

Appendix D

Summary of Quality Assurance Crosscheck Analyses



Keeping Up With Regulatory Changes

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Table D - 1

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the DOE Environmental Measurements Laboratory (EML)
Quality Assessment Program (QAP) 46; EML-591 QAP 9703, July 1, 1997**

Radionuclide	Matrix	Actual	Reported	Ratio	Accept?	Analyzed by:
Am-241	Air filter	1.52E-01	1.48E-01	0.97	Yes	EPI
Co-57	Air filter	1.08E+01	1.03E+01	0.95	Yes	EPI
Co-60	Air filter	5.01E+00	4.69E+00	0.94	Yes	EPI
Cs-134	Air filter	1.09E+01	1.08E+01	0.99	Yes	EPI
Cs-137	Air filter	8.70E+00	8.57E+00	0.99	Yes	EPI
Gross Alpha	Air filter	9.60E-01	1.01E+00	1.05	Yes	EPI
Gross Beta	Air filter	4.50E-01	4.59E-01	1.02	Yes	EPI
Mn-54	Air filter	7.62E+00	7.59E+00	1.00	Yes	EPI
Pu-238	Air filter	1.00E-01	9.80E-02	0.98	Yes	EPI
Pu-239	Air filter	1.19E-01	1.18E-01	0.99	Yes	EPI
Sb-125	Air filter	1.23E+01	1.32E+01	1.07	Yes	EPI
Sr-90	Air filter	1.45E+00	1.52E+00	1.05	Yes	EPI
U-234	Air filter	1.03E-01	9.80E-02	0.95	Yes	EPI
U-238	Air filter	1.05E-01	1.03E-01	0.99	Yes	EPI
U (µg/filter)	Air filter	8.45E+00	9.65E+00	1.14	Yes	EPI
Gross Alpha	Air filter	9.60E-01	8.41E-01	0.88	Yes	EL
Gross Beta	Air filter	4.50E-01	4.67E-01	1.04	Yes	EL
Am-241	Soil	5.68E+00	5.88E+00	1.04	Yes	EPI
Co-60	Soil	1.06E+00	8.68E-01	0.82	Pass	EPI
Cs-137	Soil	8.26E+02	8.85E+02	1.07	Yes	EPI
K-40	Soil	3.34E+02	3.69E+02	1.10	Yes	EPI
Pu-239	Soil	1.35E+02	1.35E+02	1.00	Yes	EPI
Sr-90	Soil	4.03E+01	3.03E+01	0.75	Yes	EPI
U-234	Soil	3.76E+01	3.96E+01	1.05	Yes	EPI
U-238	Soil	4.24E+01	4.07E+01	0.96	Yes	EPI
U (µg/g)	Soil	3.43E+00	3.70E+00	1.08	Yes	EPI
Am-241	Veg	1.18E+00	1.21E+00	1.02	Yes	EPI
Co-60	Veg	1.25E+01	1.56E+01	1.25	Pass	EPI
Cs-137	Veg	1.89E+02	2.36E+02	1.25	Yes	EPI
K-40	Veg	8.12E+02	1.10E+03	1.35	Pass	EPI
Pu-239	Veg	1.94E+00	2.11E+00	1.09	Yes	EPI
Sr-90	Veg	3.61E+02	4.22E+02	1.17	Pass	EPI

Units for air filters: Bq/filter; units for soil and vegetation: Bq/kg; units for water: Bq/L. Units for elemental uranium: µg/filter, µg/g, or µg/mL. Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 1 (concluded)

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the DOE Environmental Measurements Laboratory (EML)
Quality Assessment Program (QAP) 46; EML-591 QAP 9703, July 1, 1997**

