APPENDIX B

STANDARDS AND CONCENTRATION GUIDES

TABLE B-1

STANDARDS AND CONCENTRATION GUIDES

Radiation Standards for Protection of the Public*

Annual Effective Dose Equivalent

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

DOE-Derived Concentration Guides (DCG) for Drinking Water and Breathing Air Contaminated with Radionuclides by Members of the Public

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

* As transmitted by memorandum from Robert J. Stern, Director, Office of Environmental Guidance, U.S. Department of Energy, dated February 28, 1986.

APPENDIX D

SUMMARY OF QUALITY ASSURANCE ANALYSES

TABLE D - 1.1

COMPARISON OF RADIOLOGICAL CONCENTRATIONS IN QUALITY ASSURANCE SAMPLES BETWEEN WVDP LAB (WV) AND IDAHO NATIONAL ENGINEERING LABORATORY (INEL) - 1986

DATE YR/MO	TYPE	LAB	ISOTOPE	REPORTED VALUE (uCi)	INEL VALUE (uCi)	RATIO WVNS/INEL	+/-
86 05	WATER	WV	CE - 144	4.25 +/- 0.40 E-02	4.16 +/- 0.23 E-02	1.02	0.11
86 05	WATER	WV	CE - 141	1.14 +/- 0.13 E-02	1.01 +/- 0.05 E-02	1.13	0.14
86 05	WATER	WV	CR - 51	1.70 +/- 0.12 E-01	1.98 +/- 0.08 E-01	0.86	0.07
86 05	WATER	WV	CS - 134	1.57 +/- 0.12 E-02	1.71 +/- 0.08 E-02	0.92	0.08
86 05	WATER	WV	CS - 137	1.44 +/- 0.12 E-02	1.44 +/- 0.06 E-02	1.00	0.09
86 05	WATER	WV	CO - 58	3.16 +/- 0.22 E-02	3.51 +/- 0.15 E-02	0.90	0.07
86 05	WATER	WV	MN - 54	9.12 +/- 0.93 E-03	1.01 +/- 0.04 E-02	0.90	0.10
86 05	WATER	WV	FE - 59	6.48 +/- 0.43 E-02	6.39 +/- 0.29 E-02	1.01	0.08
86 05	WATER	WV	ZN - 65	2.99 +/- 0.24 E-02	3.05 +/- 0.14 E-02	0.98	0.09
86 05	WATER	WV	CO - 60	1.70 +/- 0.13 E-02	1.70 +/- 0.08 E-02	1.00	0.09
86 12	AIR FILTER	WV	CE - 144	1.17 +/- 0.04 E-01	1.06 +/- 0.03 E-01	1.10	0.05
86 12	AIR FILTER	WV	CS - 137	1.64 +/- 0.08 E-02	1.46 +/- 0.03 E-02	1.12	0.06
86 12	AIR FILTER	WV	MN - 54	1.65 +/- 0.08 E-02	1.48 +/- 0.05 E-02	1.11	0.07
86 12	AIR FILTER	WV	CO - 60	3.40 +/- 0.14 E-02	3.08 +/- 0.09 E-02	1.10	0.06
86 12	AIR FILTER	WV	Y - 88	5.89 +/- 0.23 E-02	5.38 +/- 0.13 E-02	1.09	0.05

TABLE D-1.2

COMPARISON OF RADIOLOGICAL CONCENTRATIONS IN QUALITY ASSURANCE SAMPLES BETWEEN WVNS LAB (WV) AND ENVIRONMENTAL MEASUREMENTS LABORATORY (EML) JUNE-1986

