49248

EG&G ROCKY FLATS

INTEROFFICE CORRESPONDENCE

DATE: November 16, 1994

TO: T. d. Beckman, Solar Pond Projects, Bldg. 080, X8725

FROM: T. D. Schmidt, Solar Pond Projects, Bldg. 080, X8713
S. P. Needler, Group I Closures, Bldg. 080, X6961

SUBJECT: NONRADIOLOGICAL STATUS OF PONDSLUDGE FROM PONDS 207A AND 207B - TDS-014-94, SPN-007-94

DOE Order: 1540.2

Action: None required

The pondsludge from pond 207A and the three 207B ponds is below the threshold that the Department of Transportation (DOT) uses to determine whether shipped material is considered radiological or not. In other words, all pondsludge taken from these ponds is considered to be non-radiological material. Since the sludge is more contaminated than the pond liquid, the liquid is also below the radioactivity threshold. Any material removed from these ponds is therefore exempt from any DOT regulations specific to radioactive material.

The calculations are attached to this memo.

jlb

Attachment:
As Stated

cc:
L. A. Collins
S. R. Keith
K. F. Lenarcic
File
ERPD Records (2)

ADMIN RECORD

I101-A-00019

1/19

ENVIRONMENTAL RESTORATION PROGRAM DIVISION

SOLAR POND PROJECTS

207A, 207B-NORTH, 207B-CENTER, AND 207B-SOUTH PONDS

TREATABILITY SAMPLE DATA EVALUATION FOR DEPARTMENT OF TRANSPORTATION AND HALLIBURTON NUS LABORATORY PURPOSES

PREPARED BY:

TOM D. SCHMIDT

AND

STEVEN P. NEEDLER

NOVEMBER 8, 1994

LOWER LIMIT - 2 nanocuries [(§173.403(y)]

UPPER LIMIT - 1)200 MILLIREM PER HOUR AT ANY POINT ON THE EXTERNAL SURFACE OF THE PACKAGE [§173.441(a)]

2)NRC RAD LIMITS OF LABORATORY LICENSE [1 millicurie (0.001 Ci) Americium 241], [2 grams Plutonium].

Baseline Information

a) Per §173.403(n)(3), Liquids [with a liquid volume exceeding 50 cubic centimeters (1.7 fluid ounces)] shall have sufficient absorbent material as prescribed in paragraph (n)(2) which requires sufficient absorbent material to absorb twice the volume of the liquid contents. Absorbent material shall be compatible with the package contents and suitably positioned to contact the liquid in the event of leakage.

b) Per §173.403(y), Radioactive material means any material having a specific activity greater than 0.002 microcuries per gram.

c) Per §173.403(n)(4)(i), Low Specific Activity (LSA) is defined as 0.0001 millicurie per gram of radionuclides for which the A_2 quantity is not more than .05 curie.

d) Per §173.441, Radiation level limits are not to exceed 200 millirems per hour at any point on the external surface of the package, and the transport index does not exceed 10 [see §173.403(bb)].

e) §173.425(a) requires a DOT Specification 7A Type A package.

f) The Halliburton NUS Pittsburgh Laboratory NRC Radiological limits are less than 2 grams of Plutonium, and less than 1 millicurie of Americium.

207A POND SLUDGE/WATER

a) Radioactive levels are determined from the radiochemistry information provided in the Teledyne analysis contained within the 1991 Roy F. Weston Characterization of Pond Sludge Report, Sample number 39538 (dry sludge), attached. In addition, specific gravity and sludge moisture levels are from the Weston Report.

Composite analytical data (mean + 2 standard deviations) was utilized for conservatism.