Radionuclide	Matrix	Actual	Reported	Ratio	Accept?	Analyzed by:
Am-241	Water	8.37E-01	8.07E-01	0.96	Yes	EPI
Co-60	Water	9.09E+01	9.59E+01	1.06	Yes	EPI
Cs-137	Water	6.98E+01	7.88E+01	1.13	Yes	EPI
Gross Alpha	Water	1.13E+03	1.30E+03	1.14	Yes	EPI
Gross Beta	Water	7.44E+02	6.12E+02	0.82	Yes	EPI
H-3	Water	2.50E+02	2.76E+02	1.10	Yes	EPI
Mn-54	Water	2.09E+01	2.34E+01	1.12	Yes	EPI
Pu-238	Water	1.29E+00	1.29E+00	1.00	Yes	EPI
Pu-239	Water	8.50E-01	7.59E-01	0.89	Pass	EPI
Sr-90	Water	2.32E+01	2.23E+01	0.96	Yes	EPI
U-234	Water	5.40E-01	6.03E-01	1.12	Yes	EPI
U-238	Water	5.50E-01	6.03E-01	1.10	Yes	EPI
U (µg/mL)	Water	4.40E-02	5.10E-02	1.14	Yes	EPI
Co-60	Water	9.09E+01	1.01E+02	1.11	Yes	EL
Cs-137	Water	6.98E+01	7.70E+01	1.10	Yes	EL
Gross Alpha	Water	1.13E+03	1.05E+03	0.92	Yes	EL
Gross Beta	Water	7.44E+02	6.14E+02	0.82	Yes	EL
H-3	Water	2.50E+02	2.56E+02	1.02	Yes	EL
Mn-54	Water	2.09E+01	2.48E+01	1.19	Pass	EL
Sr-90	Water	2.32E+01	2.40E+01	1.03	Yes	EL

Units for air filters: Bq/filter; units for soil and vegetation: Bq/kg; units for water: Bq/L. Units for elemental uranium: µg/filter, µg/g, or µg/mL. Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 2

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the DOE Environmental Measurements Laboratory (EML)
Quality Assessment Program (QAP) 47; EML-594 QAP 9709, January 1, 1998**

Isotope	Matrix	Actual	Reported	Ratio	Accept?	Analyzed by:
Am-241	Air filter	2.10E-01	2.00E-01	0.98	Yes	EPI
Co-57	Air filter	1.26E+01	1.12E+01	0.88	Yes	EPI
Co-60	Air filter	1.07E+01	9.58E+00	0.89	Yes	EPI
Cs-134	Air filter	2.82E+01	2.34E+01	0.82	Yes	EPI
Cs-137	Air filter	7.31E+00	6.26E+00	0.85	Yes	EPI
Gross Alpha	Air filter	1.49E+00	2.48E+00	1.66	No	EPI
Gross Beta	Air filter	3.00E+00	2.86E+00	0.95	Yes	EPI
Mn-54	Air filter	6.72E+00	6.12E+00	0.91	Yes	EPI
Pu-238	Air filter	2.10E-01	2.20E-01	1.05	Yes	EPI
Sb-125	Air filter	1.61E+01	1.58E+01	0.98	Yes	EPI
Sr-90	Air filter	2.76E+00	1.80E+00	0.65	No	EPI
U-234	Air filter	5.00E-02	6.00E-02	1.17	Yes	EPI
U-238	Air filter	5.00E-02	6.00E-02	1.11	Yes	EPI
U (µg/filter)	Air filter	4.65E+00	5.02E+00	1.07	Yes	EPI
Gross Alpha	Air filter	1.49E+00	1.23E+00	0.82	Yes	EL
Gross Beta	Air filter	3.00E+00	3.14E+00	1.04	Yes	EL
Am-241	Soil	6.04E+00	5.96E+00	0.98	Yes	EPI
Co-60	Soil	1.50E+00	1.70E+00	1.13	Yes	EPI
Cs-137	Soil	8.10E+02	7.48E+02	0.92	Yes	EPI
K-40	Soil	3.15E+02	2.82E+02	0.89	Yes	EPI
Pu-239	Soil	1.02E+01	1.25E+01	1.22	Yes	EPI
U-234	Soil	3.72E+01	3.49E+01	0.93	Yes	EPI
U-238	Soil	3.49E+01	3.68E+01	1.05	Yes	EPI
U (µg/g)	Soil	2.82E+00	2.89E+00	1.02	Yes	EPI
Am-241	Veg	3.46E+00	3.53E+00	1.02	Yes	EPI
Co-60	Veg	3.24E+01	2.80E+01	0.86	Yes	EPI
Cs-137	Veg	6.24E+02	5.27E+02	0.84	Pass	EPI
K-40	Veg	1.13E+03	1.01E+03	0.89	Pass	EPI
Pu-239	Veg	5.48E+00	5.53E+00	1.00	Yes	EPI

