

APPENDIX B
DEPARTMENT OF ENERGY RADIATION PROTECTION STANDARDS
AND CONCENTRATION GUIDES

**DEPARTMENT OF ENERGY RADIATION PROTECTION STANDARDS
AND CONCENTRATION GUIDES**

Annual Effective Dose Equivalent Radiation Standards for Protection of the Public*

Continuous Exposure of Any Member of the Public	100 mrem/yr (1 mSv/yr)
Occasional Annual Exposure (less than 5 years duration)	500 mrem/yr (5 mSv/yr)

**DOE Derived Concentration Guides (DCG) for Drinking Water and Inhaled Air
(μ CI/mL)**

<u>Radionuclide</u>	<u>In Air</u>	<u>In Water</u>	<u>Radionuclide</u>	<u>In Air</u>	<u>In Water</u>
H-3	1 E-07	2 E-03	Eu-152	5 E-11	2 E-05
C-14	6 E-09	7 E-05	Eu-154	5 E-11	2 E-05
Fe-55	5 E-09	2 E-04	Eu-155	3 E-10	1 E-04
Co-60	8 E-11	5 E-06	Th-232	7 E-15	5 E-08
Ni-63	2 E-09	3 E-04	U-233	9 E-14	5 E-07
Sr-90	9 E-12	1 E-06	U-234	9 E-14	5 E-07
Zr-93	4 E-11	9 E-05	U-235	1 E-13	6 E-07
Nb-93m	4 E-10	3 E-04	U-236	1 E-13	5 E-07
Tc-99	2 E-09	1 E-04	U-238	1 E-13	6 E-07
Ru-106	3 E-11	6 E-06	Np-239	5 E-09	5 E-05
Rh-106m	6 E-08	2 E-04	Pu-238	3 E-14	4 E-08
Sb-125	1 E-09	5 E-05	Pu-239	2 E-14	3 E-08
Te-125m	2 E-09	4 E-05	Pu-240	2 E-14	3 E-08
I-129	7 E-11	5 E-07	Pu-241	1 E-12	2 E-06
Cs-134	2 E-10	2 E-06	Am-241	2 E-14	3 E-08
Cs-135	3 E-09	2 E-05	Am-243	2 E-14	3 E-08
Cs-137	4 E-10	3 E-06	Cm-243	3 E-14	5 E-08
Pm-147	3 E-10	1 E-04	Cm-244	4 E-14	6 E-08
Sm-151	4 E-10	4 E-04	Gross Alpha (as Am-241)	2 E-14	3 E-08
			Gross Beta (as Ra-228)	3 E-12	1 E-07

* As transmitted by memorandum from John C. Tseng, Acting Director, Office of Environmental Guidance and Compliance, U.S. Department of Energy, dated November 4, 1987.

APPENDIX D
SUMMARY OF QUALITY ASSURANCE CROSS-CHECK ANALYSES

TABLE D-1.1
 COMPARISON OF RADIOLOGICAL CONCENTRATIONS IN QUALITY
 ASSURANCE SAMPLES BETWEEN WDP AND EML FOR QAP 8705 SAMPLES

<u>Sample</u>	<u>Isotope</u>	<u>Actual</u>	<u>Reported</u>	<u>Ratio Rep/Act</u>	<u>Accept</u>
air	Be-7	4.64E+03	3.75E+03	0.81	yes
air	Mn-54	4.55E+02	4.02E+02	0.88	yes
air	Co-60	4.44E+02	3.93E+02	0.89	yes
air	Sr-90	9.55E+00	8.94E+00	0.94	yes
air	Cs-137	4.70E+02	4.09E+02	0.87	yes
air	Pu-239	5.68E+00	5.23E+00	0.92	yes
air	Am-241	4.41E+00	4.46E+00	1.01	yes
air	U-234	2.39E+00	2.45E+00	1.03	yes
air	U-238	2.39E+00	2.44E+00	1.02	yes
air	U-ug	6.92E+00	7.30E+00	1.05	yes
soil	K-40	1.05E+00	1.06E+00	1.01	yes
soil	Sr-90	1.84E-01	1.75E-01	0.95	yes
soil	Cs-137	4.80E-01	5.15E-01	1.07	yes
soil	Ra-226	7.90E-01	4.76E-01	0.60	pass
soil	Pu-239	1.88E+00	1.74E+00	0.93	yes
tissue	K-40	6.08E-01	0.00E+00	0.00	below det.
tissue	Sr-90	2.87E+00	2.68E+00	0.93	yes
tissue	Cs-137	4.20E-02	0.00E+00	0.00	below det.
tissue	Ra-226	4.00E-01	2.32E-01	0.58	pass
tissue	U-234	1.00E-02	1.37E-02	1.37	pass
tissue	U-238	1.00E-02	1.40E-02	1.40	pass
tissue	U-ug	3.00E-02	4.30E-02	1.43	pass
vegetn	K-40	3.17E+01	2.44E+01	0.77	pass
vegetn	Co-60	2.14E+00	1.68E+00	0.79	pass
vegetn	Sr-90	2.06E+01	2.23E+01	1.08	yes
vegetn	Cs-137	1.45E+01	1.22E+01	0.84	yes
vegetn	Pu-239	1.17E-01	1.16E-01	0.99	yes
vegetn	Am-241	4.00E-02	5.84E-02	1.46	pass
water	H-3	3.37E+01	2.82E+01	0.84	yes
water	Mn-54	4.72E+00	5.28E+00	1.12	yes
water	Co-60	4.59E+00	4.90E+00	1.07	yes
water	Sr-90	1.33E+00	1.25E+00	0.94	yes
water	Cs-137	2.34E+00	2.56E+00	1.09	yes
water	Pu-239	1.37E-01	7.51E-02	0.55	pass
water	Am-241	1.31E-01	1.31E-01	1.00	yes
water	U-234	7.10E-02	7.12E-02	1.00	yes
water	U-238	7.10E-02	6.81E-02	0.96	yes
water	U-ug	2.06E-01	2.14E-01	1.04	yes

