

APPENDICES

APPENDIX A: Particle size distribution graphs

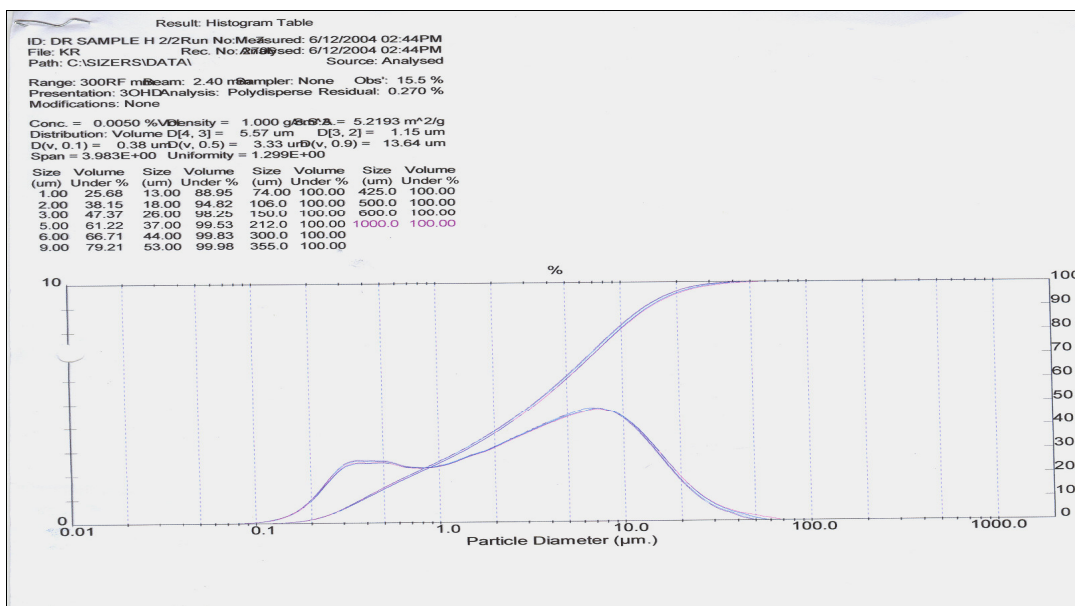


Figure 9.1 Particle size distributions for sample H

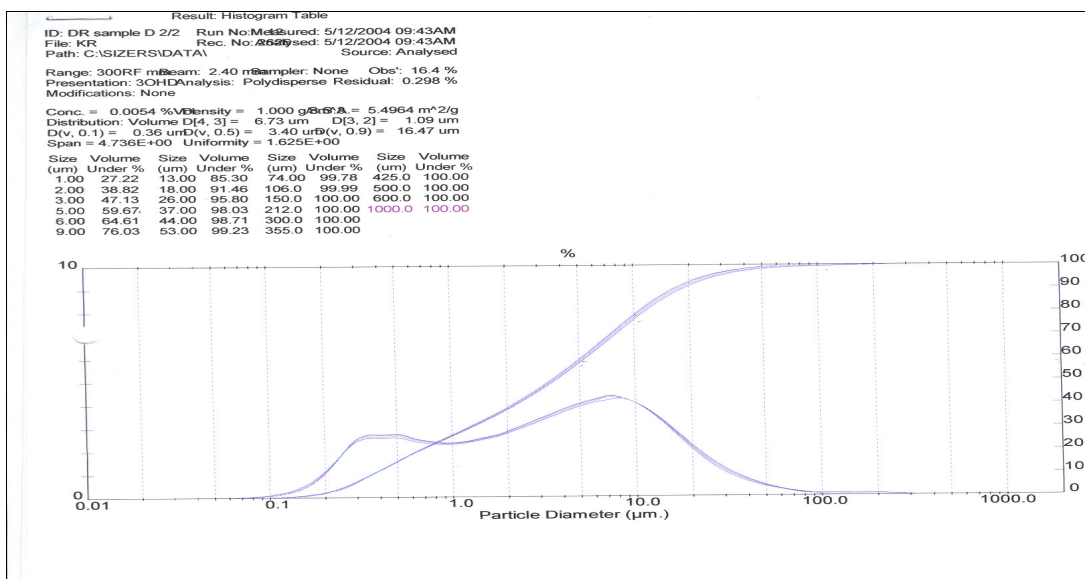


Figure 9.2 Particle size distributions for sample D

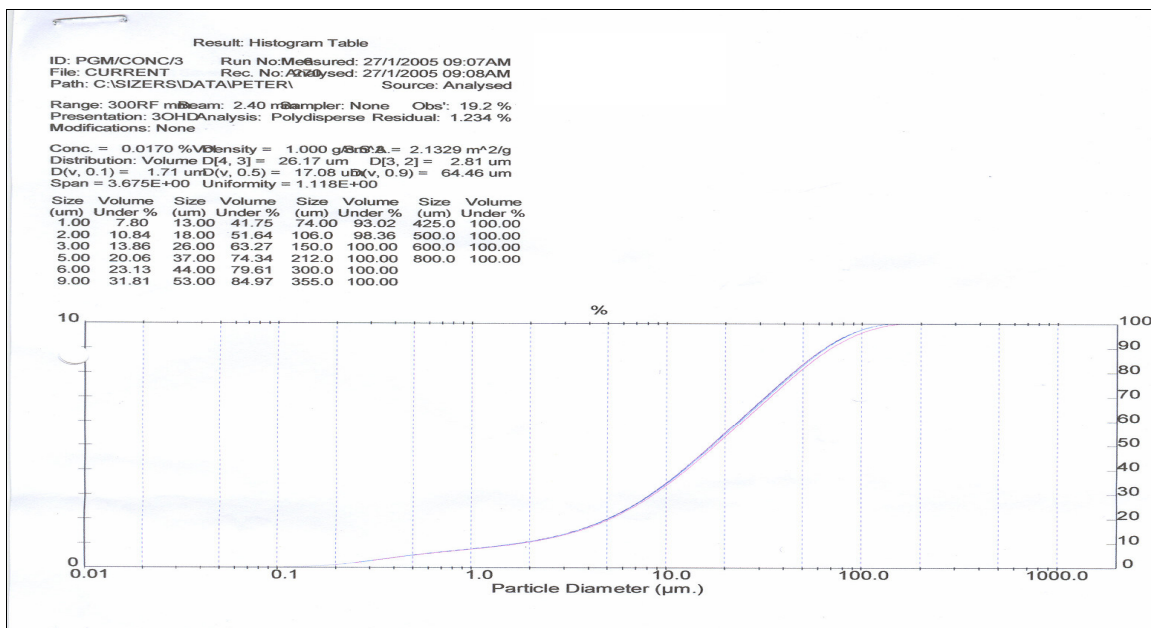


Figure 9.3 Particle size distributions for LMC QC 03 concentrate sample

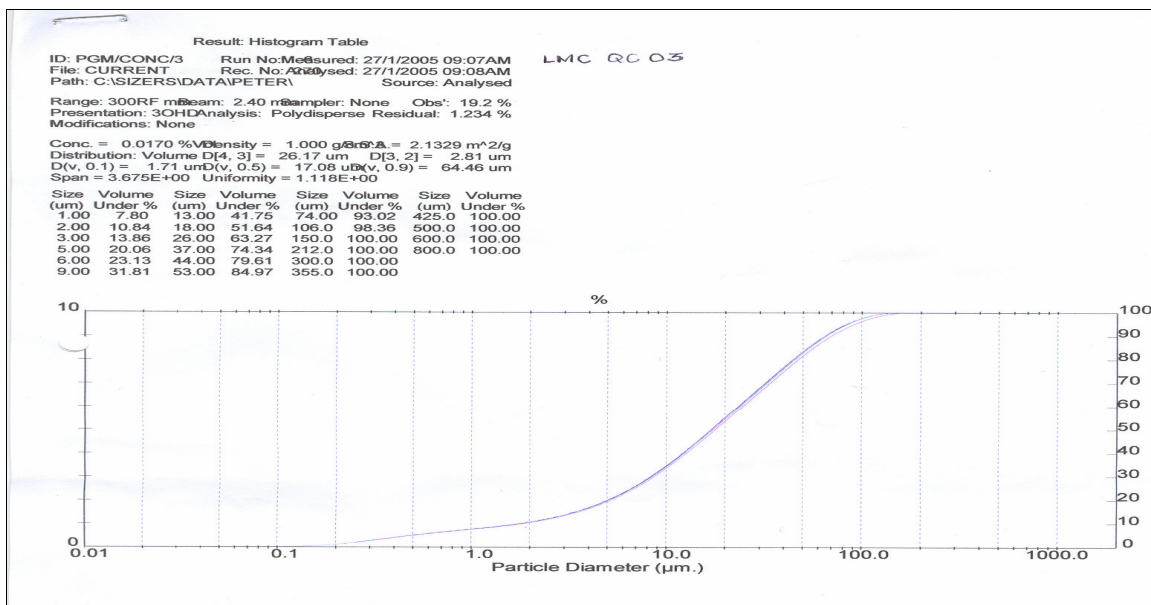


Figure 9.4 Particle size distributions for LMC QC 03 concentrate sample

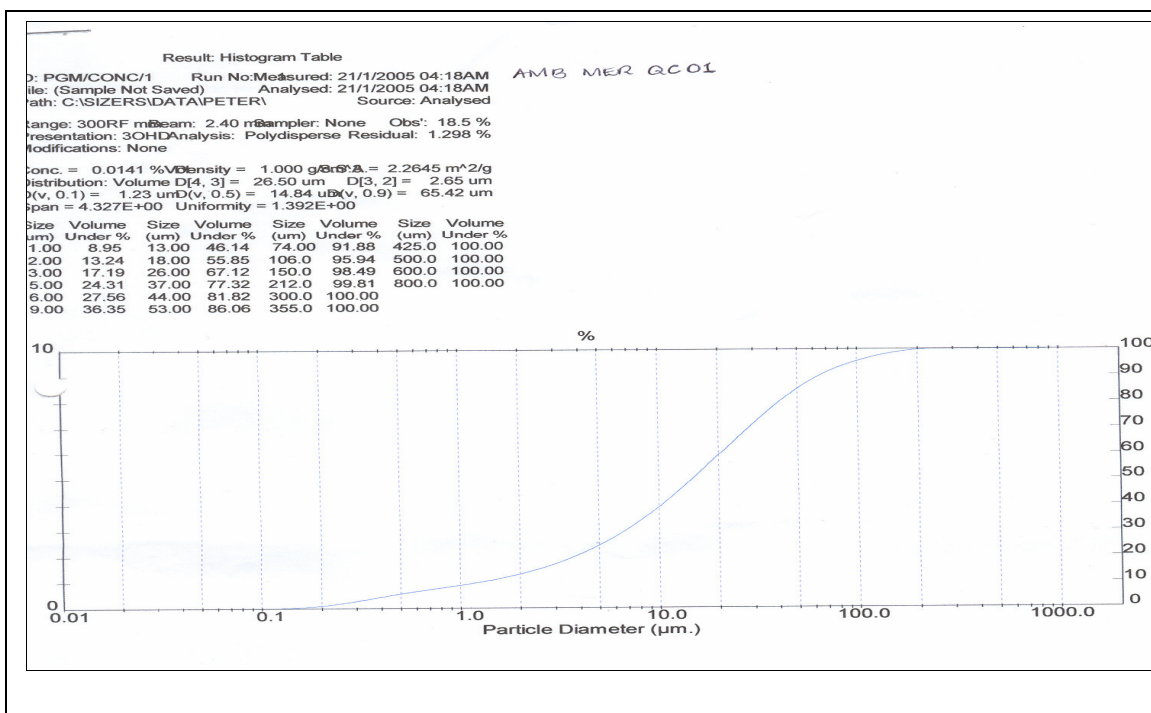


Figure 9.5 Particle size distributions for AMB MER QC O1 concentrate sample

