5.0 STANDARDS AND QUALITY ASSURANCE

5.1 Environmental Standards and Regultations

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. (Including Hazardous and Solid Waste Amendments of 1984)
- o Comprehensive Environmental Response, Compensation and Liability Act, 42 USC 960. (Including Superfund Amendments and Reauthorization Act of 1986)
- 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 limitations from Chapter XI, as amended by the Derived Concentration Guides, are listed in Appendix B.

These listed concentrations are guidelines provided by DOE to assure compliance with the performance standard of 100 mrem effective dose equivalent to the maximally exposed individual. Ambient water quality standards contained in the SPDES permit issued for the facility are listed in Table C-5.2. Airborne discharges are also regulated by the U.S. Environmental Protectio 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 use 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. Additionally, physical surveys were made of the contract laboratory facilities in conjunction with a quality assurance review by Project personnel.

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 environmental samples monitored in 1986. A comparison of water analyses at WVDP and INEL is presented in Table D-1.1. Comparative data from a variety of environmental materials analyzed at WVDP and EML are summarized in Tables D-1.2 and D-1.4. The U.S. Environmental Protection Agency (EPA) cross-check programs for nonradiological water quality parameters also provided audit samples in 1986. In addition, the routine program of splitting samples between WVDP and the New York Department of Health, and TLD monitoring point calculations with the U.S. NRC provided additional quality assurance data.

As a result of the RESL cross-checks, the current gamma isotopic analysis procedure for water was found to be satisfactory. Air filter media of the geometry provided by RESL in the cross-check sample, however, is not normally used at WVDP, the use of a nearly equivalent calibration produced results for air filter media biased about ten percent high, but with acceptable precision. The bias is accounted for in analysis of routine samples in the calibration geometry. A set of cross-check samples in 1986 between WVDP and EML included soil, tissue, vegetation, air samples, and water samples. Results were satisfactory for all media routinely analyzed at the WVDP environmental laboratory. The one unsatisfactory result was for a sample which required radiochemical separations and a significantly different (compared to WVDP analyses) counting geometry performed at the contract laboratory facilities. The isotope was reported as less than detectable activity for the aliquot analyzed. This specific analysis is also being reviewed by EML because 75% of the laboratories participating in the cross-check program reported results that were outside the expected value. Of 48 analyses performed by WVDP and our contract laboratory, four were in the warning area, and one was not acceptable.

The TLDs colocated at the NRC TLD locations from June to October 1986 yielded one set of results which were not in agreement (Table D-1.3). The maximum discrepancy was a factor of 0.74, but the remainder of the results were statistically equivalent. The location which was not in close agreement is being monitored closely in order to resolve the discrepancies. It is noted that several factors may cause variations, including the proximity of the dosimeters to poles and buildings, or the ground. The one location where these variables are removed by virtue of side-by-side colocation (DFTLD24) and an exposure rate considerably above background, gives very good agreement. The results for environmental media split with the NYSDOH through 1986 were not available for comparisons.

Results of the 1985/1986 international dosimeter intercomparison are given in Table D-1.4, and show acceptable results. Since the TLDs used at WVDP are calibrated to Cs-137, it was noted with interest that the central value was very close to the calculated laboratory Cs-137 exposure provided 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 (2σ) giving a value 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 (2σ) was equal to or greater than the value, the measurement was considered to be below the Minimum Detectable Concentration (MDC) (see Section 5.4), and is reported as a less-than (<) value. 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 1986 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 laboratory techniques, 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 (at the 95% confidence level) for each type of sample treated in a uniform manner. For most sample analyses, 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

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