1. Calculation for Department of Transportation (DOT) regulations.

For 207A dry sludge, the gross alpha is 5.6E3 pCi/gram, and the gross beta is 1.5E3 pCi/gram. If we ignore gamma radiation (this is a reasonable assumption because the primary radionuclides are not gamma emitters), the total 207A dry sludge radioactivity is then 7.1E3 pCi/gram. Since the 207A wet sludge is 87.3% liquid by weight, the wet sludge radioactivity = (7.1E3 pCi/gram)(.127) + (0.0 pCi/gram)(.873) = 9.0E2 pCi/gram = 0.9 nCi/gram. Since this is below the DOT threshold of 2.0 nCi/gram as per b) above, the 207A sludge is not radioactive per DOT regulations.

2. Calculation for Laboratory Limits.

The Halliburton NUS Pittsburgh Laboratory NRC Radiological limits are less than 2 grams of Plutonium, and less than 1 millicurie of Americium.

Pu in SLUDGE

$$\frac{\text{Pu239}}{\text{Sludge}} = \frac{97\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.000097\ \mu\text{Ci/g} = \frac{0.000097\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 9.7\times10^{-11}\ \text{Ci/g}$$

(or 0.097 nCi/g)

The moisture content in the 207A Pond sludge is 87.3% by weight, therefore:

1 kg sludge	127 grams of solids x 0.097 nCi/g	=12.3 nCi
	873 grams of liquid x 0.0 nCi/g	= 0.0 nCi
		12.3 nCi/kg

or (0.000012 mCi/kg sludge)

Using the specific activity figure of 7.6E-2 Ci/g (supplied by Jerry Anderson), there are (0.000012 mCi) (1 gram/7.6E-2 Ci) = 0.0002 mg Pu per kg of sludge = 2E-7 gram Pu/ kg sludge.

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.1 SG) (1 kg sludge/1 liter) (2E-7 gram Pu/kg sludge) = 0.000046 grams Pu.

Am-241 in SLUDGE

$$\frac{\text{Am241}}{\text{Sludge}} = \frac{1.6\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000016\ \mu\text{Ci/g} = \frac{0.0000016\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 1.6\times10^{-12}\ \text{Ci/g}$$

(or 0.0016 nCi/g)

The moisture content in the 207A Pond sludge is 87.3% by weight, therefore:

1 kg sludge =	127 grams of solids x 0.0016 nCi/g	= 0.20 nCi
	873 grams of liquid x 0.0 nCi/g	= 0.0 nCi
		0.20 nCi/kg

or (0.0000002 mCi/kg sludge)

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.1 SG) (1 kg sludge/1 liter) (2.0E-7 mCi Am/kg sludge) = 0.000046 mCi Am.

CONCLUSION:

1. The 207A sludge is nonradioactive material per DOT regulation.

2. Each 55 gallon drum contains 0.000046 grams Pu and 0.000046 mCi Am, which are much lower than laboratory limits.

207B NORTH POND SLUDGE/WATER

a) Radioactive levels are determined from the radiochemistry information provided in the Teledyne analysis contained within the 1991 Roy F. Weston Characterization of Pond Sludge Report, Sample number 38960 (dry sludge), attached. In addition, specific gravity and sludge moisture levels are from the Weston Report.

Composite analytical data (mean + 2 standard deviations) was utilized for conservatism.

1. Calculation for Department of Transportation (DOT) regulations.

For 207B North dry sludge, the gross alpha is 4.2E1 pCi/gram, and the gross beta is 4.9E1 pCi/gram. If we ignore gamma radiation (this is a reasonable assumption because the primary radionuclides are not gamma emitters), the total 207B North dry sludge radioactivity is then 9.1E1 pCi/gram. Since the 207B North wet sludge is 73.4% liquid by weight, the wet sludge radioactivity = (0.0 pCi/gram)(.734) + (9.1E1 pCi/gram)(.266) = 2.4E1 pCi/gram = 0.024 nCi/gram. Since this is below the DOT threshold of 2.0 nCi/gram, the 207B North sludge is not radioactive per DOT regulations.

2. Calculation for Laboratory Limits.

The laboratory limits are less than 2 grams of Plutonium, and less than 1 millicurie of Americium.