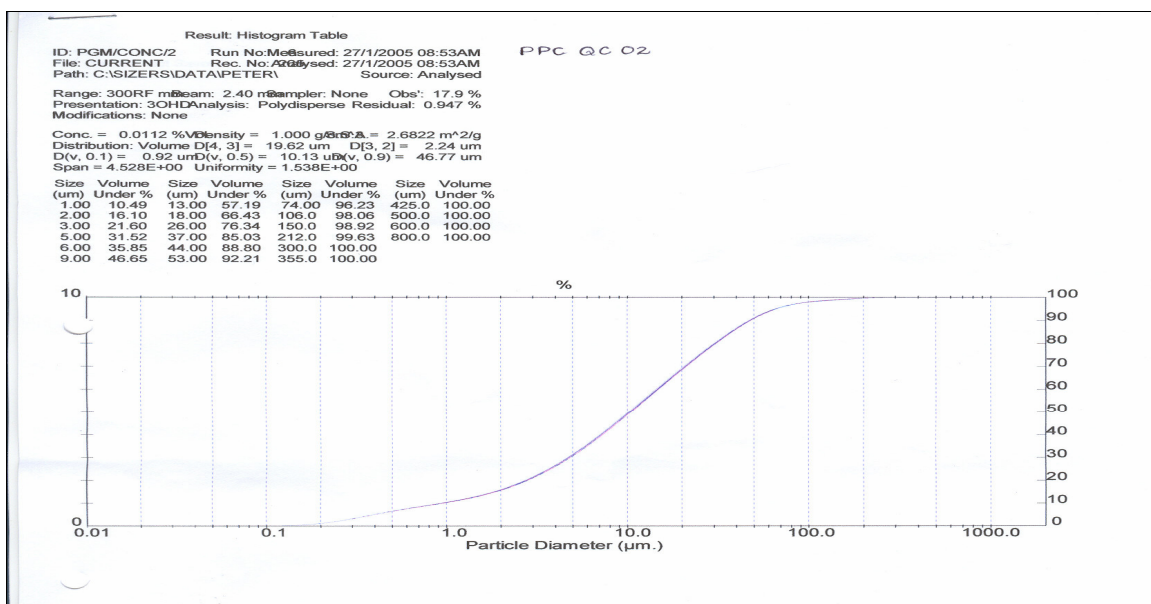


Figure 9.6 Particle size distributions for PPC QC 02 concentrate sample

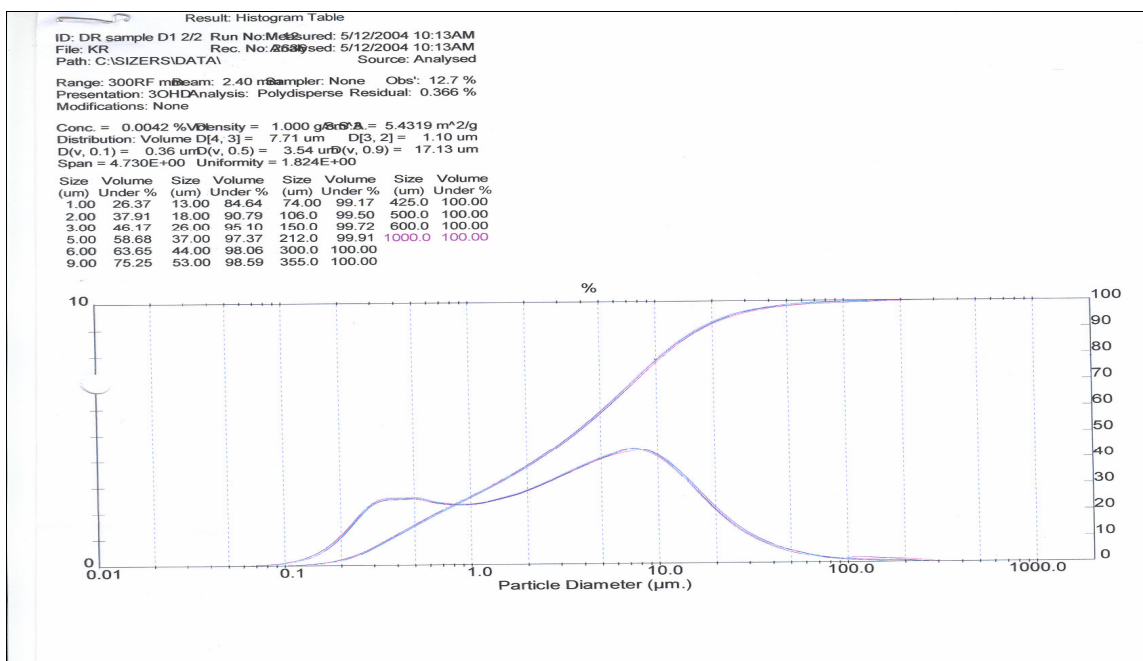


Figure 9.7 Particles size distribution for Sample D1

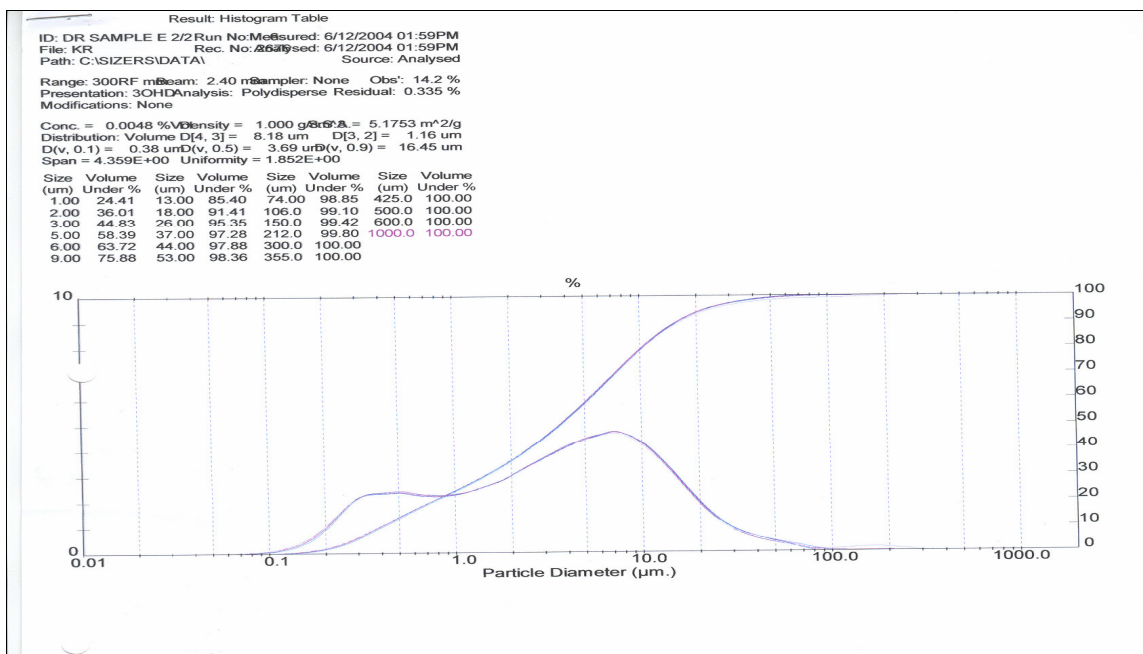


Figure 9.8 Sample size distributions for sample E

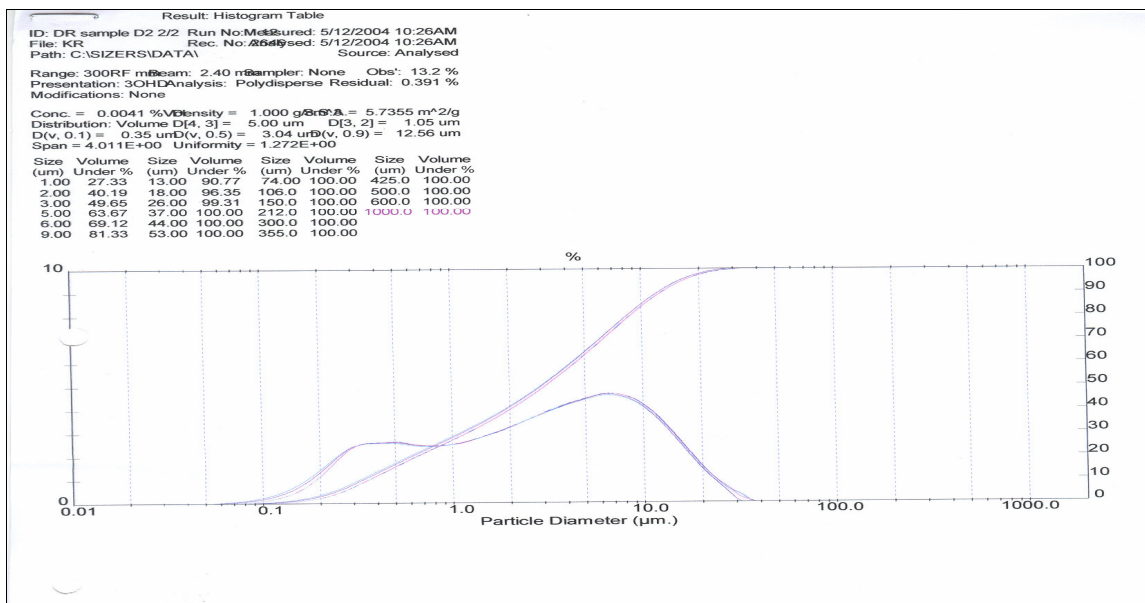


Figure 9.9 Particle size distributions for sample D2

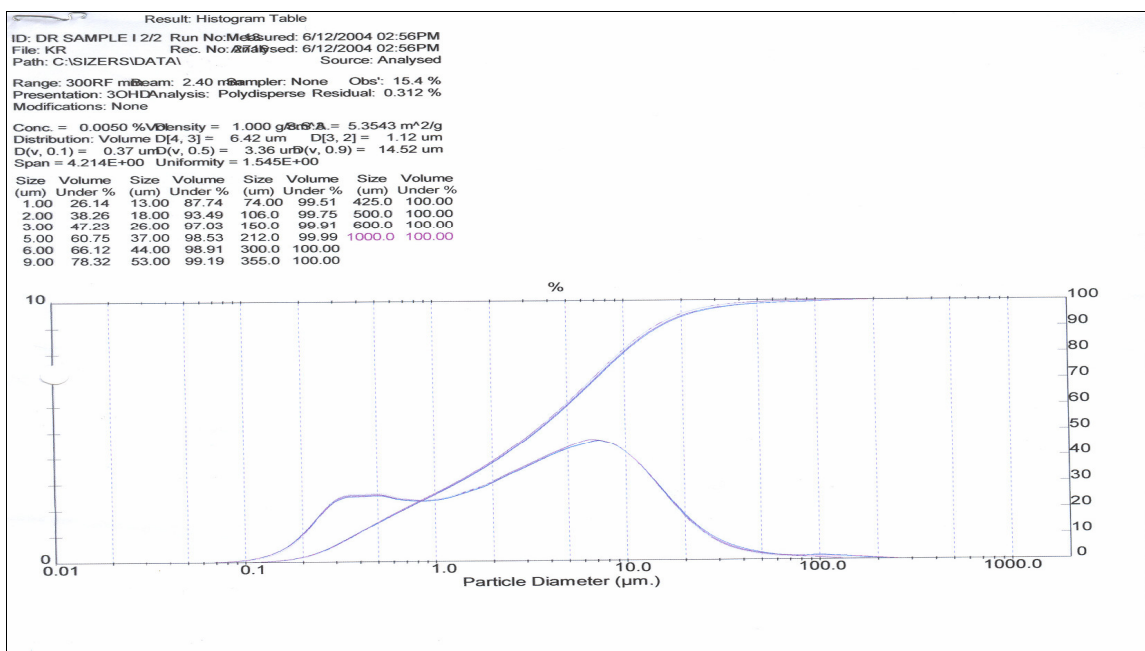
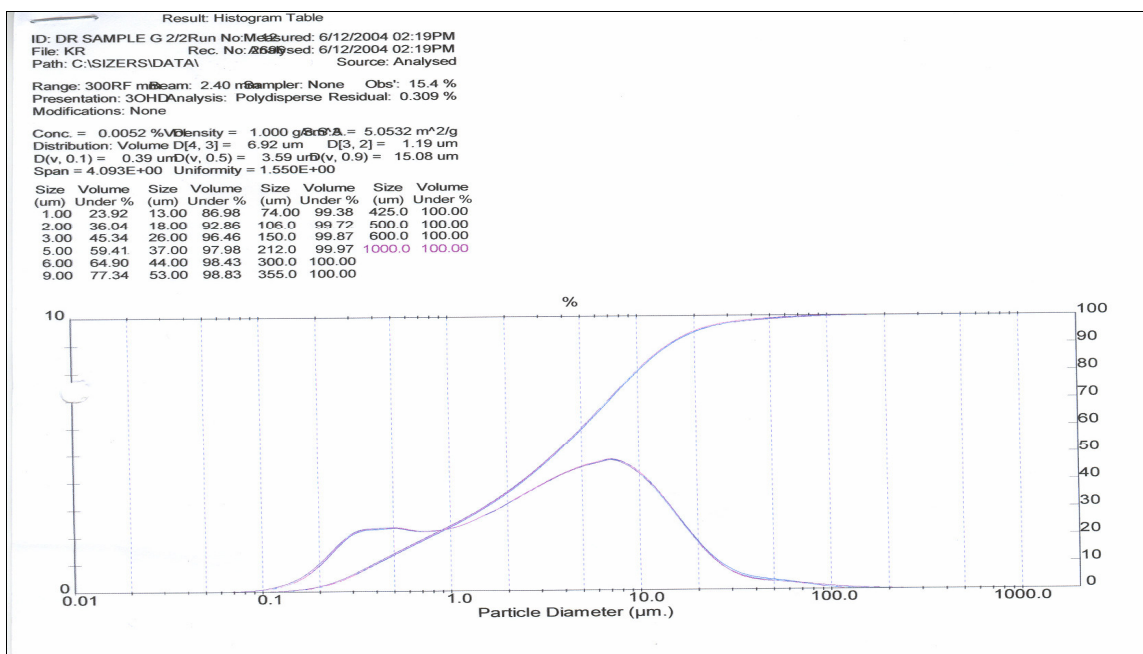
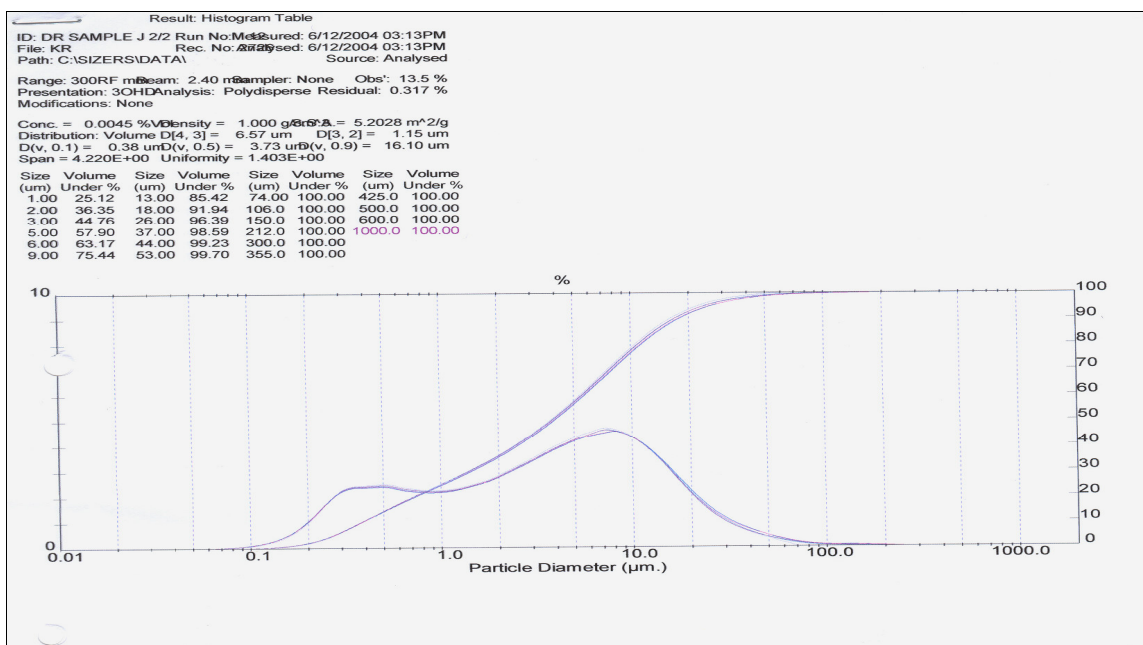