Date	Type	Lab	Isotope	Ser	Reported Value	Reported % Error	EML Value	Ratio Rp/EML	Ratio +/-
86 06	AIR	WV	BE 7	1	0.213E+04	5	0.198E+04	1.08	0.07
86 06	AIR	WV	BE 7	2	0.159E+04	6	0.198E+04	0.80	0.06
86 06	AIR	WV	MN 54	1	0.279E+03	3	0.238E+03	1.17	0.07
86 06	AIR	WV	MN 54	2	0.199E+03	4	0.238E+03	0.84	0.05
86 06	AIR	WV	CO 60	1	0.244E+03	4	0.210E+03	1.16	0.07
86 06	AIR	WV	CO 60	2	0.190E+03	5	0.210E+03	0.90	0.06
86 06	AIR	WV	SR 90	1	0.400E+01	23	0.452E+01	0.88	0.21
86 06	AIR	WV	SR 90	2	0.452E+01	11	0.452E+01	1.00	0.12
86 06	AIR	WV	CS 137	1	0.245E+03	4	0.221E+03	1.11	0.06
86 06	AIR	WV	CS 137	2	0.175E+03	4	0.221E+03	0.79	0.05
86 06	AIR	WV	PU 239	1	0.254E+01	11	0.239E+01	1.06	0.13
86 06	AIR	WV	PU 239	2	0.159E+01	13	0.239E+01	0.79	0.11
86 06	AIR	WV	AM 241	1	0.245E+01	11	0.260E+01	0.94	0.12
86 06	AIR	WV	AM 241	2	0.284E+01	11	0.260E+01	1.09	0.14
86 06	AIR	WV	U 234	1	0.134E+01	13	0.115E+01	1.17	0.18
86 06	AIR	WV	U 234	2	0.134E+01	13	0.115E+01	1.17	0.18
86 06	AIR	WV	U 238	1	0.125E+01	13	0.115E+01	1.09	0.17
86 06	AIR	WV	U 238	2	0.121E+01	14	0.115E+01	1.05	0.17
86 06	AIR	WV	U UG	1	0.377E+01	13	0.333E+01	1.13	0.17
86 06	AIR	WV	U UG	2	0.365E+01	13	0.333E+01	1.10	0.16
86 06	SOIL	WV	K 40	1	0.202E+02	10	0.204E+02	0.99	0.11
86 06	SOIL	WV	SR 90	1	0.179E+01	19	0.199E+01	0.90	0.16
86 06	SOIL	WV	CS 137	1	0.747E+00	16	0.810E+00	0.92	0.17
86 06	SOIL	WV	RA 226	1	0.570E+00	29	0.600E+00	0.95	0.29
86 06	SOIL	WV	PU 239	1	0.104E-01	35	0.100E-01	1.04	0.38
86 06	SOIL	WV	AM 241	1	0.695E-02	47			
86 06	SOIL	WV	U 234	1	0.497E+00	7	0.559E+00	0.89	0.07
86 06	SOIL	WV	U 238	1	0.518E+00	7	0.527E+00	0.98	0.10
86 06	SOIL	WV	U UG	1	0.155E+01	7	0.158E+01	0.98	0.08
86 06	TISSUE	WV	K 40	1	0.206E+01	33	0.210E+01	0.98	0.41
86 06	TISSUE	WV	SR 90	1	0.139E+01	19	0.203E+01	0.68	0.13
86 06	TISSUE	WV	RA 226	1	0.267E+00	38	0.351E+00	0.76	0.30
86 06	TISSUE	WV	PU 239	1	<0.368E-03		0.500E-03		
86 06	TISSUE	WV	AM 241	1	<0.617E-03				
86 06	VEGETN	WV	K 40	1	0.106E+02	16	0.980E+01	1.08	0.19
86 06	VEGETN	WV	SR 90	1	0.273E+01	11	0.333E+01	0.83	0.13
86 06	VEGETN	WV	CS 137	1	0.148E+01	13	0.139E+01	1.06	0.15
86 06	VEGETN	WV	PU 239	1	0.193E-01	13	0.170E-01	1.14	0.20
86 06	VEGETN	WV	AM 241	1	0.123E-01	13	0.100E-01	1.23	0.21
86 06	WATER	WV	H 3	1	0.184E+02	3	0.219E+02	0.84	0.03
86 06	WATER	WV	MN 54	1	0.237E+01	3	0.230E+01	1.03	0.07
86 06	WATER	WV	FE 55	1	0.755E+00	11	0.680E+00	1.11	0.16
86 06	WATER	WV	CO 60	1	0.229E+01	3	0.230E+01	1.00	0.07
86 06	WATER	WV	SR 90	1	0.494E+00	3	0.430E+00	1.15	0.05
86 06	WATER	WV	CS 137	1	0.256E+01	3	0.243E+01	1.05	0.06
86 06	WATER	WV	PU 239	1	0.565E-01	7	0.560E-01	1.01	0.09
86 06	WATER	WV	AM 241	1	0.676E-01	7	0.720E-01	0.94	0.14
86 06	WATER	WV	U 234	1	0.381E-01	7	0.320E-01	1.19	0.16
86 06	WATER	WV	U 238	1	0.351E-01	7	0.330E-01	1.06	0.11
86 06	WATER	WV	U UG	1	0.105E+00	7	0.940E-01	1.12	0.11