Pu in SLUDGE

$$\frac{\text{Pu239}}{\text{Sludge}} = \frac{3.3\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000033\ \mu\text{Ci/g} = \frac{0.0000033\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 3.3\text{x}10^{-12}\ \text{Ci/g}\ (\text{or } 0.0033\ \text{nCi/g})$$

The Halliburton NUS Pittsburgh Laboratory NRC Radiological Limit for any Plutonium is 2 grams and the Plutonium level in the 207B North Pond dry sludge is 0.0033 nCi/g or $3.3\text{x}10^{-12}$ Ci/g Pu.

The moisture content in the 207B North Pond sludge is 73.4% by weight, therefore:

1 kg sludge =	266 grams of solids x 0.0033 nCi/g	= 0.88 nCi
	734 grams of liquid x 0.0 nCi/g	= 0.00 nCi
		0.88 nCi/kg sludge

or (0.00000088 mCi/kg sludge)

Using the specific activity figure of 7.6E-2 Ci/g (supplied by Jerry Anderson), there are (0.00000088 mCi) (1 gram/7.6E-2 Ci) = 1.2E-5 mg Pu per kg of sludge = 1.2E-8 gram Pu/ kg sludge.

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.2 SG) (1 kg sludge/1 liter) (1.2E-8 gram Pu/kg sludge) = 3.0E-6 grams Pu.

Am-241 in SLUDGE

$$\frac{\text{Am241}}{\text{Sludge}} = \frac{1.6\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000016\ \mu\text{Ci/g} = \frac{0.0000016\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 1.6\text{x}10^{-12}\ \text{Ci/g}\ (\text{or } 0.0016\ \text{nCi/g})$$

The moisture content in the 207B North Pond sludge is 73.4% by weight, therefore:

1 kg sludge =	266 grams of solids x 0.0016 nCi/g =	0.43 nCi
	734 grams of liquid (0.0) nCi/g =	0.0 nCi
		0.43 nCi/kg

or (0.00000043 mCi/kg sludge)

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.2 SG) (1 kg sludge/1 liter) (4.3E-7 mCi Am/kg sludge) = 0.00010 mCi Am.

CONCLUSION:

1. The 207B North sludge is nonradioactive material per DOT regulation.

2. Each 55 gallon drum contains 3.0E-6 grams Pu and 0.00010 mCi Am, which are much lower than laboratory limits.

207B CENTER POND SLUDGE/WATER

a) Radioactive levels are determined from the radiochemistry information provided in the Teledyne analysis contained within the 1991 Roy F. Weston Characterization of Pond Sludge Report, Sample number 39543 (dry sludge), attached. In addition, specific gravity and sludge moisture levels are from the Weston Report.

Composite analytical data (mean + 2 standard deviations) was utilized for conservatism.

1. Calculation for Department of Transportation (DOT) regulations.

For 207B Center dry sludge, the gross alpha is 1.5E2 pCi/gram, and the gross beta is 4.3E2 pCi/gram. If we ignore gamma radiation (this is a reasonable assumption because the primary radionuclides are not gamma emitters), the total 207B Center dry sludge radioactivity is then 5.8E2 pCi/gram. Since the 207B Center wet sludge is 92.1% liquid by weight, the wet sludge radioactivity = (7.1E3 pCi/gram)(.073) + (0.0 pCi/gram)(.921) = 5.2E2 pCi/gram = 0.52 nCi/gram. Since this is below the DOT threshold of 2.0 nCi/gram, the 207B Center sludge is not radioactive per DOT regulations.

2. Calculation for Laboratory Limits.

The Halliburton NUS Pittsburgh Laboratory NRC Radiological limits are less than 2 grams of Plutonium, and less than 1 millicurie of Americium.