Ratio: 1.2 - 0.8 acceptable; 1.5 - 0.5 pass

TABLE D-1.2
COMPARISON OF RADIOLOGICAL CONCENTRATIONS IN QUALITY
ASSURANCE SAMPLES BETWEEN WVDP AND EML FOR QAP 8709 SAMPLES

<u>Sample</u>	<u>Isotope</u>	<u>Actual</u>	<u>Reported</u>	<u>Ratio Rep/Act</u>	<u>Accept</u>
air	Be-7	1.91E+01	1.42E+01	0.74	pass
air	Zr-95	1.88E+02	1.62E+02	0.86	yes
air	Sr-89	3.83E+01	3.20E+01	0.84	yes
air	Sr-90	3.69E+01	3.52E+01	0.95	yes
air	Ru-106	2.51E+02	1.46E+02	0.58	pass
air	Sb-125	9.63E+02	6.82E+02	0.71	pass
air	Cs-137	2.90E+02	2.70E+02	0.93	yes
air	Ce-144	4.06E+02	3.54E+02	0.87	yes
air	Pu-239	5.23E+00	5.77E+00	1.10	yes
air	Am-241	5.18E+00	5.65E+00	1.09	yes
air	U-234	1.70E+00	2.14E+00	1.26	pass
air	U-238	1.71E+00	2.00E+00	1.17	yes
air	U-pCi	4.94E+00	6.00E+00	1.21	pass
soil	K-40	2.00E+01	2.23E+01	1.12	yes
soil	Sr-90	1.27E+01	1.19E+01	0.94	yes
soil	Cs-137	2.11E-01	1.87E-01	0.89	yes
soil	Ra-226	6.36E-01	5.48E-01	0.86	yes
soil	Pu-239	2.90E-02	3.67E-02	1.27	pass
soil	U-234	1.24E+00	1.22E+00	0.98	yes
soil	U-238	1.20E+00	1.30E+00	1.08	yes
soil	U-pCi	2.44E+00	3.89E+00	1.59	no
tissue	K-40	2.68E+00	2.09E+00	0.78	pass
tissue	Sr-90	1.29E+01	1.23E+01	0.95	yes
tissue	Cs-137	1.90E-01	1.71E-01	0.90	yes
tissue	Ra-226	3.50E-01	2.85E-01	0.81	yes
vegetn	K-40	1.63E+02	1.73E+02	1.06	yes
vegetn	Sr-90	1.50E+01	1.34E+01	0.89	yes
vegetn	Cs-137	1.82E+00	1.88E+00	1.03	yes
vegetn	Ra-226	2.40E-01	1.97E-01	0.82	yes
vegetn	Pu-239	1.80E-02	1.95E-02	1.08	yes
vegetn	U-234	8.00E-02	6.67E-02	0.83	yes
vegetn	U-238	9.00E-02	6.69E-02	0.74	pass
vegetn	U-pCi	1.70E-01	2.01E-01	1.18	yes
water	H-3	1.91E+01	1.42E+01	0.74	pass
water	Mn-54	2.28E+00	2.24E+00	0.98	yes
water	Fe-55	1.48E+00	1.12E+00	0.76	pass
water	Co-57	1.42E-01	1.44E-01	1.01	yes
water	Co-60	2.27E+00	2.20E+00	0.97	yes
water	Sr-90	2.52E-01	2.31E-01	0.92	yes
water	Cs-137	2.28E+00	2.24E+00	0.98	yes
water	Pu-239	2.26E-01	2.09E-01	0.92	yes
water	Am-241	1.40E-01	1.60E-01	1.14	yes
water	U-234	5.40E-02	3.89E-02	0.72	pass
water	U-238	5.40E-02	4.12E-02	0.76	pass
water	U-pCi	1.08E-01	1.23E-01	1.14	yes