TABLE D - 1.3

COMPARISON OF WVDP TO USNRC CO-LOCATED ENVIRONMENTAL TLD DOSIMETERS - 3RD QTR 1986

PERIOD: 7/10/86 TO 10/6/86		PERIOD: 6/19/86 TO 9/23/86		
USNRC TLD NO.	DOSE RATE (ur/hr)	WVNS TLD I.D.*	DOSE RATE (ur/hr)	RATIO WVNS/USNRC
2	10.6	DFTLD 22	9.5	0.90
3	11.0	DFTLD 05	9.5	0.86
4	10.2	DFTLD 07	8.8	0.86
5	11.4	DFTLD 09	8.4	0.74
7	10.9	DFTLD 14	10.6	0.97
8	11.0	DFTLD 15	9.6	0.87
9	19.6	DFTLD 25	16.2	0.83
11	698.1	DFTLD 24	696.5	1.00

* SEE FIGURES A-1 AND A-4

TABLE D - 1.4
INTERCOMPARISON PROJECT RESULTS

EIGHTH INTERNATIONAL ENVIRONMENTAL DOSIMETER
INTERCOMPARISON PROJECT
DECEMBER 1985 TO MARCH 1986

EXPOSURE CATEGORY	WEST VALLEY DEMONSTRATION PROJECT (WVDP) RESULTS		ENVIRONMENTAL MEASUREMEMTS LABORATORY (EML) ESTIMATED VALUES		RATIO
	EXPOSURE (MR)	UNCERTAINTY (MR)	EXPOSURE (MR)	UNCERTAINTY (MR)	WVDP/EML
FIELD SITE #1 (CHESTER, N.J.)	31.6	3.8	29.7	1.5	1.06
FIELD SITE #2 (SANDY HOOK, N.J.)	9.1	1.2	10.4	0.5	0.88
LABORATORY (CESIUM - 137)	17.0	2.3	17.2	0.9	0.99

APPENDIX E

HYDROGEOLOGY OF THE WVDP SITE

The WVDP site lies within the Glaciated Alleghany Plateau section of the Appalachian Plateau Physiographic Province. The section is a maturely dissected plateau with surficial bedrock units of Devonian shales and sandstones. Bedding dips gently (4 to 7.5 metres per km) and uniformly to the south. The plateau has been subjected to the erosional and depositional actions of repeated glaciations, resulting in accumulation of till, outwash, and lacustrine deposits over the area.