Pu in SLUDGE

$$\frac{\text{Pu239}}{\text{Sludge}} = \frac{6.7\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000067\ \mu\text{Ci/g} = \frac{0.0000067\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 6.7\text{x}10^{-12}\ \text{Ci/g}$$

(or 0.0067 nCi/g)

The moisture content in the 207B Center Pond sludge is 92.1% by weight, therefore:

1 kg sludge =	78 grams of solids x 0.0067 nCi/g	= 0.52 nCi
	921 grams of liquid x 0.0 nCi/g	= 0.00 nCi
		0.52 nCi/kg

or (0.00000052 mCi/kg sludge)

Using the specific activity figure of 7.6E-2 Ci/g (supplied by Jerry Anderson), there are (0.00000052 mCi) (1 gram/7.6E-2 Ci) = 6.8E-6 mg Pu per kg of sludge = 6.8E-9 gram Pu/ kg sludge.

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.0 SG) (1 kg sludge/1 liter) (6.8E-9 gram Pu/kg sludge) = 0.0000014 grams Pu.

Am-241 in SLUDGE

$$\frac{\text{Am241}}{\text{Sludge}} = \frac{1.15\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.00000115\ \mu\text{Ci/g} = \frac{0.00000115\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 1.15\text{x}10^{-12}\ \text{Ci/g}$$

(or 0.00115 nCi/g)

The moisture content in the 207B Center Pond sludge is 92.1% by weight, therefore:

1 kg sludge =	79 grams of solids x 0.00115 nCi/g	= 0.09 nCi
	921 grams of liquid (0.0) nCi/g	= 0.00 nCi
		0.09 nCi/kg

or (0.00000009 mCi/kg sludge)

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.0 SG) (1 kg sludge/1 liter) (9E-8 mCi Am/kg sludge) = 0.000019 mCi Am.

CONCLUSION:

1. The 207B Center sludge is nonradioactive material per DOT regulation.

2. Each 55 gallon drum contains 0.0000014 grams Pu and 0.000019 mCi Am, which are much lower than laboratory limits.

207B SOUTH POND SLUDGE/WATER

a) Radioactive levels are determined from the radiochemistry information provided in the Teledyne analysis contained within the 1991 Roy F. Weston Characterization of Pond Sludge Report, Sample number 40034 (dry sludge), attached. In addition, specific gravity and sludge moisture levels are from the Weston Report.

Composite analytical data (mean + 2 standard deviations) was utilized for conservatism.

1. Calculation for Department of Transportation (DOT) regulations.

For 207B South dry sludge, the gross alpha is 1.9E2 pCi/gram, and the gross beta is 5.8E2 pCi/gram. If we ignore gamma radiation (this is a reasonable assumption because the primary radionuclides are not gamma emitters), the total 207B South dry sludge radioactivity is then 7.7E2 pCi/gram. Since the 207B South wet sludge is 88.1% liquid by weight, the wet sludge radioactivity = (0.0 pCi/gram)(.881) + (7.7E2 pCi/gram)(.119) = 9.2E1 pCi/gram = 0.0092 nCi/gram. Since this is below the DOT threshold of 2.0 nCi/gram, the 207B South sludge is not radioactive per DOT regulations.

2. Calculation for Laboratory Limits.

The Halliburton NUS Pittsburgh Laboratory NRC Radiological limits are less than 2 grams of Plutonium, and less than 1 millicurie of Americium.

Pu in SLUDGE

$$\frac{\text{Pu239}}{\text{Sludge}} = \frac{2.4\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000024\ \mu\text{Ci/g} = \frac{0.0000024\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 2.4\text{x}10^{-12}\ \text{Ci/g}$$

(or 0.0024 nCi/g)

The moisture content in the 207B South Pond sludge is 88.1% by weight, therefore:

1 kg sludge =	119 grams of solids x 0.0024 nCi/g	= 0.29 nCi
	881 grams of liquid x 0.0 nCi/g	= 0.00 nCi
		0.29 nCi/kg sludge

or (0.00000029 mCi/kg sludge)

Using the specific activity figure of 7.6E-2 Ci/g (supplied by Jerry Anderson), there are (0.00000029 mCi) (1 gram/7.6E-2 Ci) = 3.8E-6 mg Pu per kg of sludge = 3.8E-9 gram Pu/ kg sludge.