Figure 9.10 Particle size distributions for Sample I



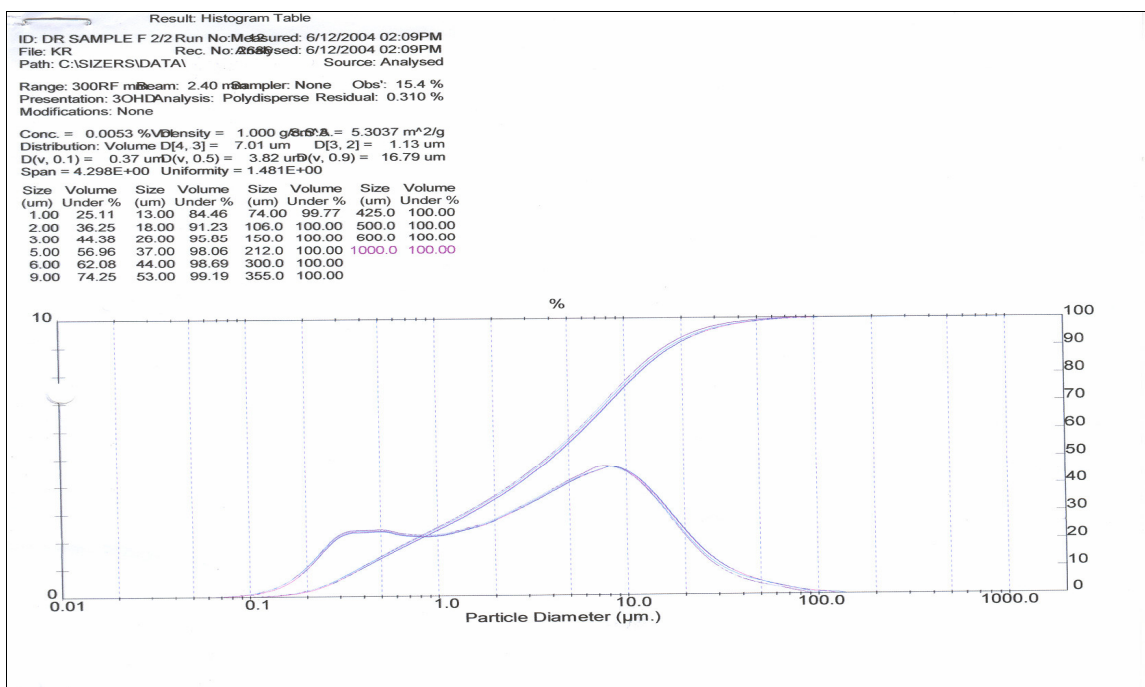


Figure 9.13 Particle size distributions for sample F

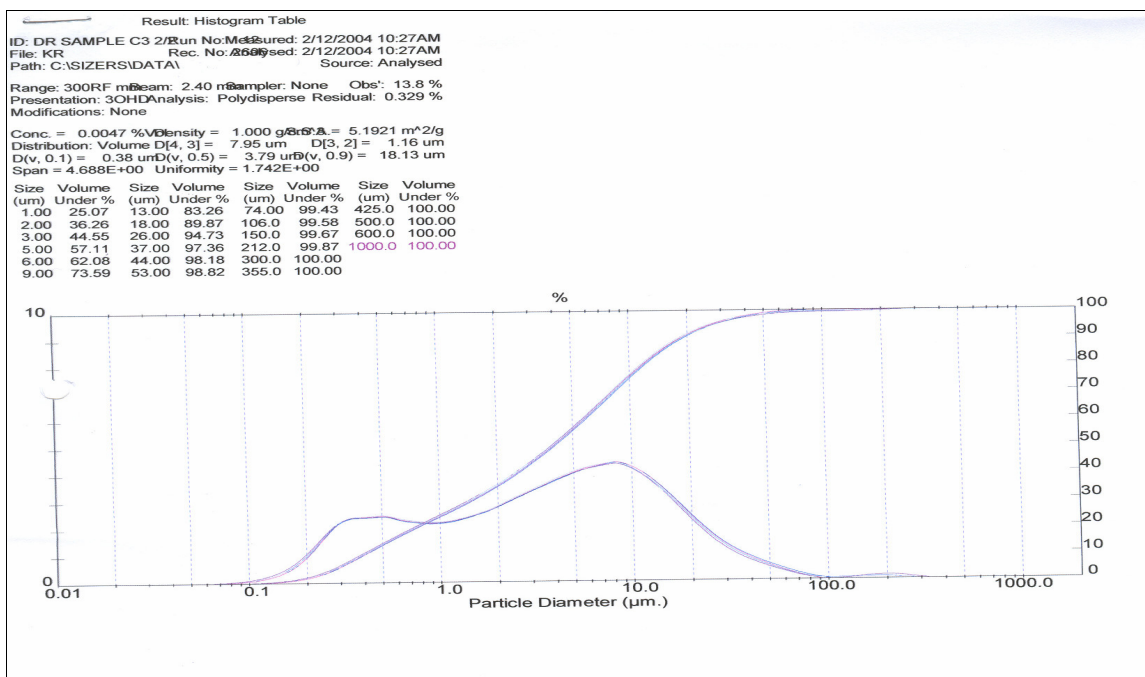


Figure 9.14 Particle size distributions for sample C3

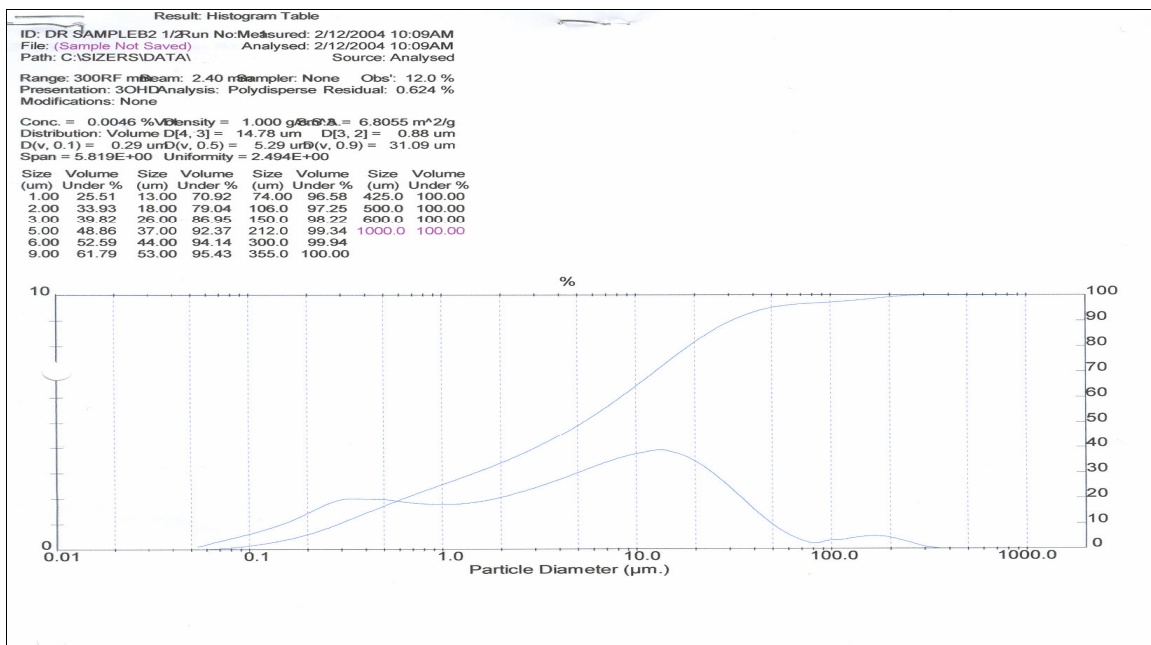


Figure 9.15 Particle size distributions for sample B2

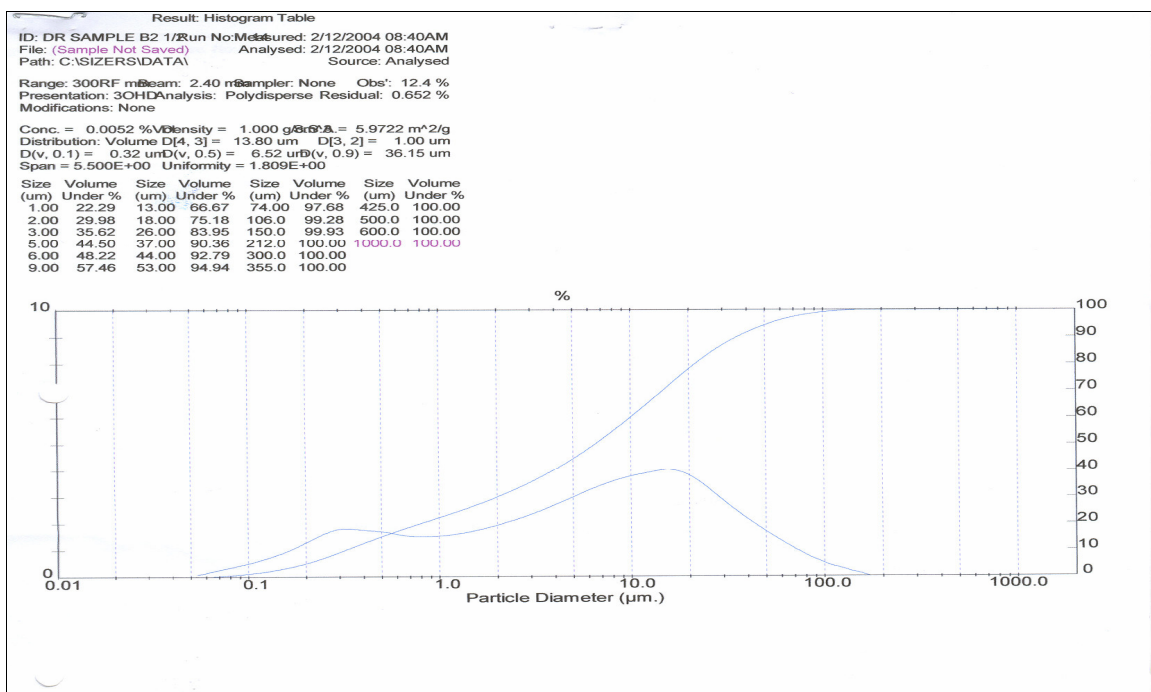


Figure 9.16 Particle size distributions for sample B2

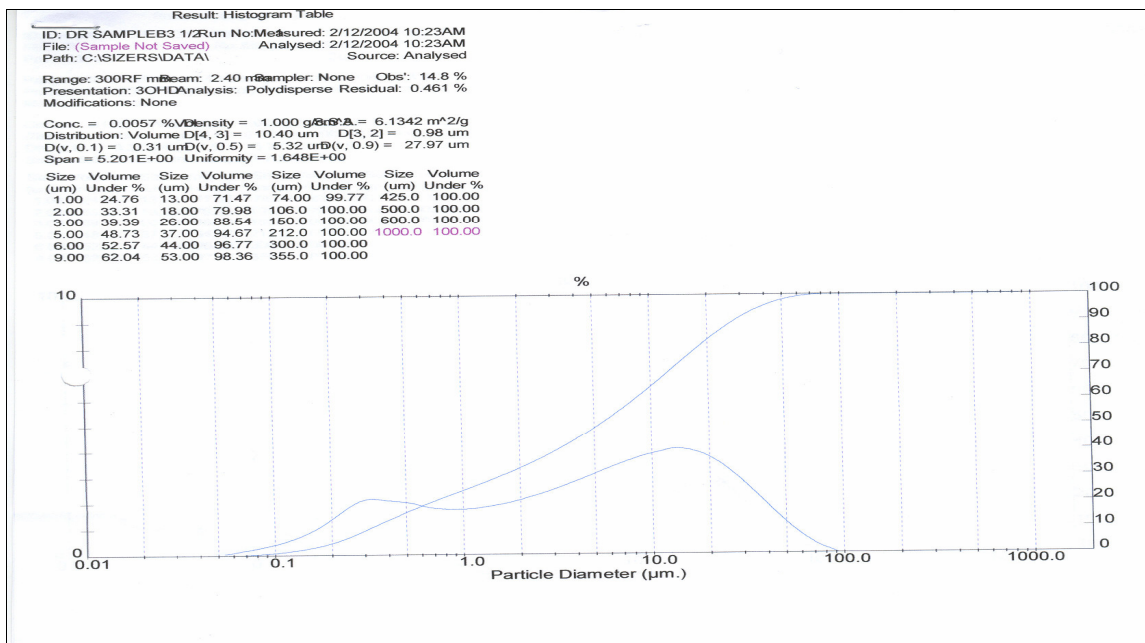


Figure 9.17 Particle size distributions for sample B3

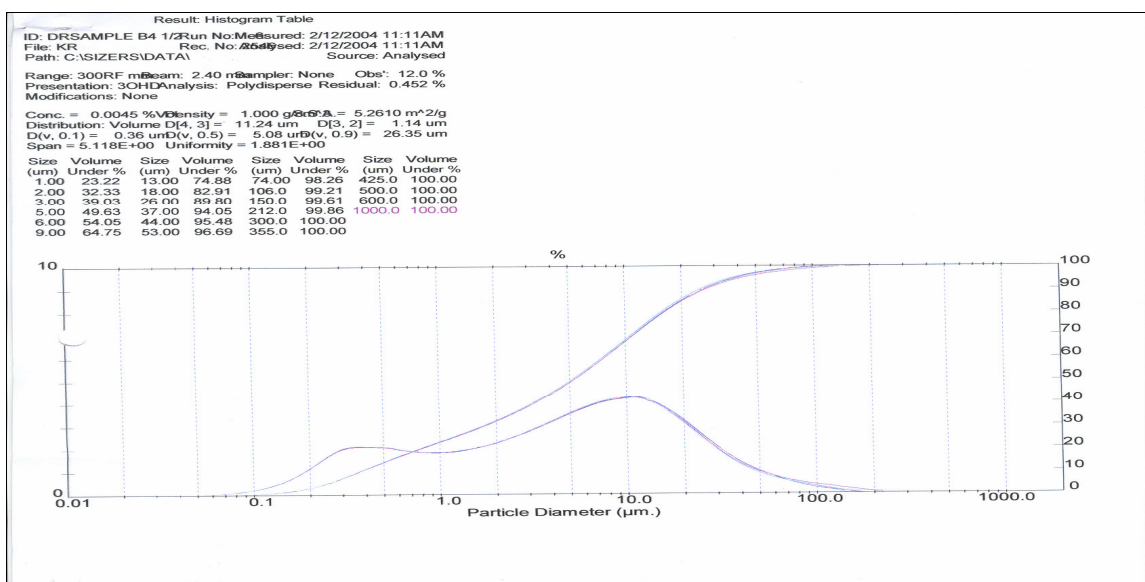


Figure 9.18 Particle size distributions for sample B4

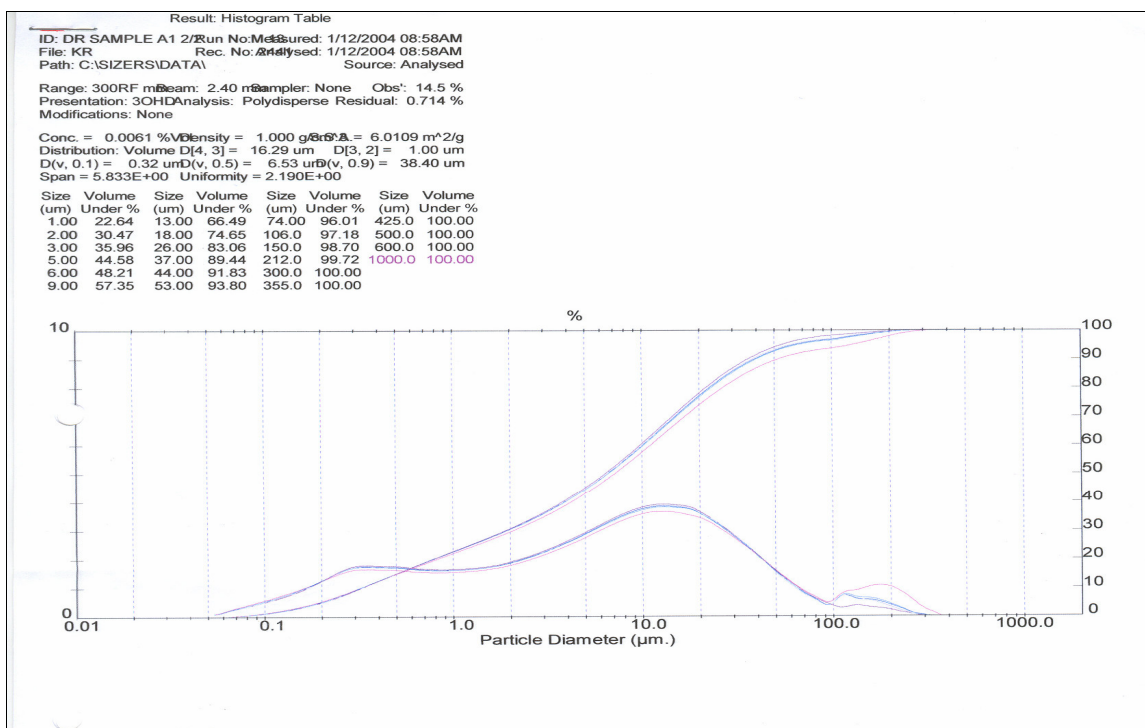


Figure 9.19 Particle size distributions for sample A1

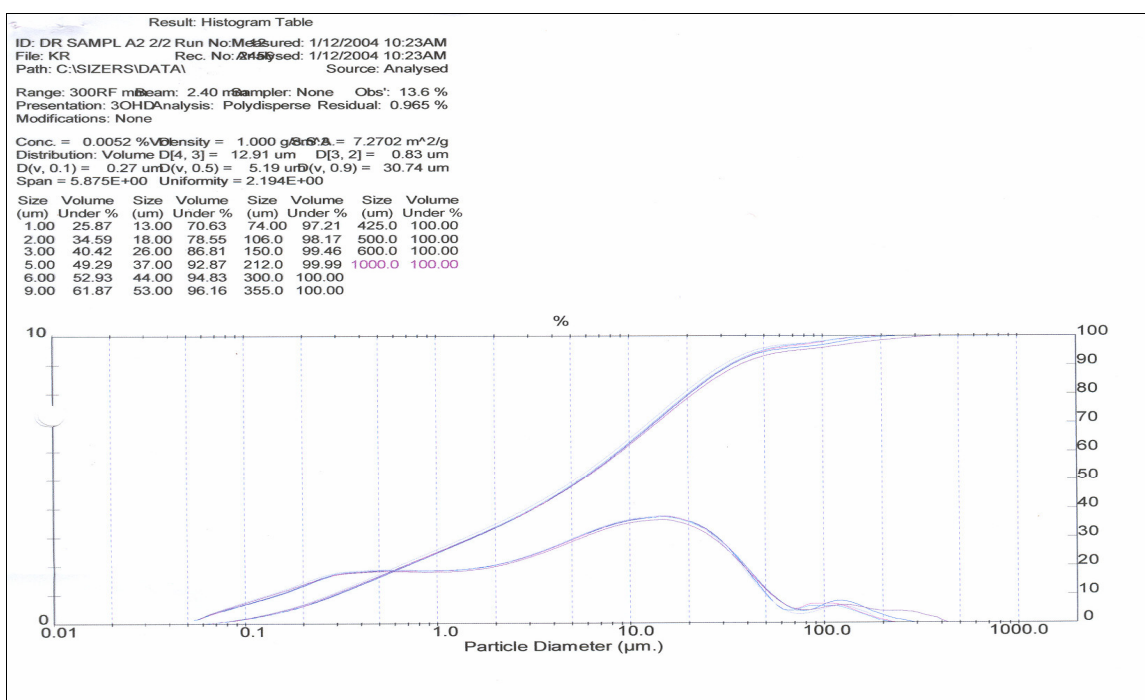


