5.0 STANDARDS AND QUALITY ASSURANCE

5.1 Environmental Standards and Regulations

The following environmental standards and laws are applicable to the WVDP:

- o DOE Orders including 5480.1, "Requirements for Radiation Protection," August 1981 and 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements", February 1981.
- o Clean Air Act 42 USC 1857 et. seq., as amended.
- o Federal Water Pollution Control Act (Clean Water Act), 33 USC 1251, as amended.
- o Resource Conservation and Recovery Act, 42 USC 6905 as amended.
- o Comprehensive Environmental Response, Compensation and Liability Act, 42 USC 960.
- o Toxic Substances Control Act, 15 USC 2601, as amended.
- o Environmental Conservation Law of New York State.

The standards and guides applicable to releases of radionuclides from the WVDP are those of DOE Order 5480.1 Chapter XI, dated August 13, 1981, entitled, "Requirements for Radiation Protection." Radiation protection standards and selected radioactivity concentration guides from Chapter XI are listed in Appendix B. When there is a difference between soluble and insoluble chemical forms, the most restrictive guide is listed.

These listed guides are virtually identical to those in the Code of Federal Regulations (CFR), Title 10, Part 20. Ambient water quality standards contained in the SPDES permit issued for the facility are listed in Table C-5.2. Airborne discharges also are regulated by the U.S. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants, 40 CFR 61, 1984.

5.2 Quality Assurance

Off-site laboratories performed the majority of the analyses requiring radiochemical separation for the environmental samples collected during 1985. The documented quality assurance plan used by these laboratories includes periodic interlaboratory cross-checks, prepared standard and blank analyses, routine instrument calibration, and use of standardized procedures. Off-site laboratories analyze blind duplicates of approximately 10% of the samples analyzed on-site for the same parameters in addition to unknown cross-check samples.

Sample collection, preparation, and most direct radiometric analyses were performed at the WVDP Environmental Laboratory for all media collected. Additionally, determination of Sr-90 in water is a routine radiochemical measurement performed in the Environmental Laboratory. For all continuous sampling equipment, measurement devices, and counting instruments, periodic calibration was maintained using standards traceable to the National Bureau of Standards.

Formal cross-check programs between the WVDP Environmental Laboratory and the DOE Radiological and Environmental Science Laboratory (RESL), Idaho National Engineering Laboratory (INEL) and Environmental Measurements Laboratory (EML), New York City, included the entire range of media monitored in 1985. A comparison of water analyses at WVDP and INEL is presented in Table D-1.1. Comparative analyses of a variety of media at WVDP and EML are summarized in Tables D-1.2 and D-1.3. The U.S. Environmental Protection Agency (EPA) cross-check programs for nonradiological water quality parameters also provided audit samples in 1985. In addition, the routine program of splitting samples between WVDP and the New York Department of Health, and a special sample split with the U.S. NRC provided additional quality assurance data.

As a result of the RESL cross-checks, one gamma standard was found to have been degraded and was replaced. A review of data which might have been impacted was performed, but no results were found to be affected substantially since the problem was limited to radionuclides not normally present in project effluents. Recalibration with a fresh standard has resulted in satisfactory performance. Two series of cross-checks in 1985 between WVDP and EML included soil, tissue, vegetation, air filters, and water. Results were satisfactory for all media routinely analyzed by WVDP. The several unsatisfactory results were for samples which required radiochemical separations or counting geometries not routinely used at WVDP in 1985. Procedures for analyzing these media are being carefully evaluated since they will be required on a routine basis in the immediate future.

The samples split with the U.S. NRC yielded several analyses which did not agree. The maximum discrepancy was a factor of 2.75, but the majority of the results were statistically equivalent. The analyses which were not in close agreement are being followed-up in accordance with the WVDP environmental monitoring procedures in order to resolve the discrepancies.

Given the slight differences in sample composition and collection schedule, the results for environmental media split with the NYSDOH through the first half of 1985 agreed quite well.