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.1 SG) (1 kg sludge/1 liter) (3.8E-9 gram Pu/kg sludge) = 8.7E-7 grams Pu.

Am-241 in SLUDGE

$$\frac{\text{Am241}}{\text{Sludge}} = \frac{3.3\ \text{pCi}}{\text{gram}} \times \frac{1\ \mu\text{Ci}}{1{,}000{,}000\ \text{pCi}} = 0.0000033\ \mu\text{Ci/g} = \frac{0.0000033\ \mu\text{Ci}}{\text{gram}} \times \frac{1\ \text{Ci}}{1{,}000{,}000} = 3.3\text{x}10^{-12}\ \text{Ci/g}$$

(or 0.0033 nCi/g)

The moisture content in the 207B South Pond sludge is 88.1% by weight, therefore:

1 kg sludge = 119 grams of solids x 0.0033 nCi/g = 0.39 nCi
881 grams of liquid (0.0) nCi/g = 0.0 nCi
0.39 nCi/kg

or (0.00000039 mCi/kg sludge)

Each 55 gallon drum then contains (55 gallons) (3.785 l/gal) (1.1 SG) (1 kg sludge/1 liter) (3.9E-7 mCi Am/kg sludge) = 0.000089 mCi Am.

CONCLUSION:

1. The 207B South sludge is nonradioactive material per DOT regulation.

2. Each 55 gallon drum contains 8.7E-7 grams Pu and 0.000089 mCi Am, which are much lower than laboratory limits.

The total amount of plutonium and americium in the shipment to Halliburton NUS from Building 788 is now calculated and compared to the laboratory's limits. This consists of six 55 gallon drums (2 from 207A, 2 from 207B North, and 2 from 207B Center), and three 30 gallon drums (all from B South). The total plutonium is

Pu(tot) = 2 (0.000046 grams) + 2 (3E-6 grams) + 2 (0.0000014 grams) + 3 (8.7E-7 grams X 30/55) = 5.1E-5 grams Pu.

The total americium is
Am (tot) = 2 (0.000046 mCi) + 2 (0.0001 mCi) + 2 (0.000019 mCi) + 3 (0.000089 mCi X 30/55) = 3.8E-4 mCi Am.

The plutonium and americium totals are much smaller than the limits of 2 grams plutonium and 1 millicurie of americium.

PREPARED BY:

11/8/94
T. D. SCHMIDT

11/8/94
S. P. NEEDLER

REVIEWED BY:

8Nov94
T. d. BECKMAN

CONCURRED BY:

11/9/94
RADIOLOGICAL ENGINEERING

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE
4-1803	LSA LL-0771-E2	05/20/91	06/22/91	1

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

SEDIMENT/SILT

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
39518	207A-CP-SL		05/17				GR-A	5.1 +-0.5 E 03		06/18			3
							GR-B	1.4 +-0.1 E 03		06/18			3
							GR-A	L.T. 2. E 01		06/18			3
							GR-B	L.T. 1. E-01		06/18			3
							U-234	9.5 +-0.2 E 01		06/23			6
							U-235	2.9 +-0.3 E 00		06/23			6
							U-238	9.3 +-0.2 E 01		06/23			6
							AM-241	1.5 +-0.1 E 00		06/23			6
							PU-239	7.2 +-2.5 E 01		06/21			6
							PU-239	L.T. 1. E 01		06/21			6
							AM-241	L.T. 6. E-03		06/23			6
							U-234	L.T. 3. E-02		06/23			6
							U-235	L.T. 2. E-02		06/23			6
							U-238	L.T. 2. E-02		06/23			6

12.
+ 25/91

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 2
4-1803	LSA LL-0771-E2	05/20/91	06/22/91	