Figure 9.20 Particle size distributions for sample A2

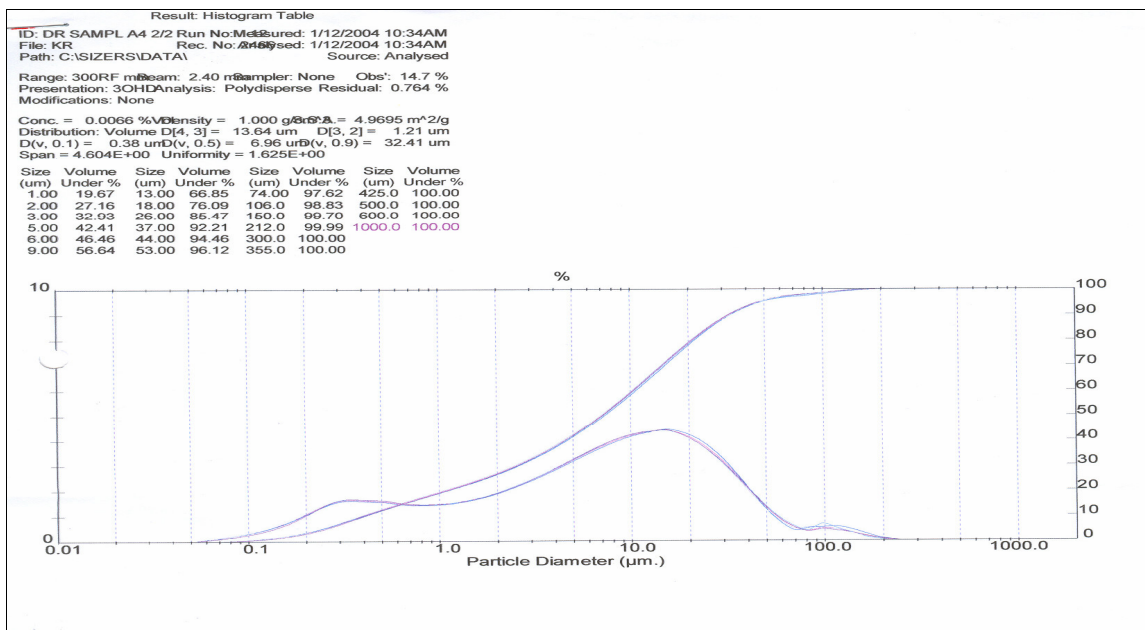


Figure 9.21 Particle size distributions for sample A4

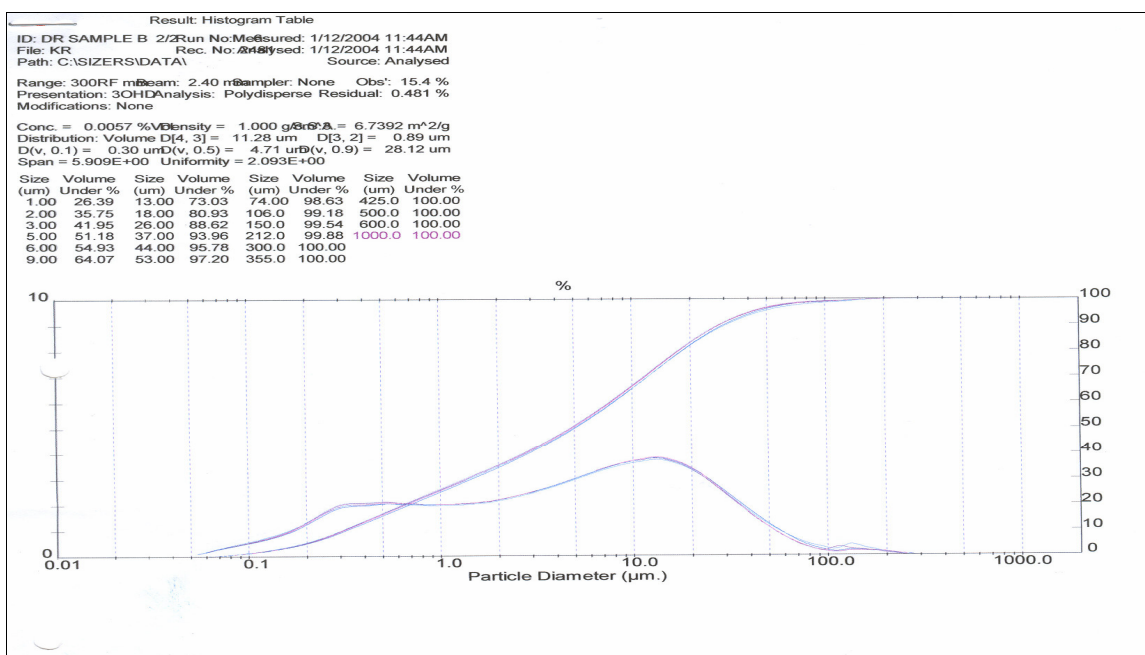


Figure 9.22 Particle size distributions for sample B

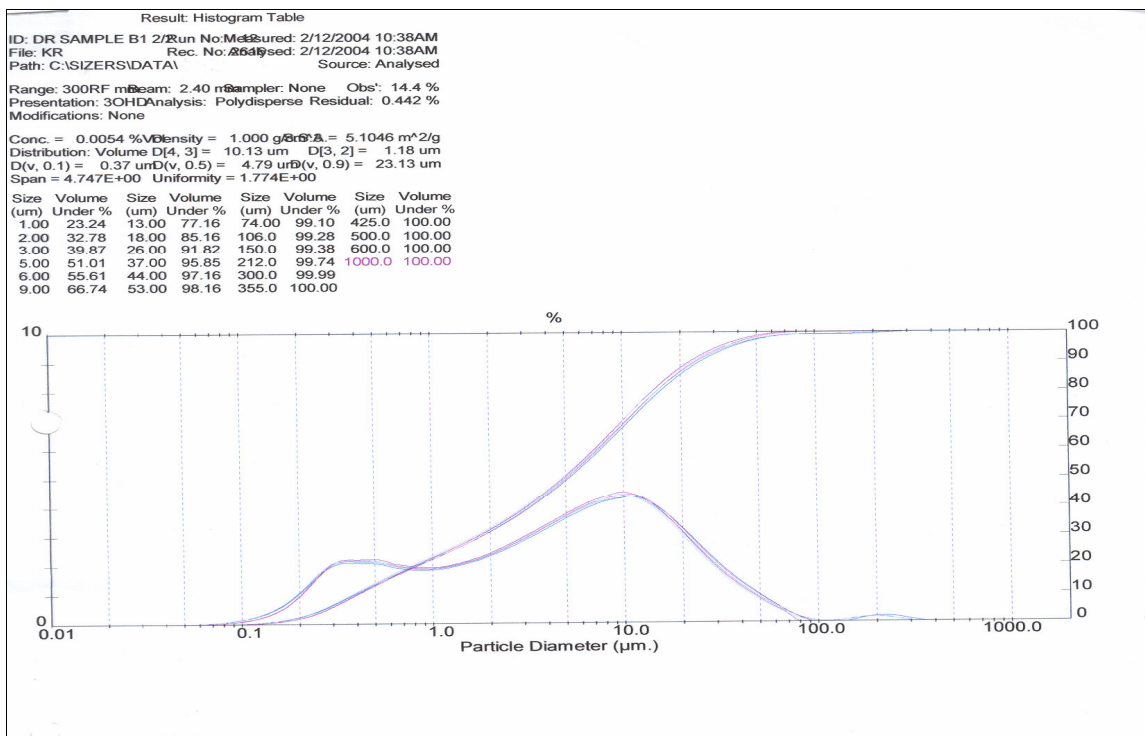


Figure 9.23 Particle size distributions for sample B1

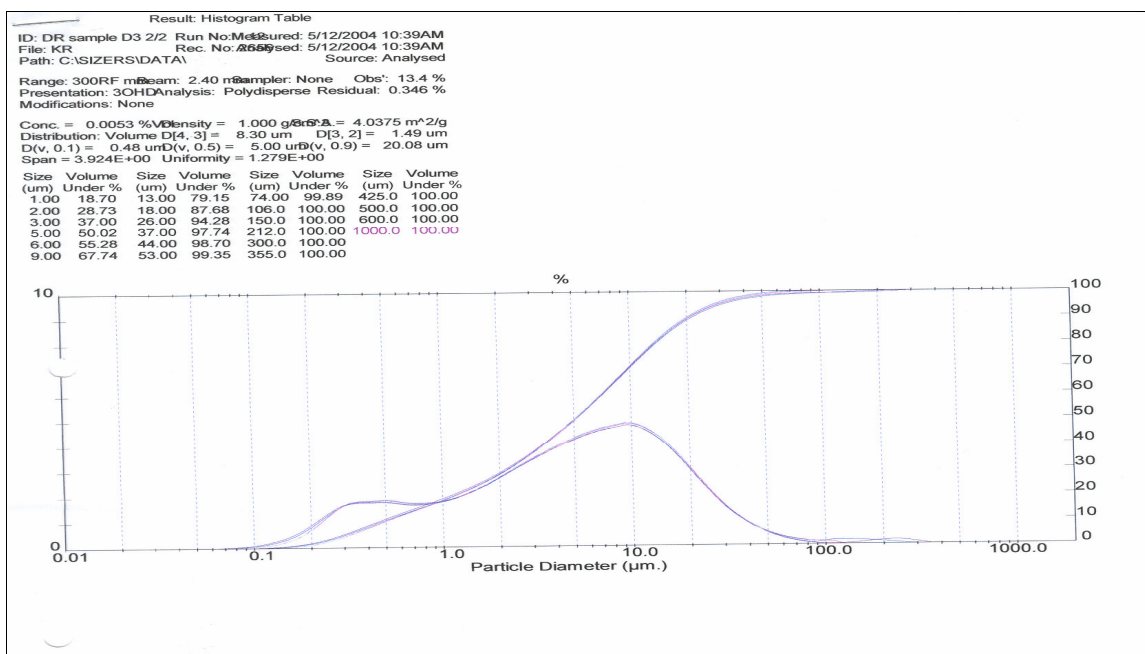


Figure 9.24 Particle size distributions for sample D3

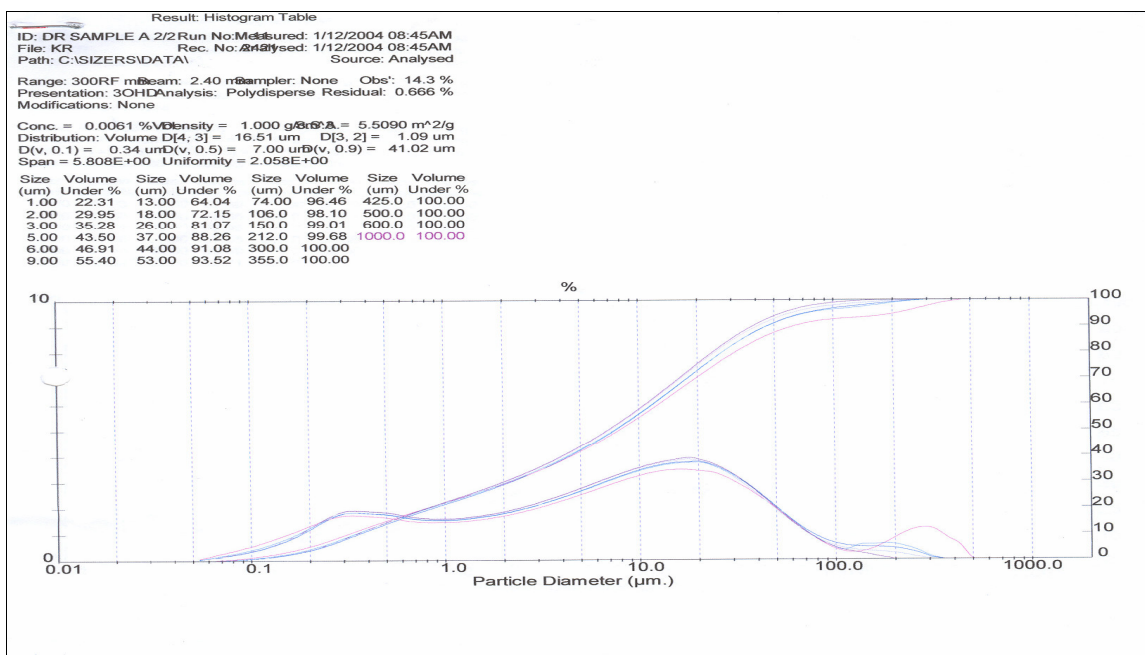


Figure 9.25 Particle size distribution for sample A

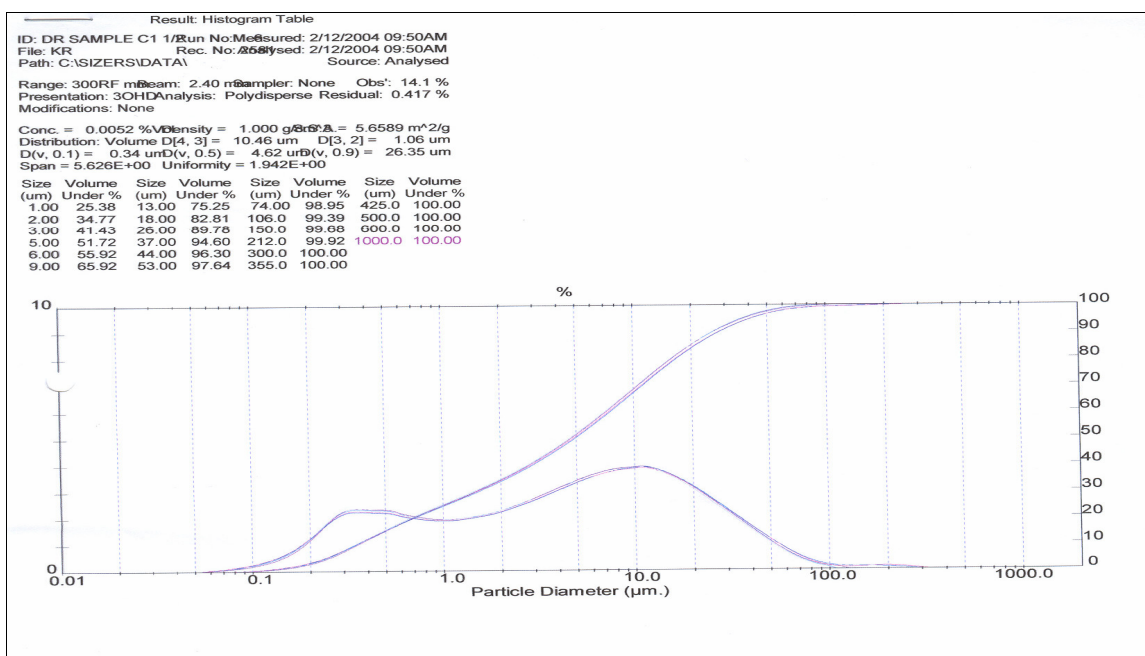


Figure 9.26 Particle size distributions for sample C1

APPENDIX B: Platinum group metals and gold wavelengths' sensitivity and interferences

1. Iridium

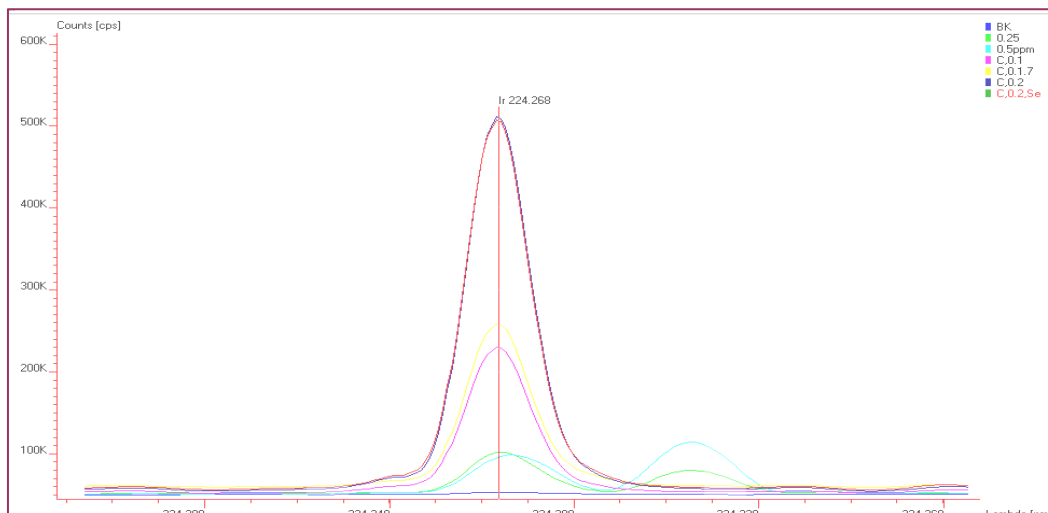


Figure 9.28 Iridium 224.268