Units for air filters: Bq/filter; units for soil and vegetation: Bq/kg; units for water: Bq/L. Units for elemental uranium: µg/filter, µg/g, or µg/mL. Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 2 (concluded)

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the DOE Environmental Measurements Laboratory (EML)
Quality Assessment Program (QAP) 47; EML-594 QAP 9709, January 1, 1998**

Isotope	Matrix	Actual	Reported	Ratio	Accept?	Analyzed by:
Am-241	Water	7.50E-01	7.40E-01	0.99	Yes	EPI
Co-60	Water	2.33E+01	2.38E+01	1.01	Yes	EPI
Cs-134	Water	6.60E+01	6.56E+01	0.99	Yes	EPI
Cs-137	Water	3.43E+01	3.52E+01	1.02	Yes	EPI
Gross Alpha	Water	5.57E+02	7.99E+02	1.43	Pass	EPI
Gross Beta	Water	7.12E+02	8.56E+02	1.20	Yes	EPI
H-3	Water	1.15E+02	1.34E+02	1.16	Yes	EPI
Mn-54	Water	3.78E+01	4.03E+01	1.06	Yes	EPI
Pu-238	Water	7.20E-01	7.40E-01	1.03	Yes	EPI
Pu-239	Water	7.50E-01	7.80E-01	1.05	Yes	EPI
Sr-90	Water	2.94E+00	2.60E+00	0.88	Yes	EPI
U-234	Water	2.30E-01	2.50E-01	1.08	Yes	EPI
U-238	Water	2.40E-01	2.50E-01	1.05	Yes	EPI
U (µg/mL)	Water	2.00E-02	2.00E-02	1.05	Yes	EPI
Co-60	Water	2.33E+01	2.43E+01	1.04	Yes	EL
Cs-134	Water	6.60E+01	6.62E+01	1.00	Yes	EL
Cs-137	Water	3.43E+01	3.51E+01	1.02	Yes	EL
Gross Alpha	Water	5.57E+02	5.44E+02	0.97	Yes	EL
Gross Beta	Water	7.12E+02	9.54E+02	1.33	Yes	EL
H-3	Water	1.15E+02	1.22E+02	1.06	Yes	EL
Mn-54	Water	3.78E+01	4.19E+01	1.10	Yes	EL
Sr-90	Water	2.94E+00	3.46E+00	1.17	Yes	EL

Units for air filters: Bq/filter; units for soil and vegetation: Bq/kg; units for water: Bq/L. Units for elemental uranium: µg/filter, µg/g, or µg/mL. Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

*Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.*

Table D - 3

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the EPA National Exposure Research Laboratory,
Environmental Science Division (NERL-ESD)**

Sample	Analyte	Matrix	Actual	Reported	Accept?	Analyzed By:
ABW (January 1997)	Alpha	Water	5.2	5.63	Yes	EL
	Alpha	Water	5.2	4.83	Yes	EPI
	Beta	Water	14.7	13.63	Yes	EL
	Beta	Water	14.7	14.23	Yes	EPI
ABW (July 1997)	Alpha	Water	3.1	4.53	Yes	EL
	Alpha	Water	3.1	3.63	Yes	EPI
	Beta	Water	15.1	16.97	Yes	EL
	Beta	Water	15.1	14.07	Yes	EPI
ABW (October 1997)	Alpha	Water	14.7	16.13	Yes	EL
	Alpha	Water	14.7	15.13	Yes	EPI
	Beta	Water	48.9	52.00	Yes	EL
	Beta	Water	48.9	46.47	Yes	EPI
TRW (March 1997)	H-3	Water	7,900	7,882.33	Yes	EL
	H-3	Water	7,900	7,406.67	Yes	EPI
TRW (August 1997)	H-3	Water	11,010	10,861.67	Yes	EL
	H-3	Water	11,010	9,566.67	Pass	EPI
PE-A (April 1997)	Alpha	Water	48	38.97	Yes	EL
	Alpha	Water	48	52.90	Yes	EPI
	Ra-226	Water	13	10.97	Yes	EPI
	Ra-228	Water	3.1	3.67	Yes	EPI
	U(Nat)	Water	24	20.37	Pass	EPI

Units are in pCi/L.

Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI) as indicated.

Explanation of code(s): PE-A = performance evaluation (alpha); PE-B = performance evaluation (beta); GAM = gamma in water; TRW = tritium in water; ABW = alpha and beta in water.