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
39536	207A-CP-LQ		05/17				GR-A	3.0 +-0.6 E 02		07/18			3
							GR-B	9.3 +-0.6 E 02		07/18			3
							GR-A	L.T. 3. E 01		07/18			3
							GR-B	L.T. 3. E 01		07/18			3
							U-234	3.1 +-0.1 E 02		06/09			6
							U-235	1.1 +-0.1 E 01		06/09			6
							U-238	3.4 +-0.1 E 02		06/09			6
							AM-241	4.2 +-1.9 E-01		06/11			6
							PU-239	7.1 +-2.9 E-01		06/24			6
							AM-241	L.T. 8. E-02		06/11			6
							U-234	L.T. 1. E-01		06/09			6
							U-235	L.T. 1. E-01		06/09			6
							U-238	L.T. 3. E-01		06/09			6
							PU-239	L.T. 8. E-02		06/24			6
39537	207A-CP-MS		05/17				GR-A	4.3 +-0.7 E 02		07/18			3
							GR-B	8.5 +-0.6 E 02		07/18			3
							GR-A	L.T. 3. E 01		07/18			3
							GR-B	L.T. 3. E 01		07/18			3
							U-234	3.1 +-0.1 E 02		06/11			6
							U-235	1.4 +-0.3 E 01		06/11			6
							U-238	3.3 +-0.1 E 02		06/11			6
							AM-241	L.T. 5. E-01		06/13			6
							PU-239	4.8 +-1.7 E-01		06/11			6
							AM-241	2.9 +-3.2 E-01		06/13			6
							U-234	L.T. 8. E-01		06/11			6
							U-235	L.T. 4. E-01		06/11			6
							U-238	L.T. 4. E-01		06/11			6
							PU-239	L.T. 6. E-02		06/11			6

.71 .29 .00 1

.48 .17 .65 1

.42 .19 .10 6

.29 .32 .61 1 ✓

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 1
4-1850	LSA LL-0771-E2	05/23/91	06/25/91	

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

SEDIMENT/SILT

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
40034	2078S-CP-SL		05/21				GR-A	1.5 +-0.4 E 02		06/18			3
							GR-B	5.3 +-0.5 E 02		06/18			3
	88.10% moisture						GR-A	L.T. 8. E 00		06/18			3
							GR-B	L.T. 1. E 01		06/18			3
							U-234	1.3 +-0.1 E 02		07/07			6
							U-235	2.9 +-2.2 E 00		07/07			6
							U-238	1.5 +-0.2 E 02		07/07			6
							AM-241	2.4 +-0.9 E 00		07/07			6
							PU-239	1.9 +-0.5 E 00		07/07			6
							PU-239	L.T. 2. E-01		07/07			6
							AM-241	L.T. 2. E-01		07/07			6
							U-234	L.T. 2. E 00		07/07			6
							U-235	L.T. 1. E 00		07/07			6
							U-238	L.T. 1. E 00		07/07			6
40035	2078S-NW-SL		05/21				GR-A	2.0 +-0.4 E 02		06/18			3
							GR-B	5.2 +-0.5 E 02		06/18			3
							GR-A	L.T. 8. E 00		06/18			3
							GR-B	L.T. 1. E 01		06/18			3
							U-234	3.5 +-2.1 E-02		06/24			6
							U-235	1.6 +-0.1 E 00		06/24			6
							U-238	3.8 +-2.2 E-02		06/24			6
							AM-241	1.2 +-0.6 E 00		06/25			6
							PU-239	7.4 +-0.3 E 00		06/25			6
							PU-239	L.T. 9. E-03		06/25			6
							AM-241	L.T. 2. E-01		06/25			6
							U-234	L.T. 9. E-03		06/24			6
							U-235	L.T. 9. E-03		06/24			6
							U-238	L.T. 9. E-03		06/24			6

1.9
.5
2.4

1
2.4
.9
3.3

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 4
4-1850	LSA LL-0771-E2	05/23/91	06/25/91	