Table 9.1 Iridium 228 wavelength sensitivity and interferences

Elements	Sensitivity	Interference
Ir 224.268	150.0	Cu, Pb
Cu 224.261	60.0	
Nb 224.258	4.0	

Comment

Iridium 224.268 was the only iridium wavelength that showed a peak. The other three recommended Iridium lines had no peaks. However, there was serious copper and palladium interference at this wavelength.

2. Osmium

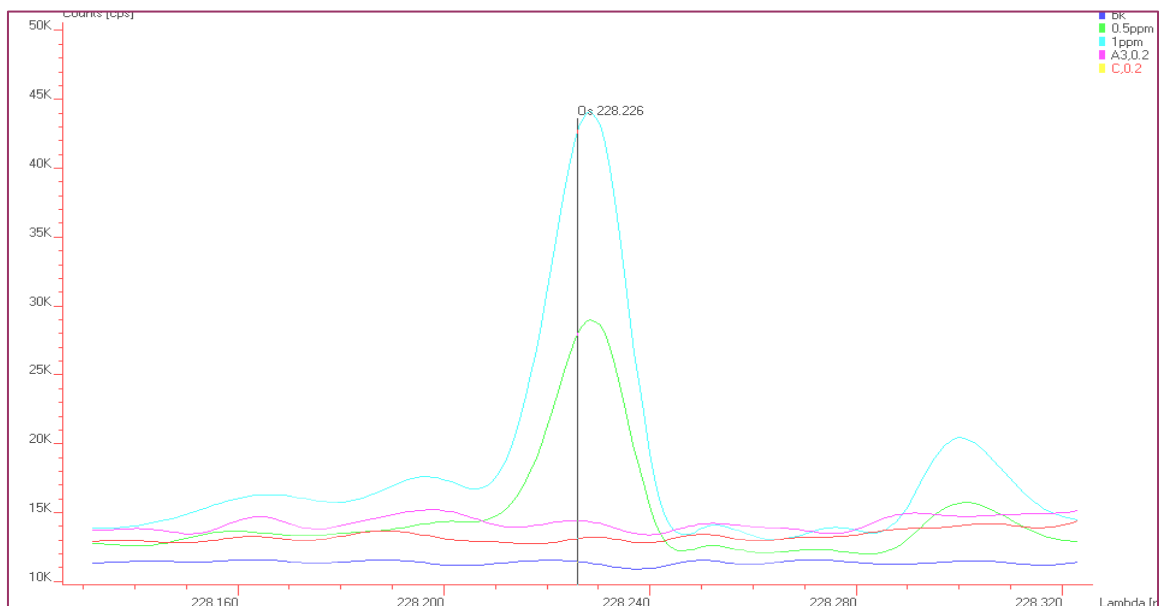


Figure 9.29 Osmium 228.226 wavelength

Table 9.2 Osmium 228.226 wavelength sensitivity and interference

Element	Sensitivity	Interference
Os 228.226	310.0	Ta, Pd
Ta 228.219	6.0	
Pd 228.210	1.5	

Comment

Best Osmium line obtained. The sensitivity of the two interfering elements is way too low to be of significance relative to the sensitivity of osmium 228.226.