Acceptance limits are statistically defined by NERL-ESD for individual analytes and matrices. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 3 (continued)

Comparison of Radiological Results with Known Results of Crosscheck Samples from the EPA National Exposure Research Laboratory, Environmental Science Division (NERL-ESD)

Sample	Analyte	Matrix	Actual	Reported	Accept?	Analyzed By:
PE-B (April 1997)	Beta	Water	102.1	104.70	Yes	EL
	Beta	Water	102.1	91.97	Yes	EPI
	Sr-89	Water	24	30	Pass	EPI
	Sr-90	Water	13	11.67	Yes	EPI
	Co-60	Water	21	22.33	Yes	EL
	Co-60	Water	21	21.67	Yes	EPI
	Cs-134	Water	31	26.00	Yes	EL
	Cs-134	Water	31	28.67	Yes	EPI
	Cs-137	Water	22	23.67	Yes	EL
	Cs-137	Water	22	24.00	Yes	EPI
PE-A (October 1997)	Alpha	Water	49.9	38.57	Yes	EL
	Alpha	Water	49.9	50.13	Yes	EPI
	Ra-226	Water	5.0	5.40	Yes	EPI
	Ra-228	Water	5.0	6.97	Pass	EPI
	U(Nat)	Water	31.0	30.53	Yes	EPI
PE-B (October 1997)	Beta	Water	143.4	136.30	Yes	EL
	Beta	Water	143.4	123.63	Yes	EPI
	Sr-89	Water	36.0	27.33	Pass	EPI
	Sr-90	Water	22.0	16.67	Yes	EPI
	Co-60	Water	10.0	13.67	Yes	EL
	Co-60	Water	10.0	11.33	Yes	EPI
	Cs-134	Water	41.0	35.67	Yes	EL
	Cs-134	Water	41.0	39.00	Yes	EPI
	Cs-137	Water	34.0	34.67	Yes	EL
	Cs-137	Water	34.0	37.00	Yes	EPI

Units are in pCi/L.

Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI), as indicated.

Explanation of code(s): PE-A = performance evaluation (alpha); PE-B = performance evaluation (beta); GAM = gamma in water; TRW = tritium in water; ABW = alpha and beta in water.

Acceptance limits are statistically defined by NERL-ESD for individual analytes and matrices. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 3 (concluded)

**Comparison of Radiological Results with Known Results of Crosscheck Samples
from the EPA National Exposure Research Laboratory,
Environmental Science Division (NERL-ESD)**

Sample	Analyte	Matrix	Actual	Reported	Accept?	Analyzed By:
GAM (June 1997)	Co-60	Water	18.0	23.33	Yes	EL
	Co-60	Water	18.0	19.00	Yes	EPI
	Zn-65	Water	100.0	114.67	Pass	EL
	Zn-65	Water	100.0	111.33	Yes	EPI
	Cs-134	Water	22.0	19.33	Yes	EL
	Cs-134	Water	22.0	21.67	Yes	EPI
	Cs-137	Water	49.0	51.67	Yes	EL
	Cs-137	Water	49.0	52.67	Yes	EPI
	Ba-133	Water	25.0	24.00	Yes	EL
	Ba-133	Water	25.0	25.67	Yes	EPI
GAM (November 1997)	Co-60	Water	27.0	29.00	Yes	EL
	Co-60	Water	27.0	27.33	Yes	EPI
	Zn-65	Water	75.0	80.00	Yes	EL
	Zn-65	Water	75.0	81.33	Yes	EPI
	Cs-134	Water	10.0	8.00	Yes	EL
	Cs-134	Water	10.0	9.00	Yes	EPI
	Cs-137	Water	74.0	73.67	Yes	EL
	Cs-137	Water	74.0	78.33	Yes	EPI
	Ba-133	Water	99.0	92.00	Yes	EL
	Ba-133	Water	99.0	100.33	Yes	EPI

Units are in pCi/L.

Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI), as indicated.

Explanation of code(s): PE-A = performance evaluation (alpha); PE-B = performance evaluation (beta); GAM = gamma in water; TRW = tritium in water; ABW = alpha and beta in water.

Acceptance limits are statistically defined by NERL-ESD for individual analytes and matrices. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; **No** indicates a ratio outside control limits.