Review of 1984 TLD data identified the need for verification of the measurements using accurate exposure rate instruments. Individual exposure rate measurements at each of the TLD locations showed quite good agreement with the integrated measurements during the third quarter of 1985. Results of an intercomparison between TLD measurements by NRC and WVDP which was begun in the fourth quarter of 1985 are summarized in Table D-1.4. Despite the fact that the periods of measurement are offset by one full month, these data are in good agreement at all locations where the dose rate is assumed to have been constant for the entire period. Additionally, WVDP is participating in the 1985-86 environmental dosimetry intercomparison program sponsored by EML. Based on the various audit and cross-check results, the WVDP Environmental Monitoring Program is functioning well, and the areas needing improvement have been identified and are receiving appropriate attention.

5.3 Statistical Reporting Of Data

Except where noted, individual analytical results are reported with plus or minus (±) two standard deviations (2 σ) giving a value with an uncertainty band at the 95% confidence level. The arithmetic averages were calculated using actual results, including zero and negative values. In the final results, if the uncertainty (±) was equal to or greater than the value, the measurement was considered to be below the Minimum Detectable Concentration (MDC) for that measurement (see Section 5.4). Less than (<) values indicate the value below which activity could not be measured at the 95% confidence level. These MDC values will vary among samples, especially in biological media where sample size cannot be easily standardized.

The total statistical uncertainty for radiological measurements, including systematic (processing and physical measurement) uncertainty plus the random radioactivity counting uncertainty, is reported as one value for the 1985 data. In most cases, systematic uncertainties (e.g., due to laboratory glassware or analytical balance variation) are a small percentage of the larger counting uncertainties at typical environmental levels of radioactivity. The notation normally used in reporting of raw laboratory data to convey the total uncertainty is in the form: (V.00 ± R.0; T.0) E-00 where "V.00" is the analytical value to three significant figures, "± R.0" is the random uncertainty to two significant figures, "T.0" is the total of random plus systematic uncertainties, and "E-00" is the exponent of 10 used to signify the magnitude of the parenthetical expression.

5.4 Analytical Detection Limits

For unique or individual samples analyzed on an infrequent basis, generic minimum detection limits for the entire analytical measurement protocol have not been developed, although a Lower Limit of Detection (LLD) based solely on the counting uncertainty is calculated for each sample. For routine measurements using standardized sample sizes, equipment, and preparation techniques, an average Minimum Detectable Concentration (MDC) has been calculated for WVDP environmental samples. These are listed in Table 5-1.

Specific sample media were analyzed for radionuclides from multiple split samples, using routine procedures, normal techniques and labware, and standard counting parameters. The counting statistics determined the estimated LLD above which there was 95% probability that radioactivity was present. This LLD is derived from the detection efficiency of the measuring instrument for the type of activity being measured, the level of normal background signal with no sample present (determined by counting a "background" of the same material as the sample) and the length of time the background and sample were counted. For radioactive decay, these factors can be used to accurately predict what value is the lowest which can be measured at a given confidence level. A separate calculation for systematic uncertainty, including the variation between duplicate samples, labware differences, and physical measurements was made and added to the statistical counting LLD to obtain the minimum analytical detection limit or MDC for the entire process. Volumetric measurement of sample flow rates, calibration standard uncertainties, and pipetting device accuracy were some of the factors included in this calculation. The overall result is the average Minimum Detectable Concentration (MDC) (at the 95% confidence level) for that type of sample treated in a uniform manner. For most samples, there is little or no significant difference between the LLD and the MDC.

TABLE 5-1

MINIMUM DETECTABLE CONCENTRATIONS FOR ROUTINE SAMPLES

Measurement	Medium	Sample Size	MDC
gross alpha	water	1 litre	8.1 E-10 uCi/ml
gross beta	water	1 litre	7.7 E-10 uCi/ml
Cs-137	water	250 ml	2.1 E-08 uCi/ml
H-3	water	5 ml	1.0 E-07 uCi/ml
Sr-90	water	1 litre	1.6 E-09 uCi/ml
gross alpha	air	400 m^3	1.1 E-15 uCi/ml
gross beta	air	400 m^3	1.9 E-15 uCi/ml
Cs-137	air	400 m^3	1.4 E-14 uCi/ml
gross alpha	soil	150 mg	5.5 E-06 uCi/g
gross beta	soil	150 mg	5.3 E-06 uCi/g
Cs-137	soil	350 g	6.3 E-08 uCi/g