3. Palladium

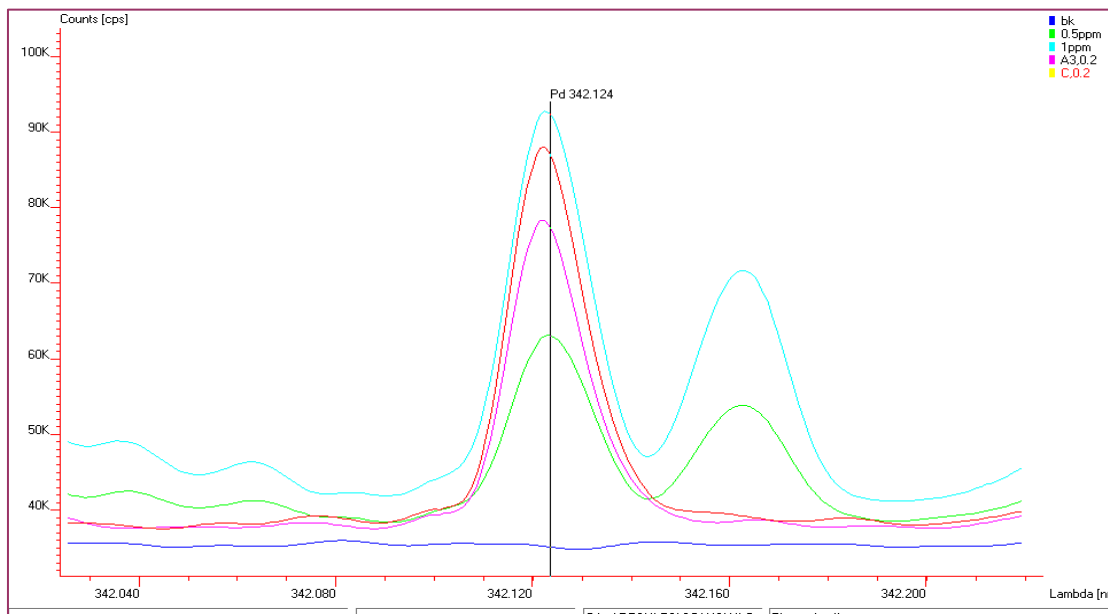


Figure 9.30 Palladium 229.653 wavelength

Table 9.3 Palladium 229.653 wavelength sensitivity and interference

Element	Sensitivity	Interference
Pd 342.124	360.0	Rh, Ni
Rh 342.122	6.0	
Ni 342.134	5.5	

Comment

Best line obtained for palladium metal, high sensitivity with good peaks and less interference.

4. Platinum

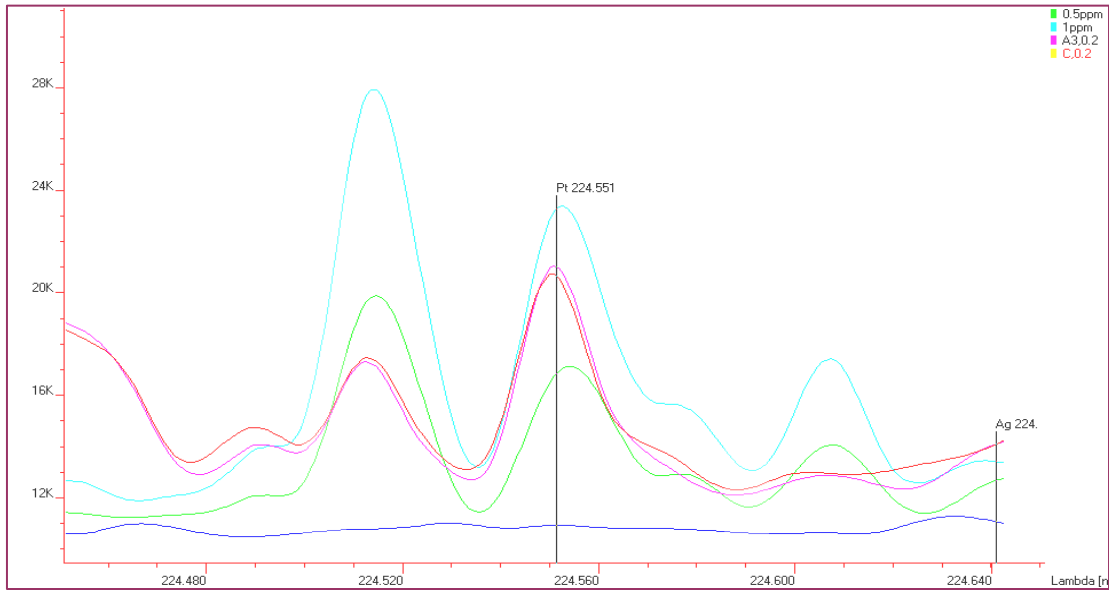


Figure 9.31 Platinum 224.551 wavelength

Table 9.4 Platinum 224.551 wavelength sensitivity and interference

Element	Sensitivity	Interference
Pt 224.551	48.0	Ba 225.561
Co 224.513	60.0	
Ba 224.561	6.0	

Comment

Excellent platinum peaks but low sensitivity hence not a very good peak for use.

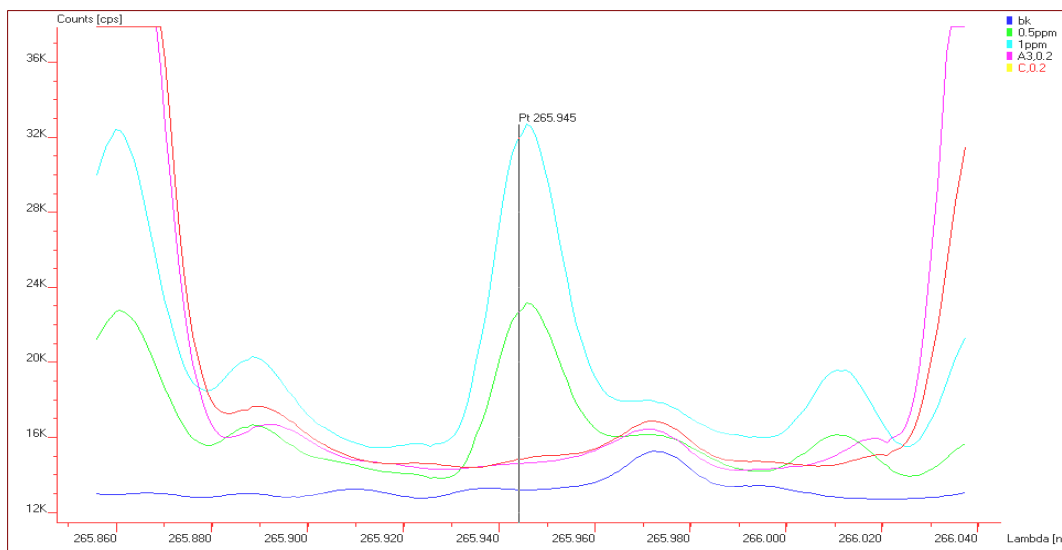


Figure 9.32 Platinum 265.945 wavelength

Table 9.5 Platinum 265.945 wavelength sensitivity and interference

Element	Sensitivity	Interference
Pt 265.945	230.0	U
U 265.946	2.5	
Os 265.983	6.0	

Comment

Best Platinum line obtained with a good sensitivity and less interference. However, the sample peaks, A3,0.2 and C,0.2 were not evident. The line produced good sample recovery percentage for platinum metal.

5. Rhodium

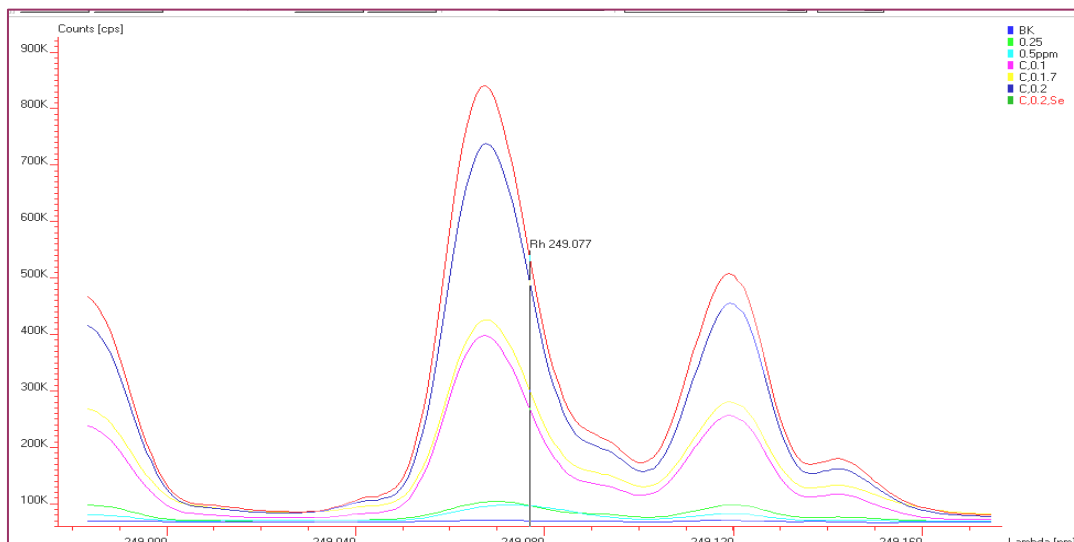


Figure 9.33 Rhodium 343.489 wavelength

Table 9.6 Rhodium 343.489 wavelength sensitivity and interference

Element	Sensitivity	Interference
Rh 343.489	710.0	Mo
Mo 343.479	11.0	

Comment

Good rhodium line with a high sensitivity and less interference. The sensitivity of molybdenum 343.479 line relative to that of rhodium wavelength renders its interference negligible.

6. Ruthenium

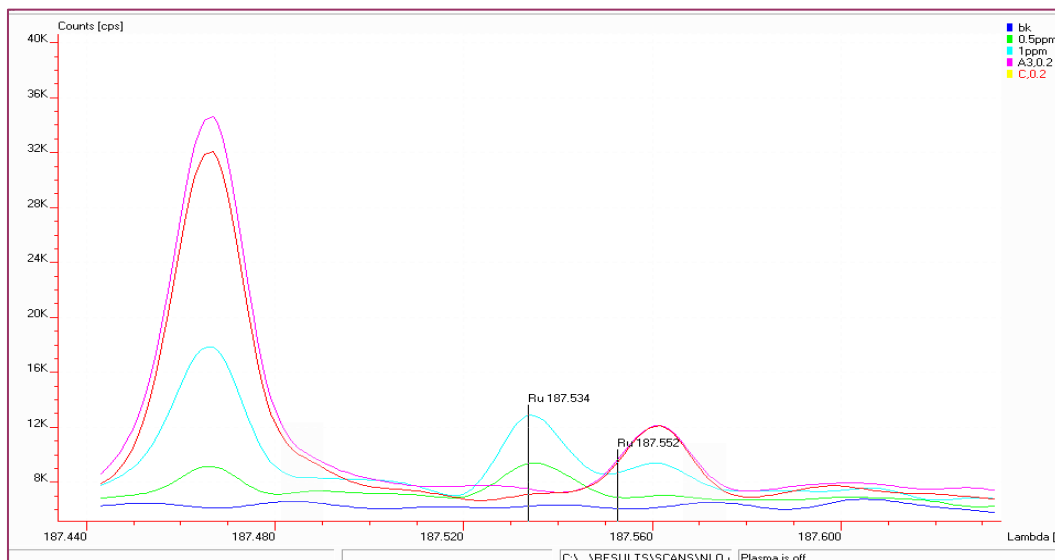


Figure 9.34 Ruthenium 187.534 wavelength

Table 8.7 Ruthenium 187.534 wavelength sensitivity and interference

Element	Sensitivity	Interference
Ru 187.534	9000.0	Non

Comment

Ruthenium 187.534 was the best wavelength obtained for ruthenium metal with very high sensitivity and no interference. However, the peaks obtained were low especially for the samples, A2,0.2 and C, 0.2.

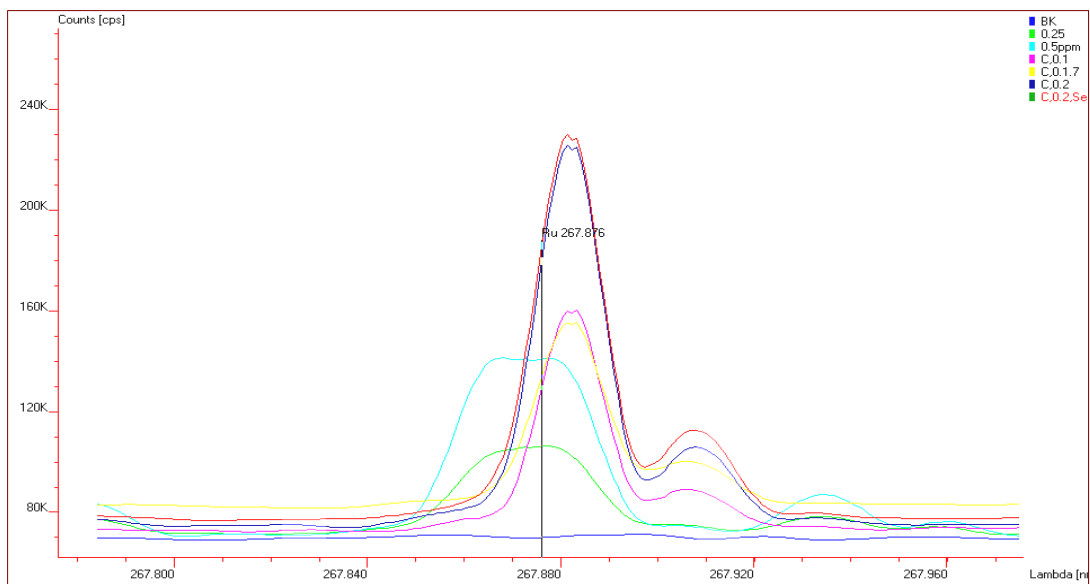


Figure 9.37 Ruthenium 267.876 wavelength

Table 9.8 Ruthenium 267.876 wavelength sensitivity and interference

Element	Sensitivity	Interference
Ru 267.876		Nb, Ta
Nb 267.876	40.0	
Ta	267.880	

Comment

Nb and Ta enhances ruthenium 267.876 peak hence this wavelength was not used.