Ratio: 1.2 - 0.8 acceptable; 1.5 - 0.5 pass

TABLE D-1.3
 COMPARISON OF RADIOLOGICAL CONCENTRATIONS IN QUALITY
 ASSURANCE SAMPLES BETWEEN WVDP AND INEL FOR 1987 INEL QA SAMPLES

<u>Sample</u>	INEL QA 20		<u>Gamma in Water</u>		<u>Ratio WV/INEL</u>	<u>Accept</u>
	<u>Isotope</u>		<u>Actual</u>	<u>Reported</u>		
water	Ce-141		3.76E-03	3.70E-03	0.98	yes
water	Cr-51		6.64E-02	5.96E-02	0.90	no
water	Cs-137		1.32E-02	1.34E-02	1.02	yes
water	Co-58		8.82E-03	8.10E-03	0.92	no
water	Mn-54		3.53E-03	3.08E-03	0.87	no
water	Fe-59		8.60E-03	8.60E-03	1.00	yes
water	Zn-65		1.31E-02	1.29E-02	0.98	yes
water	Co-60		4.81E-03	5.08E-03	1.06	no

<u>Sample</u>	INEL QA 21		<u>Gamma in Charcoal</u>		<u>Ratio WV/INEL</u>	<u>Accept</u>
	<u>Isotope</u>		<u>Actual</u>	<u>Reported</u>		
cartridge	Ba-133		5.63E-02	5.80E-02	1.03	yes
cartridge	Cs-137		6.66E-03	1.38E-02	2.07	no
cartridge	Co-58		3.10E-03	5.20E-03	1.68	no
cartridge	Mn-54		1.59E-03	3.00E-03	1.89	no
cartridge	Zn-65		5.96E-03	1.20E-02	2.01	no
cartridge	Co-60		2.44E-03	5.36E-03	2.20	no

Note: Acceptable ratio range is 1.00 ± 0.05 .

TABLE D-1.4
 COMPARISON OF WATER QUALITY PARAMETERS IN
 QUALITY ASSURANCE SAMPLES BETWEEN WWDP AND NYSDOH, JANUARY 1987

<u>Sample</u>	<u>Analyte</u>	<u>Actual</u>	<u>Reported</u>	<u>Ratio Rep/Act</u>	<u>Accept</u>
water	Ag	49.5	52.0	1.05	yes
water	Ag	247.6	224.0	0.90	pass
water	Al	158.4	156.0	0.98	yes
water	Al	453.7	476.0	1.05	yes
water	As	80.4	88.0	1.09	yes
water	As	318.3	338.0	1.06	yes
water	BOD-5	39.7	40.5	1.02	yes
water	BOD-5	74.3	79.3	1.07	yes
water	CN	1.0	1.2	1.24	yes
water	CN	2.3	2.6	1.13	yes
water	Fe	103.2	104.0	1.01	yes
water	Fe	273.3	277.0	1.01	yes
water	NH-3(as N)	1.6	1.5	0.96	yes
water	NH-3(as N)	3.9	3.9	0.99	yes
water	Ni	99.5	96.0	0.96	yes
water	Ni	451.0	470.0	1.04	yes
water	Oil&Grease	23.8	23.9	1.00	yes
water	Oil&Grease	90.5	84.6	0.93	yes
water	Pb	121.2	128.0	1.06	yes
water	Pb	402.3	409.0	1.02	yes
water	pH	4.5	4.5	1.00	yes
water	pH	7.4	7.4	1.00	yes
water	Sus Solids	72.8	72.4	0.99	yes
water	Sus Solids	40.2	40.5	1.01	yes
water	Se	152.6	144.0	0.94	yes
water	Se	308.9	303.0	0.98	yes
water	Zn	495.8	495.0	1.00	yes
water	Zn	1984.2	2000.0	1.01	yes