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
40032	207BS-CP-LQ		05/21				GR-A	1.6 +-0.2 E 03		07/18			3
							GR-B	2.3 +-0.2 E 03		07/18			3
							GR-A	L.T. 8. E 01		07/18			3
							GR-B	L.T. 9. E 01		07/18			3
							U-234	7.6 +-0.5 E 02		06/15			6
							U-235	3.1 +-1.1 E 01		06/15			6
							U-238	8.7 +-0.6 E 02		06/15			6
							AM-241	1.3 +-1.1 E-01		06/15			6
							PU-239	1.4 1.2 E-01		06/15			6
							AM-241	L.T. 1. E-01		06/15			6
							U-234	L.T. 4. E 00		06/15			6
							U-235	L.T. 4. E 00		06/15			6
							U-238	L.T. 5. E 00		06/15			6
							PU-239	L.T 7. E-02		06/15			6
40033	207BS-CP-MS		05/21				GR-A	1.4 +-0.2 E 03		07/18			3
							GR-B	1.9 +-0.2 E 03		07/18			3
							GR-A	L.T. 8. E 01		07/18			3
							GR-B	L.T. 9. E 01		07/18			3
							U-234	4.2 +-0.3 E 02		06/15			6
							U-235	8.4 +-4.3 E 00		06/15			6
							U-238	4.4 +-0.3 E 02		06/15			6
							AM-241	1.3 +-1.1 E-01		06/18			6
							PU-239	L.T. 1. E-01		06/15			6
							AM-241	L.T. 7. E-02		06/18			6
							U-234	L.T. 2. E 00		06/15			6
							U-235	L.T. 2. E 00		06/15			6
							U-238	L.T. 2. E 00		06/15			6
							PU-239	7.6 +-9.8 E-02		06/15			6

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 4
4-1804	LSA LL-0771-E2	05/20/91	06/22/91	

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
39544	207BC-CP-LQ		05/19				GR-A	2.4 +-0.3 E 03		07/18			3
							GR-B	3.9 +-0.2 E 03		07/18			3
							GR-A	L.T. 1. E 02		07/18			3
							GR-B	L.T. 1. E 02		07/18			3
							U-234	7.8 +-0.3 E 02		06/11			6
							U-235	3.6 +-0.7 E 01		06/11			6
							U-238	9.0 +-0.4 E 02		06/11			6
							AM-241	5.5 +-4.5 E 00		06/13			6
							PU-239	3.6 +-1.8 E-01		06/11			6
							AM-241	L.T. 2. E 00		06/13			6
							U-234	L.T. 1. E 00		06/11			6
							U-235	L.T. 1. E 00		06/11			6
							U-238	L.T. 1. E 00		06/11			6
							PU-239	L.T. 6. E-02		06/11			6
39545	207BC-CP-MS		05/19				GR-A	2.3 +-0.3 E 03		07/26			3
							GR-B	3.1 +-0.2 E 03		07/18			3
							GR-A	L.T. 1. E 02		07/18			3
							GR-B	L.T. 1. E 02		07/18			3
							U-234	1.1 +-0.1 E 03		06/12			6
							U-235	5.4 +-0.8 E 01		06/12			6
							U-238	1.3 +-0.1 E 03		06/12			6
							AM-241	7.6 +-4.2 E-01		06/13			6
							PU-239	1.8 +-1.5 E-01		06/12			6
							AM-241	L.T. 2. E-01		06/13			6
							U-234	L.T. 8. E-01		06/12			6
							U-235	L.T. 8. E-01		06/12			6
							U-238	L.T. 8. E-01		06/12			6
							PU-239	L.T. 1. E-01		06/12			6

1
.36
.18
.54
.5

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE
4-1804	LSA LL-0771-E2	05/20/91	06/22/91

