASA Work Zone														

In-situ soil	2081	2.68E+09	Site soils	2.78E-01	2.75E-01	1.55E-02	1.18E-02	2.92E-02	3.00E-02	1.31E-02	1.07E-02	1.31E-02	6.76E-01	
Miscellaneous														
DHO decon pad recirculation pond	150	1.93E+08	Site soils	2.00E-02	1.98E-02	1.12E-03	8.49E-04	2.10E-03	2.16E-03	9.46E-04	7.72E-04	9.46E-04	4.87E-02	
Soils around DHO decon pad	145	1.87E+08	Site soils	1.94E-02	1.91E-02	1.08E-03	8.21E-04	2.03E-03	2.09E-03	9.14E-04	7.47E-04	9.14E-04	4.71E-02	
SWTP filter cake	213	2.74E+08	Site soils	2.85E-02	2.81E-02	1.59E-03	1.21E-03	2.99E-03	3.07E-03	1.34E-03	1.10E-03	1.34E-03	6.92E-02	
Hot spots	11675	1.50E+10	Site soils	1.56E+00	1.54E+00	8.72E-02	6.61E-02	1.64E-01	1.68E-01	7.36E-02	6.01E-02	7.36E-02	3.79E+00	
CMSA basin sediments	1985	2.55E+09	Site soils	2.65E-01	2.62E-01	1.48E-02	1.12E-02	2.78E-02	2.86E-02	1.25E-02	1.02E-02	1.25E-02	6.45E-01	
Cell Dimple Items														
Quarry soils, sediments, filter & media	1875	2.41E+09	Site soils	2.50E-01	2.48E-01	1.40E-02	1.06E-02	2.63E-02	2.70E-02	1.18E-02	9.65E-03	1.18E-02	6.09E-01	
Totals	1206028			**2.95E+02**	**2.78E+02**	**1.38E+01**	**3.09E+01**	**5.12E+03**	**4.17E+02**	**1.77E+02**	**3.08E+01**	**2.04E+02**	6.57E+03	
% of Total				4.5%	4.2%	0.2%	0.5%	78.0%	6.4%	2.7%	0.5%	3.1%		
Notes:								**Summed for All Listed Nuclides =**				**6.57E+03**	**Ci**	
a: Waste streams with < 0.01 Ci not included.														
1: Source: *Chemical Plant Operable Unit Remedial Action Report* (DOE/OR/21548-909) Rev. A, September 2002, p. 13														
2: mass (g) = volume (cy) x density (g/cy). See Density Calculations worksheet for raffinate, soil, and filter cake density calculations.														
3: See Radiological Profiles worksheet.														
4: Nuclide Activity (Ci) = mass (g) x Nuclide Activity Concentration (pCi/g) [from Radiological Profiles worksheet] x (1E-12 Ci/pCi)														
5: Rn-222 assumed to be in equilibrium with Ra-226 when Rn-222 concentration not reported in reference.														

Contamination Profiles for the Various Waste Streams										
Profile			Nuclide Activity Concentration (pCi/g)							Source
	U-238	U-234	U-235	Th-228	Th-230	Th-232	Ra-226	Ra-228	Rn-222[3]	
Site soils	103.8	5.8	102.6	4.4	10.9	11.2	4.9	4	4.9	Note 6
TSA bulk waste	198	198	9.1	96.4	328	25.7	109	96.4	109	Ref. 1 Tbl 2-2
Raffinate[1,2]	410	410	19	60	27000	320	840	61	988	Ref. 1 Tbl 2-10
Raffinate pit soils[2,4]	41	41	2	6	2700	32	84	6.1	98.8	Ref. 1 Tbl 2-2
										footnote (e)
MSA waste piles[2,5]	Total surficial activity = 0.126 Ci									Ref. 1 Tbl 2-15
MSA containerized waste	5239	198	13	3	16	28	3	0	3	Ref. 1 Tbl 2-16
MSA WTP filter cake	90420	90420	4159	4.22	58.6	11.4	175	65	175	Ref. 1 Tbl 2-17
TSA filter cake[2]	1563	1563	73	0.8	58.6	11.4	6.3	5.3	6.3	Ref. 2 Tbl 3-3
TSA non-filter cake	3200	3200	150	96.4	23000	86000	108.8	96.4	108.8	Ref. 2 Tbl 3-5
containerized waste[2]										
References										
1. *Hazard Categorization for the Disposal Cell* (DOE/OR/21548-579) Rev. 2, September 1997										
2. *Interim Facility Safety Documentation for the Temporary Storage Area* (DOE/OR/21548-513) Rev. 3, December 1997										
Notes										
1: This is raffinate concentrations, not grout (i.e. first column of Table 2-10).										
2: Reference provides either total U only, or U-238 only. Natural U ratios assumed to calculate isotopic i.e. U-238 = U-234 = total U/2.047,										
and U-235 = total U x (0.047/2.047).										
3: Rn-222 assumed to be in equilibrium with Ra-226 when Rn-222 concentration not reported in reference.										
4: Raffinate pit soils activity is assumed to be equivalent to 10% of raffinate activity.										
5: MSA waste piles were building components surficially contaminated with uranium. Total (surficial) uranium activity is 0.126 Ci.										
6: See next page - Site Soils Radiological Profile Calculation										
Site Soils Radiological Profile Calculation										