Table D - 4

**Comparison of the West Valley Demonstration Project's
Thermoluminescent Dosimeters (TLDs) with the
Co-located Nuclear Regulatory Commission (NRC) TLDs**

NRC TLD#	WVDP TLD#	NRC mR/90days	WVDP* mR/Qtr	WVDP/NRC Ratio
<i>1st Quarter 1997</i>				
2	22	15.7	15	0.96
3	5	15.2	14	0.92
4	7	14.4	14	0.97
5	9	14.9	16	1.07
7	14	15.9	17	1.07
8	15	15.3	16	1.05
9	25	25.0	23	0.92
11	24	744.0	641	0.86
<i>2nd Quarter 1997</i>				
2	22	18.4	16	0.87
3	5	15.9	19	1.19
4	7	16.1	16	0.99
5	9	15.5	14	0.90
7	14	17.2	17	0.99
8	15	16.5	<i>Missing</i>	<i>NA</i>
9	25	28.6	19	0.66
11	24	698.0	677	0.97
<i>3rd Quarter 1997</i>				
2	22	16.5	20	1.21
3	5	17.9	18	1.01
4	7	17.1	16	0.94
5	9	17.1	21	1.23
7	14	17.6	20	1.14
8	15	17.8	18	1.01
9	25	26.2	24	0.92
11	24	662.0	692	1.05
<i>4th Quarter 1997</i>				
2	22	<i>Missing</i>	18**	<i>NA</i>
3	5	14.2	21	1.48
4	7	15.6	20	1.28
5	9	14.8	22	1.49
7	14	15.8	22	1.39
8	15	15.4	23	1.49
9	25	27.7	23	0.83
11	24	647.0	670**	1.04

* WVDP results produced under contract by Lockheed Martin Idaho Technologies Co. (LMITCO)

Ratios of results are listed for each set of co-located TLDs.

"Missing" indicates that a TLD was no longer in place at the time of collection so no analysis could be performed. NA = not available. ** = Data were flagged as unreliable.

No control or warning limits are applicable to these results. Ratios of the duplicate measurements are presented for comparison purposes.

Table D-5

***Comparison of Water Quality Parameters in Crosscheck Samples
between the West Valley Demonstration Project and the EPA's
1997 Discharge Monitoring Report-Quality Assurance (DMR-QA) Study 17
for the National Pollutant Discharge Elimination System (NPDES)***

Analyte	Units	Actual	Reported	Accept?	Analyzed by:
Aluminum	µg/L	1,903	1,850	Yes	E&E
Arsenic	µg/L	410	397	Yes	E&E
Cadmium	µg/L	69.0	64.3	Yes	E&E
Chromium	µg/L	420	410	Yes	E&E
Cobalt	µg/L	401	388	Yes	E&E
Copper	µg/L	277	277	Yes	E&E
Iron	µg/L	2,100	2,000	Yes	E&E
Lead	µg/L	430	421	Yes	E&E
Manganese	µg/L	1,100	1,090	Yes	E&E
Mercury	µg/L	3.85	1.56	No	E&E
Nickel	µg/L	188	192	Yes	E&E
Selenium	µg/L	1,951	1,780	Yes	E&E
Vanadium	µg/L	7,604	7,570	Yes	E&E
Zinc	µg/L	1,551	1,610	Yes	E&E
pH	s.u.	6.58	6.58	Yes	WVNS
Total cyanide	mg/L	0.19	0.165	Yes	E&E
Non-filterable residue (TSS)	mg/L	46.0	46.5	Pass	E&E
Oil and grease	mg/L	12.2	18.2	Pass	E&E
Total phenolics	mg/L	0.113	0.062	Yes	E&E
Total residual chlorine	mg/L	1.39	1.59	Yes	WVNS
Ammonia-nitrogen	mg/L	2.80	2.80	Yes	E&E
Nitrate-nitrogen	mg/L	31.0	30.8	Yes	E&E
BOD-5	mg/L	50.3	43.6	Yes	E&E

Analyses were conducted by Ecology & Environment, Inc. (E&E) or WVNS, as indicated.

*Acceptance limits are determined by the EPA: **Yes** indicates a result within warning limits; **Pass** indicates a result within control limits but outside warning limits; **No** indicates a result outside control limits.*