The site is underlain by a thick sequence of silty clay tills and more granular deposits overlying a bedrock valley that has been carved through Devonian shales by Cattaraugus Creek and its tributaries. Figure 3-5 shows a generalized east-west cross section through the site. The uppermost till unit is the Lavery, a very compact gray silty clay. The Lavery is approximately 6 m thick at the western boundary of the WVDP and thickens to the east. At the western edge of the developed portion of the WVDP, the Lavery is approximately 30 m thick. In situ measurements of the hydraulic conductivity in the Lavery have generally ranged between 10^{-9} and 10^{-7} cm/sec.

The upper 3 m (approximately) of the Lavery have been chemically weathered by leaching and oxidation and mechanically weathered by bioturbation. The hydraulic conductivity of the weathered till is much higher than that of the underlying unweathered parent material, probably as a result of increased fracture flow.

The northern portion of the WVDP site is blanketed by a layer of alluvial gravels up to 6 m thick. These gravels extend from the plant area northward; they are not encountered in the disposal areas in the southern part of the WVDP site.

Below the Lavery till is a more granular unit referred to locally as the Lacustrine Unit. It comprises silts, sands and, in some areas, gravels which overlie a varved clay. The Lacustrine is believed to be more permeable than the Lavery, but little permeability testing has been performed in this unit. Prior modelers of site hydrogeology have generally assumed hydraulic conductivities on the order of 10^{-5} to 10^{-4} cm/sec-- conservative in consideration of the gradation of the Lacustrine Unit materials.

Free field groundwater flow through the described geosystem occurs in two aquifers and to a considerably lesser extent in the aquaclude between them. The upper aquifer is a transient water table aquifer in the weathered till and, where it is encountered, the alluvial gravels. To a lesser extent, the highly fractured upper metre of the unweathered till is also part of this aquifer. This unit is generally unsaturated, but immediately after periods of intensive runoff, such as a spring thaw, significant quantities of groundwater are believed to flow through this unit. The primary flow occurs through the extensive system of fractures which dissects this unit.

The lower aquifer is an unconfined aquifer in the Lacustrine Unit. The piezometers embedded in this unit all exhibit phreatic heads below the top of this unit. The total recharge mechanism for the unit is not well defined because of a paucity of data, but it is reasonable to conclude from available data that the unit is recharged from the fractured bedrock and downward seepage through the overlying Lavery till. The bedrock recharge zone to the west is recharged at outcrops in the uplands to the west of the site. Flow through this unit appears to be to the east toward Buttermilk Creek.

The aquaclude that separates these two aquifers is the Lavery. Its mass permeability is extremely low but it does permit seepage. When the weathered till is acting as a transient aquifer, a vertical gradient of unity exists in the till and causes water to move downward, but at a very low rate.

The USGS and NYSGS have performed extensive hydrogeologic investigations in and around the area once used by NFS for solid waste disposals and now contemplated as a potential site for disposal of Project wastes. All of these studies assumed that the groundwater pathway from the disposal trenches was one-dimensional downward seepage through the unweathered till. This was based on observations of water levels in well screen piezometers and some simplifying assumptions. No measurements were made to characterize unsaturated flow in the weathered till.

The observation of solvent in the shallow weathered till some 60 ft (18 m) away from its point of disposal casts considerable doubt on some of the assumptions which neglected flow in the unsaturated zone. Therefore, as part of the preparation of the Environmental Assessment for low-level waste disposal, WVNS has implemented extensive explorations and an instrumentation network to characterize and monitor flow in the unsaturated weathered till. Because data from the solvent seepage explorations indicated rapid fluctuations in the level of the transient perched water table, the instrumentation network uses real-time data loggers that record water levels at hourly intervals.

The hypothesis of one-dimensional downward flow is also being tested as part of this exploration program. The well screen piezometers all have significant time lags. (For example if the piezometric level rose one foot, it might take more than a year before the rise was evident in a well screen piezometer. This could mask a lateral flow component, particularly a transient one.) WVNS has therefore installed pneumatic pore pressure transducers which have a time lag of less than one minute.

The results of this investigation were reported in the Environmental Assessment published in February 1986.