Note: Acceptable range determined by NYSDOH

TABLE D-1.5
COMPARISON OF WATER QUALITY PARAMETERS
IN QUALITY ASSURANCE SAMPLES BETWEEN WVPD AND NYSDOH, JUNE 1987

<u>Sample</u>	<u>Analyte</u>	<u>Actual</u>	<u>Reported</u>	<u>Ratio Rep/Act</u>	<u>Accept</u>
water	Ag	102.3	119.0	1.16	no
water	Ag	307.7	344.0	1.12	pass
water	Al	120.4	140.0	1.16	yes
water	Al	357.7	411.0	1.15	yes
water	Cd	39.2	43.8	1.12	yes
water	Cd	97.3	102.0	1.05	yes
water	BOD-5	35.7	36.8	1.03	yes
water	BOD-5	60.3	62.5	1.04	yes
water	CN	1.0	1.0	1.07	yes
water	CN	1.7	1.6	0.96	yes
water	Cr	105.2	158.0	1.50	no
water	Cr	264.3	311.0	1.18	no
water	Cu	107.4	120.0	1.12	yes
water	Cu	480.1	530.0	1.10	pass
water	Fe	81.2	87.5	1.08	yes
water	Fe	394.9	436.0	1.10	yes
water	NH-3(as N)	1.0	1.0	1.01	yes
water	NH-3(as N)	3.0	3.0	0.99	yes
water	Ni	150.8	172.0	1.14	pass
water	Ni	405.4	464.0	1.14	no
water	Oil&Grease	32.8	27.6	0.84	yes
water	Oil&Grease	113.1	98.0	0.87	yes
water	Pb	154.6	165.0	1.07	yes
water	Pb	307.7	342.0	1.11	yes
water	pH	8.0	8.0	1.00	yes
water	pH	4.0	4.0	1.00	yes
water	Sus Solids	28.7	28.9	1.01	yes
water	Sus Solids	77.4	74.7	0.96	yes
water	Se	82.0	104.0	1.27	pass
water	Se	201.2	231.0	1.15	yes
water	Zn	759.8	820.0	1.08	yes
water	Zn	3056.4	3200.0	1.05	yes

Note: Acceptable range determined by NYSDOH

TABLE D-1.6
COMPARISON OF WATER QUALITY PARAMETERS
IN QUALITY ASSURANCE SAMPLES BETWEEN WVDP AND USEPA, JULY 1987

<u>Sample</u>	<u>Analyte</u>	<u>Actual</u>	<u>Reported</u>	<u>Ratio Rep/Act</u>	<u>Accept</u>
water	Al	220.0	209.0	0.95	yes
water	As	150.0	140.0	0.93	yes
water	Cd	55.0	50.0	0.91	yes
water	Cr	514.0	540.0	1.05	yes
water	Cu	953.0	960.0	1.01	yes
water	Fe	1096.0	1070.0	0.98	yes
water	Pb	685.0	715.0	1.04	yes
water	Ni	762.0	780.0	1.02	yes
water	Se	20.0	9.0	0.45	no
water	Zn	1059.0	1080.0	1.02	yes
water	pH	5.2	5.2	0.99	yes
water	Sus Solids	80.9	65.6	0.81	yes
water	Oil&Grease	8.0	7.3	0.91	yes
water	NH-3(as N)	12.5	12.0	0.96	yes
water	NO-3(as N)	4.0	3.6	0.89	yes
water	TOC	21.5	20.0	0.93	yes
water	BOD-5	35.0	39.7	1.13	yes
water	CN	0.1	0.1	0.86	yes

Note: Acceptable range determined by USEPA

TABLE D-1.7
COMPARISON OF WVDP TO USNRC CO-LOCATED
ENVIRONMENTAL TLD DOSIMETERS 1ST HALF OF 1987

FIRST QTR TLDs 1987					
<u>NRC TLD #</u>	<u>WVDP TLD #</u>	<u>μR/hr NRC</u>	<u>μR/hr WVDP</u>	<u>WV/NRC</u>	<u>Accept</u>
2	22	8.2	7.3	0.89	yes
3	5	7.8	7.6	0.97	yes
4	7	7.4	6.8	0.92	yes
5	9	9.0	7.1	0.79	pass
7	14	8.9	8.1	0.91	yes
8	15	8.7	8.1	0.93	yes
9	25	19.0	16.7	0.88	yes
11	24	747.7	882.2	1.18	yes
SECOND QTR TLDs 1987					
<u>NRC TLD #</u>	<u>WVDP TLD #</u>	<u>μR/hr NRC</u>	<u>μR/hr WVDP</u>	<u>WV/NRC</u>	<u>Accept</u>
2	22	8.2	9.6	1.18	yes
3	5	10.0	10.4	1.04	yes
4	7	8.1	11.4	1.41	pass
5	9	10.0	9.5	0.95	yes
7	14	8.7	10.9	1.25	pass
8	15	8.6	10.2	1.19	yes
9	25	22.5	19.9	0.89	yes
11	24	451.4	817.3	1.81	no

Ratio: 1.2 - 0.8 acceptable; 1.5 - 0.5 pass