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

SEDIMENT/SILT

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
39543	2078C-CP-SL		05/19				GR-A	1.2 +-0.3 E 02		06/18			3
							GR-B	3.8 +-0.5 E 02		06/18			3
							GR-A	L.T. 8. E 00		06/18			3
							GR-B	L.T. 1. E 01		06/18			3
							U-234	7.0 +-0.2 E 01		06/23			6
							U-235	2.5 +-0.4 E 00		06/23			6
							U-238	7.5 +-0.2 E 01		06/23			6
							AM-241	L.T. 1. E 00		06/24			6
							PU-239	5.1 +-1.6 E 00		06/22			6
							PU-239	L.T. 4. E-01		06/22			6
							AM-241	3.6 +-7.9 E-01		06/24			6
							U-234	L.T. 5. E-02		06/23			6
							U-235	L.T. 5. E-02		06/23			6
							U-238	L.T. 5. E-02		06/23			6

2.1 %

5.1
1.6
6.7

.36
.79
1.15

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 4
4-1807	LSA LL-0771-E2	05/15/91	06/17/91	

MR MARK SELMON
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
38953	207BN-CP-MSD		05/13				GR-A	4.9 +-2.0 E 01		07/18			3
							GR-B	1.1 +-0.2 E 02		07/18			3
							GR-A	L.T. 2. E 01		07/18			3
							GR-B	L.T. 2. E 01		07/18			3
							U-234	1.9 +-0.9 E 01		06/09			6
							U-235	8.7 +-6.5 E 00		06/09			6
							U-238	2.3 +-0.3 E 02		06/09			6
							AM-241	7.2 +-0.9 E 02		06/11			6
							PU-239	1.2 +-1.1 E-01		06/09			6
							AM-241	L.T. 7. E 00		06/11			6
							U-234	L.T. 3. E 00		06/09			6
							U-235	L.T. 3. E 00		06/09			6
							U-238	L.T. 5. E 00		06/09			6
							PU-239	L.T. 7. E-02		06/09			6
38954	207BN-CP-LO		05/13				GR-A	5.9 +-2.1 E 01		07/18			3
							GR-B	1.1 +-0.2 E 02		07/18			3
							GR-A	L.T. 2. E 01		07/18			3
							GR-B	L.T. 2. E 01		07/18			3
							U-234	4.0 +-0.2 E 01		06/11			6
							U-235	1.7 +-0.5 E 00		06/11			6
							U-238	2.6 +-0.2 E 01		06/11			6
							AM-241	1.4 +-1.1 E-01		06/11			6
							PU-239	L.T. 1. E-01		06/11			6
							AM-241	L.T. 6. E-02		06/11			6
							U-234	L.T. 2. E-01		06/11			6
							U-235	L.T. 1. E-01		06/11			6
							U-238	L.T. 1. E-01		06/11			6
							PU-239	3.5 +-71.7E-03		06/11			6

72.4% [illegible]

.12
.11
.23

.0035
.0710
.0745

.14
.11
.25

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 07/24/91

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE
4-1807	LSA LL-0771-F2	05/15/91	06/17/91

MR MARK SELMAN
WESTON INC
215 UNION BLVD - STE 600
LAKEWOOD CO 80228

SLUDGE

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
38960	207-BN-CP-SL		05/13				GR-A	3.3 +-0.9 E 01		06/20			3
							GR-B	4.6 +-0.3 E 01		06/20			3
							GR-A	L.T. 5. E 00		06/20			3
							GR-B	L.T. 2. E 00		06/20			3
							U-234	1.3 +-0.1 E 01		06/22			6
							U-235	4.1 +-1.3 E-01		06/22			6
							U-238	8.4 +-0.6 E 00		06/22			6
							PU-239	2.2 +-1.1 E 00		06/21			6
							AM-241	L.T. 1. E 00		06/25			6
							AM-241	2.0 +-7.2 E-01		06/25			6
							PU-239	L.T. 4. E-01		06/21			6
							U-234	L.T. 4. E-02		06/22			6
							U-235	L.T. 3. E-02		06/22			6
							U-238	L.T. 3. E-02		06/22			6

2.2
1.1
3.3

.2
.12
.9 2