From *Interim Facility Safety Documentation for the Ash Pond Storage Area* (DOE/OR/21548-551) Rev. 1, December 1996

	Source			Activity Concentration (pCi/g)						
Source	Vol (cy)	Wtd Vol[1]	U-238	U-235	U-234	Th-228	Th-230	Th-232	Ra-226	Ra-228
Imhoff Tank sludge Tbl 3-1	510	0.001972	843.0	35.9	831.1	5.6	26.0	5.2		
Weighted Activity (pCi/g)[2]			1.7	0.1	1.6	0.0	0.1	0.0		
Decon sump Tbl 3-2	56	0.000217	256.4	10.9	252.7					
Weighted Activity (pCi/g)[2]			0.1	0.0	0.1					
Bldg demo waste Tbl 3-3	73270	0.283327	250.0	15.0	246.0	2.7	25.7	28.0	3.4	
Weighted Activity (pCi/g)[2]			70.8	4.2	69.7	0.8	7.3	7.9	1.0	
Vicinity prop. soils Tbl 3-4	3640	0.014075	20.0	0.9	20.0	1.4	1.2	0.8	1.3	1.4
Weighted Activity (pCi/g)[2]			0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Bldg found. soils Tbl 3-5	170000	0.657371	42.3	2.0	42.3	5.5	5.4	5.0	6.0	6.0
Weighted Activity (pCi/g)[2]			27.8	1.3	27.8	3.6	3.5	3.3	3.9	3.9
Bldg found. conc. Tbl 3-6	11130	0.043038	73.3	3.4	73.3					
Weighted Activity (pCi/g)[2]			3.2	0.1	3.2					
Total waste volume (cy)	258606									
Sum of Weighted Activities			103.8	5.8	102.6	4.4	10.9	11.2	4.9	4.0

Notes:

1: Weighted volume = source volume / total waste volume

2: Weighted Activity = weighted volume x activity concentration

Density Calculations
From *Hazard Categorization for the Chemical Stabalization and Solidification Facility* (DOE/OR/21548-570) Rev. 4, November 1997

1. Section 2.1, p. 4: maximum sludge concentration (i.e. dry sludge solids in water) in raffinate pits before dredging = 27%
2. Section 2.1, p. 5: density of dry sludge solids = 1.8148 g/cu cm

in-situ sludge density = [fractional sludge concentration x density of dry sludge solids] + [fractional water concentration x density of water]
= [0.27 x 1.8148] + [0.73 x 1.00]
= 1.22 g/cu cm

= 1.22 g/cu cm x [2.54 cm/(1/12) ft]^3 x (27 cf/cy)
= 932754 g/cy
76 lb/cf

From e-mail from Serban Grozescu to David Fleming dated 9-9-02, subject "sludge"

Soil density = 105 lb/cf
= 105 lb/cf x (454 g/lb) x (27 cf/cy)
= 1287090 g/cy

From *Interim Facility Safety Documentation for the Temporary Storage Area* (DOE/OR/21548-513) Rev. 3, December 1997, p. 10

1. Density of filter cake = 1.25 g/cu cm
= 1.25 g/cu cm x [2.54 cm/(1/12) ft]^3 x (27 cf/cy)
= 955694 g/cy