APPENDIX C: Platinum group metals and gold wavelengths (scans)

Table 9.9 Description of samples

Sample	Reagents
A	0.2g soil sample, 5mL Conc HNO ₃ (55%), 95 mL 0.05% Na ₄ P ₂ O ₇
B	0.2g soil sample, 5mL Conc HNO ₃ (55%), 95 mL 0.05% Na ₄ P ₂ O ₇

Table 9.10 KEY describing the symbols used

Symbol	Description
Bkfm	Blank (5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇); fm - fast mode strategy
Bkm	Blank (5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇); m - manual strategy
0.25fm	0.25 ppm specpure calibration standard containing 5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇ ; fm – fast mode strategy.
0.25m	0.25 ppm specpure calibration standard containing 5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇ ; m – manual strategy
0.5m	0.5 ppm specpure calibration standard containing 5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇ ; m – manual strategy
0.5fm	0.5 ppm specpure calibration standard containing 5mL HNO ₃ , 95mL 0.05% Na ₄ P ₂ O ₇ ; fm – fast mode strategy
A2m	Sample A; m – manual mode strategy.
B2mu	Sample B; m – manual mode strategy
B2Se	Sample B; Se – sensitive mode strategy

Osmium 228.226

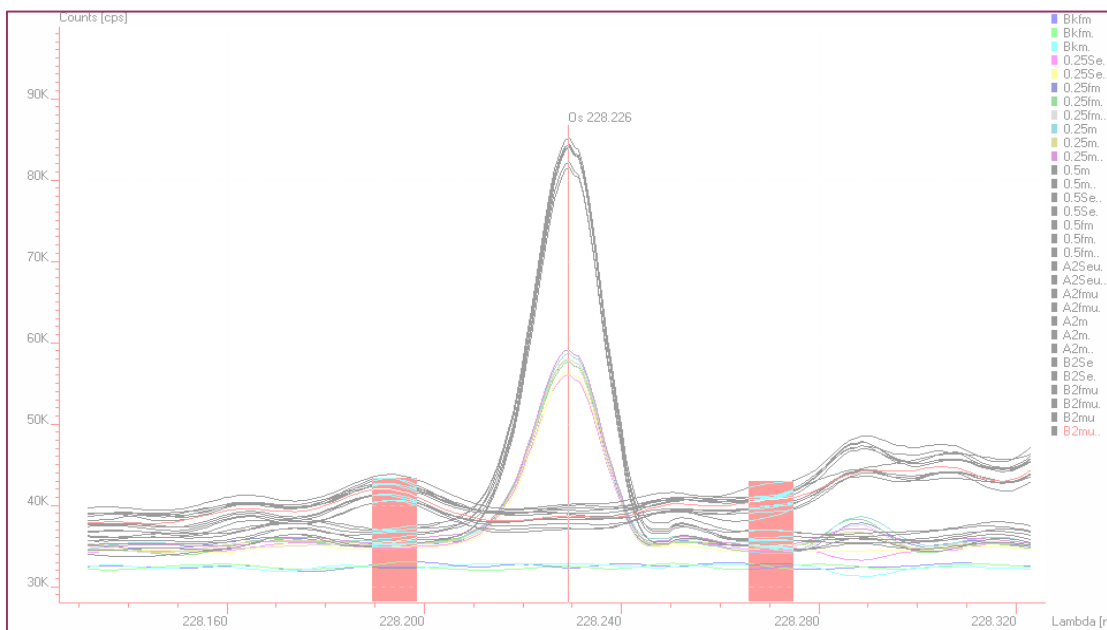


Figure 9.36 Osmium 228.226 wavelength

8. Palladium 342.124

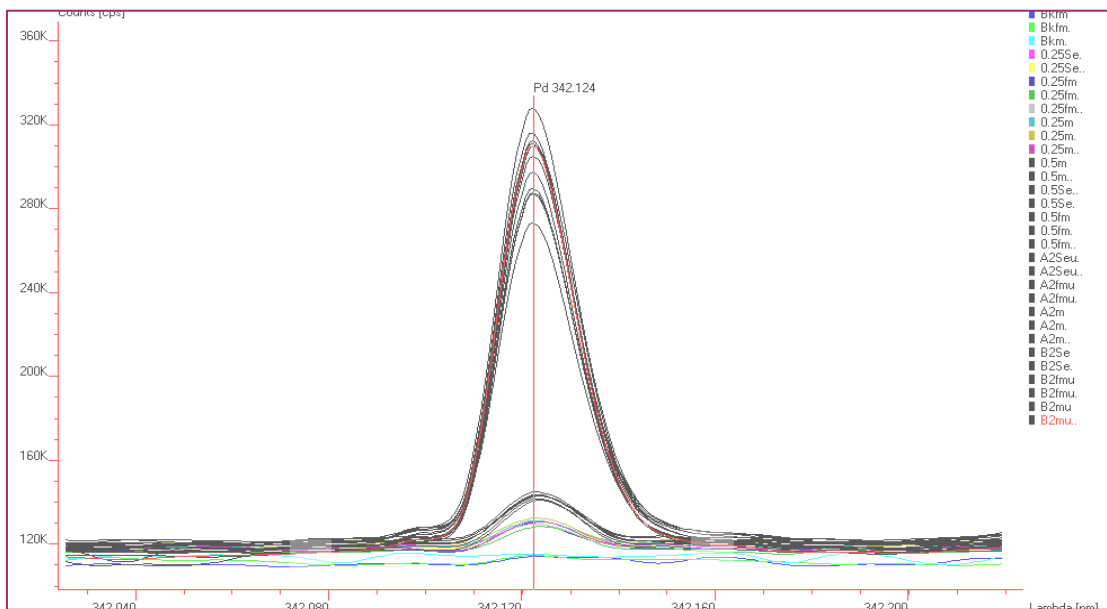


Figure 9.37 Palladium 342.124 wavelength

9. Rhodium 343.489

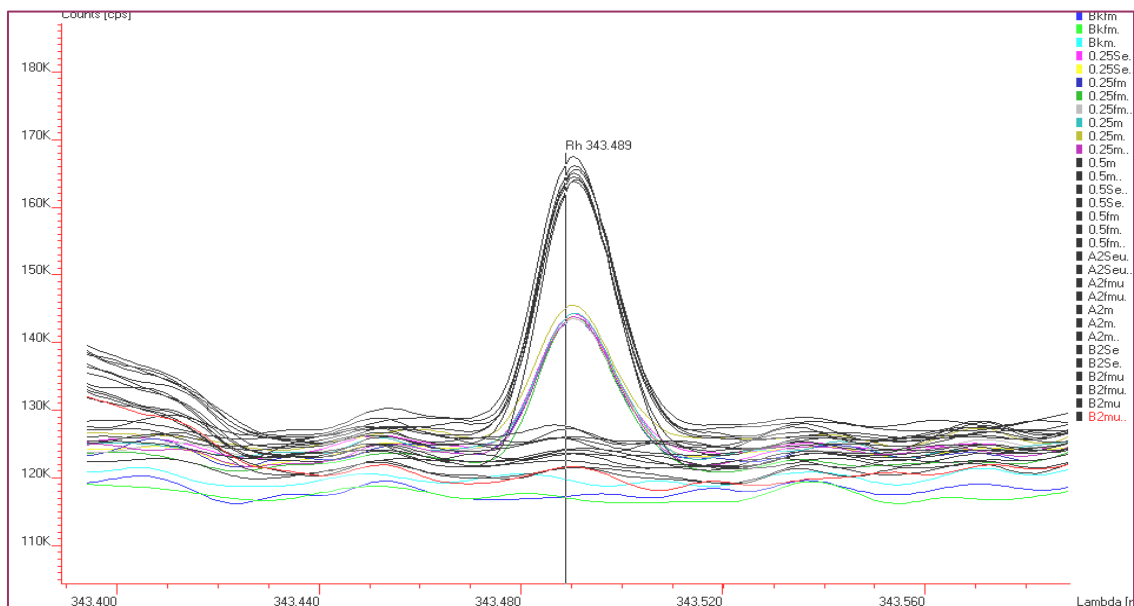


Figure 9.38 Rhodium 343.489 wavelength

Platinum 224.551

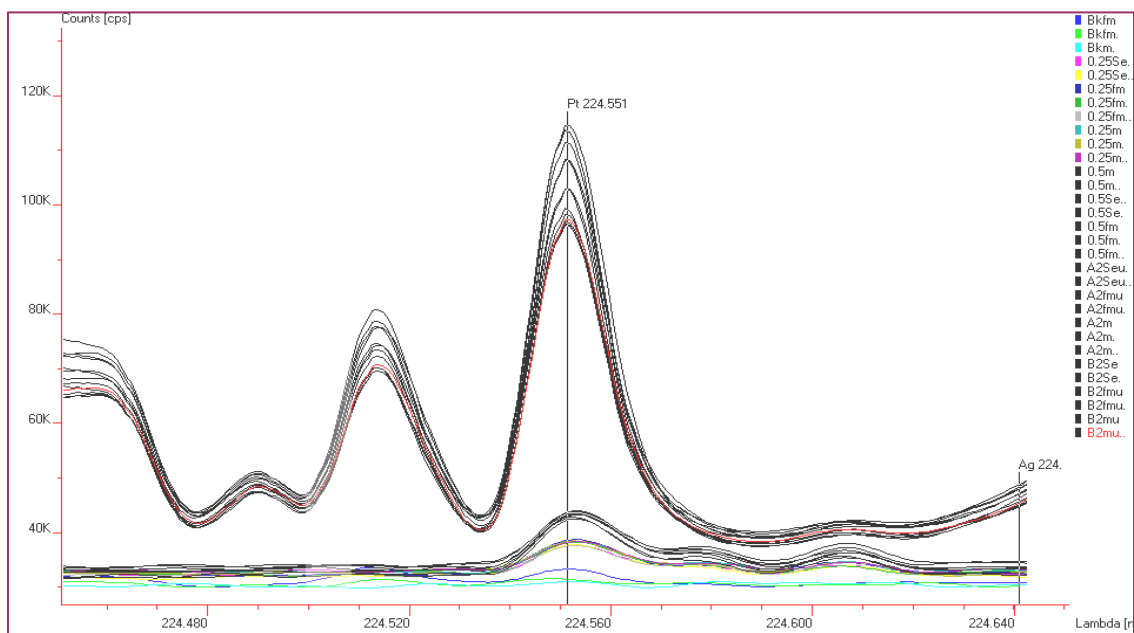


Figure 8.39 Platinum 224.551 wavelength

Rhodium 369.240

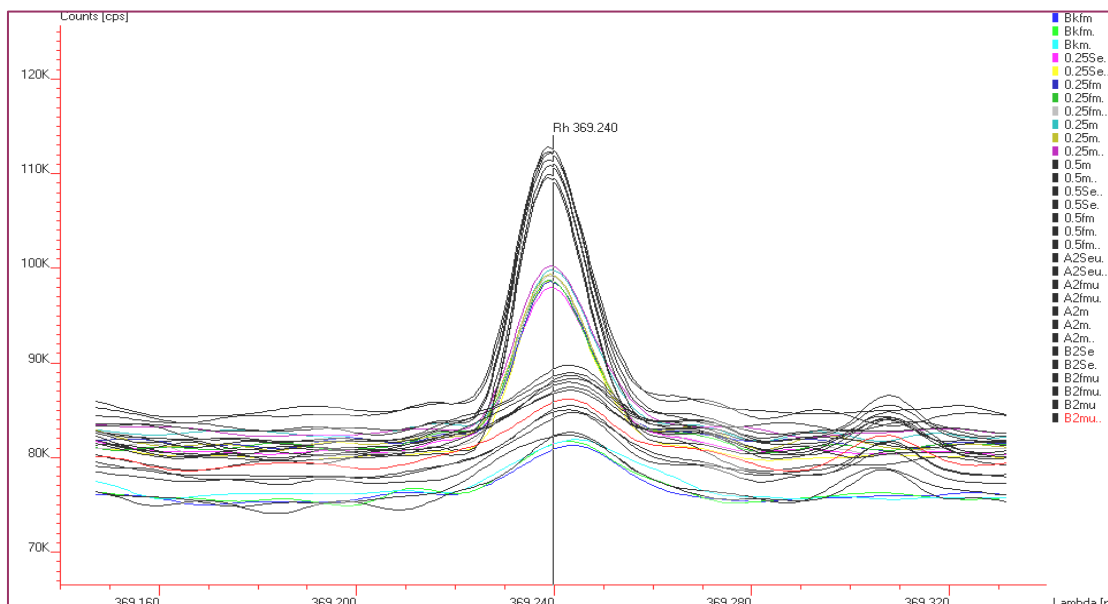


Figure 9.40 Rhodium 369.240 wavelength

Palladium 340.450

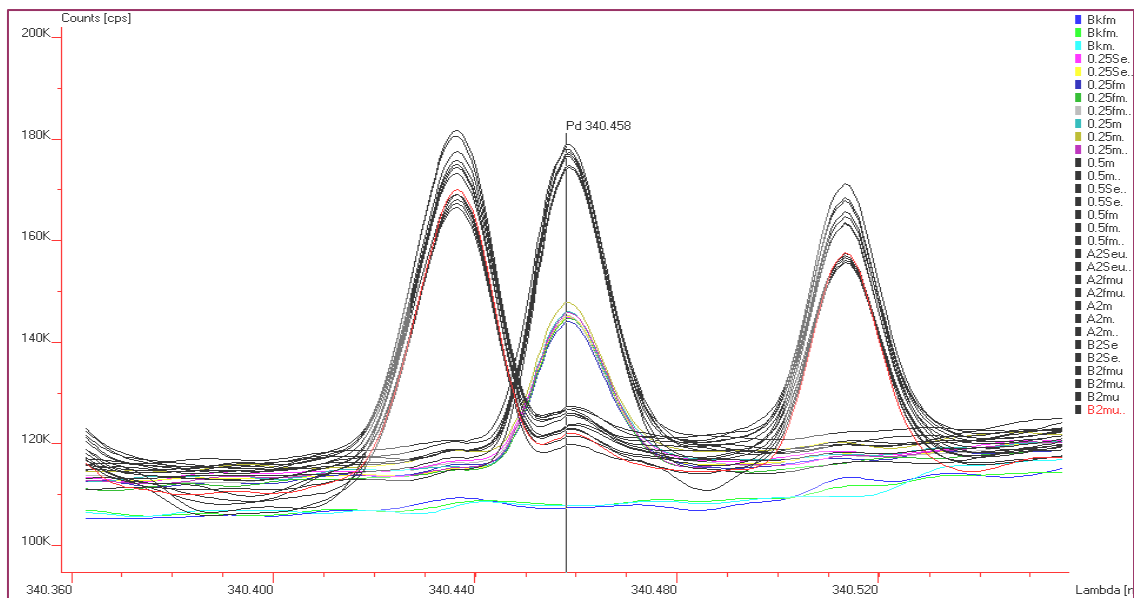


Figure 9.41 Palladium 340.458 wavelength

Ruthenium 187.584

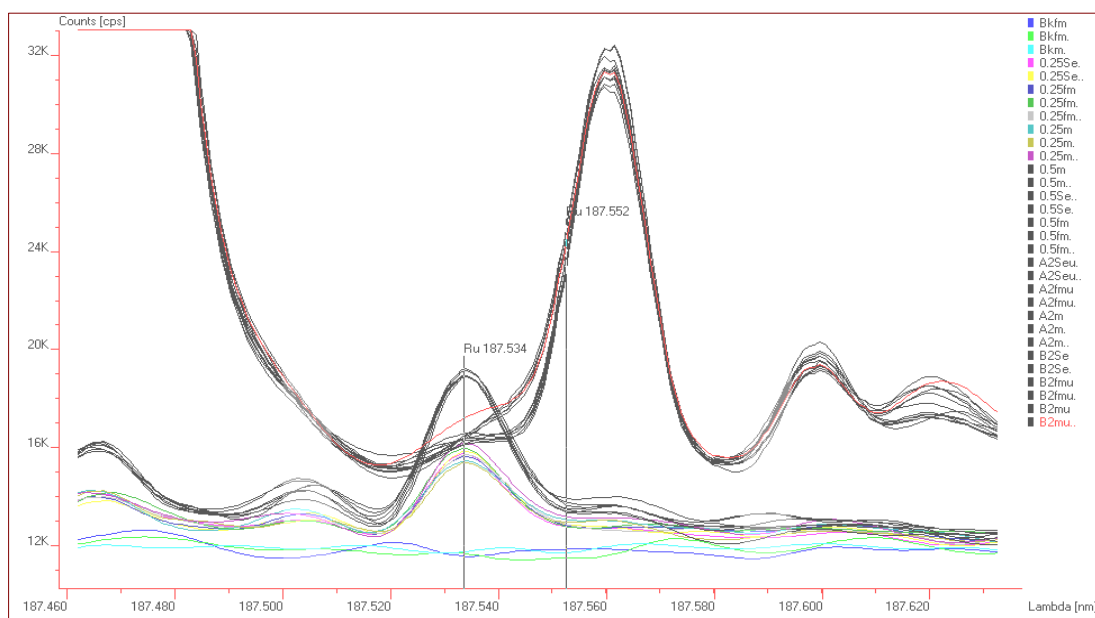


Figure 9.42 Ruthenium 187.584 wavelength

APPENDIX D: Base metals (Co, Ni, Cu and Fe) selected wavelength peaks

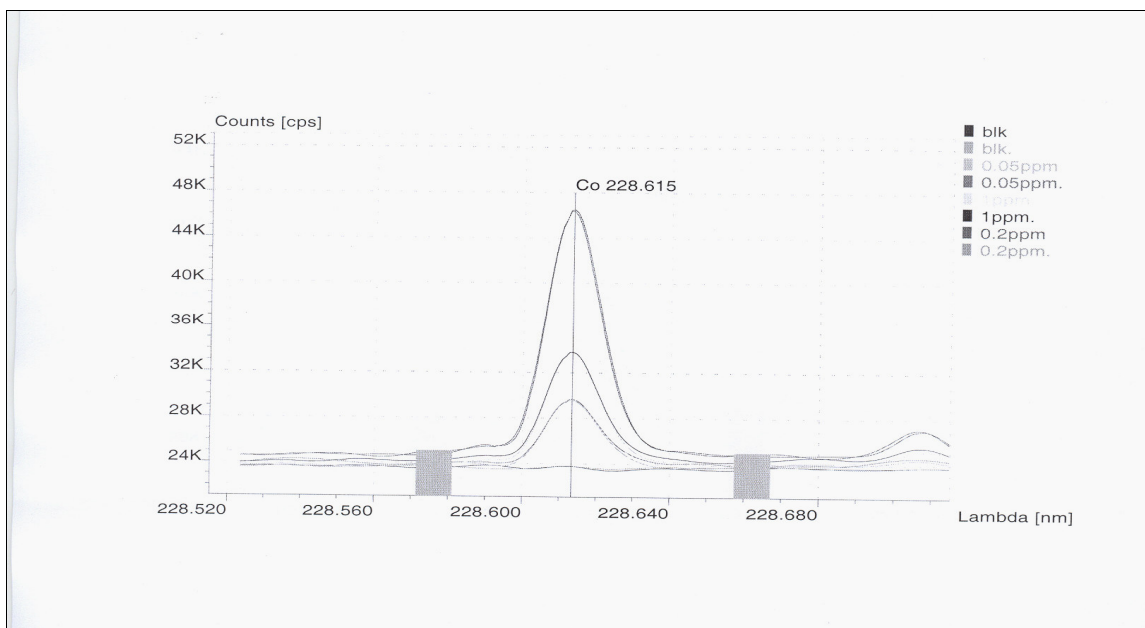


Figure 8.43 Cobalt 228.615 wavelength

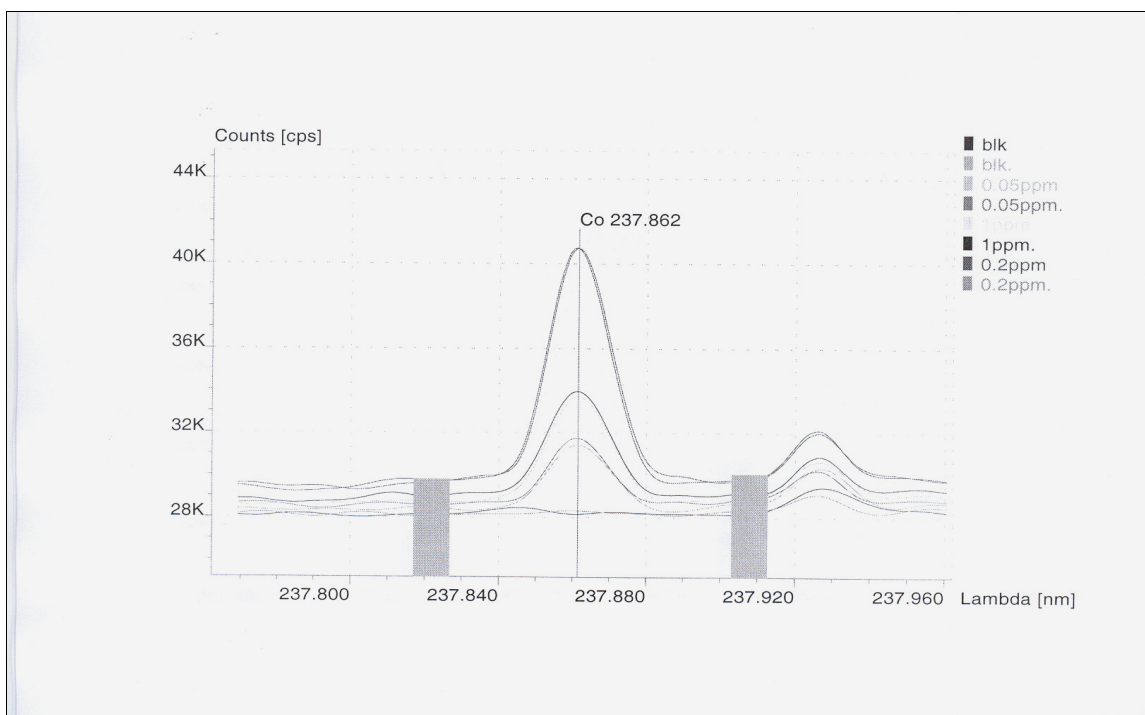


Figure 9.44 Cobalt 237.662 wavelength

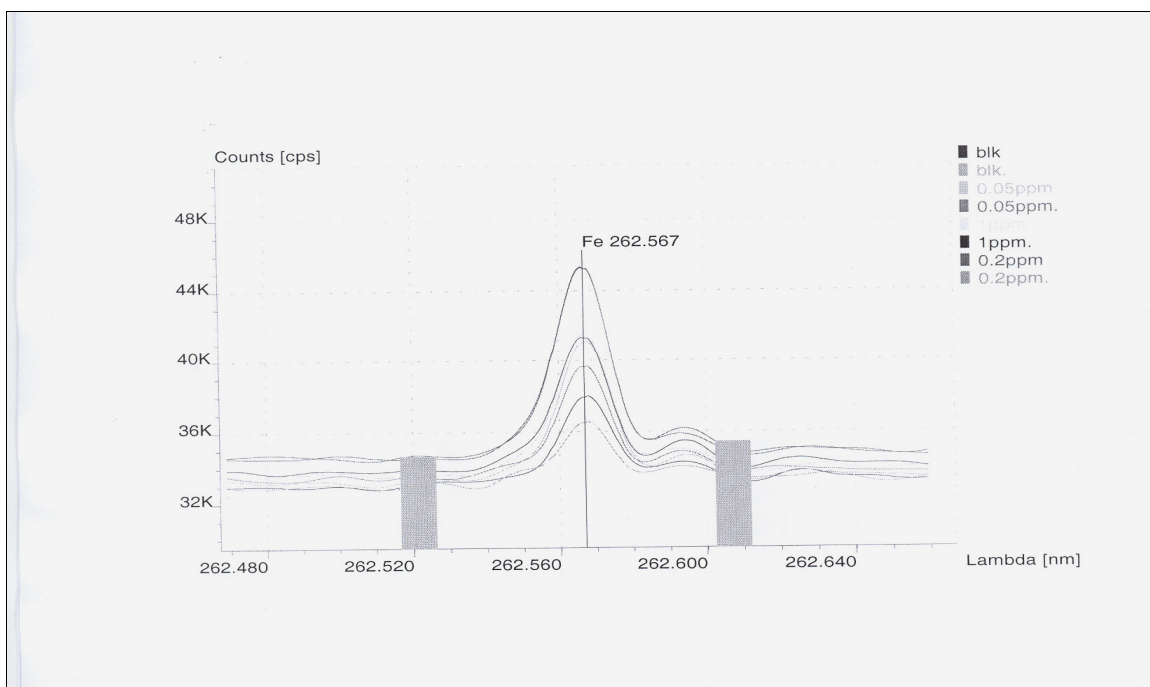


Figure 9.45 Iron 262.567 wavelength

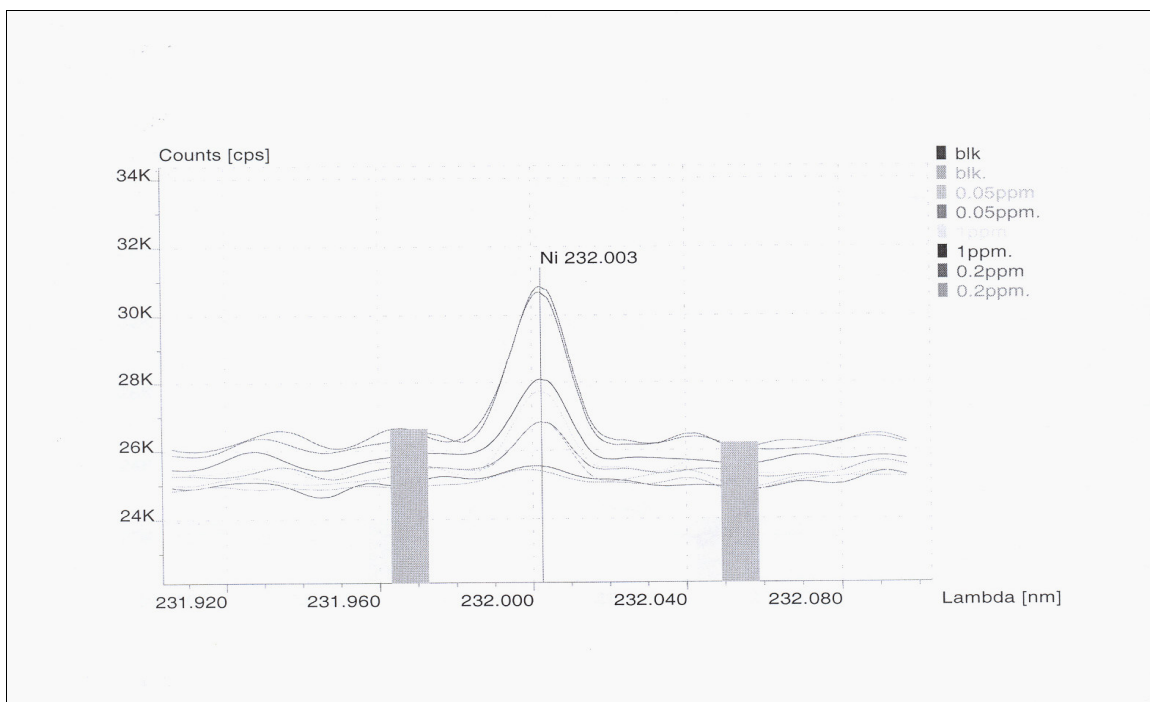


Figure 9.46 Nickel 232.003 wavelength

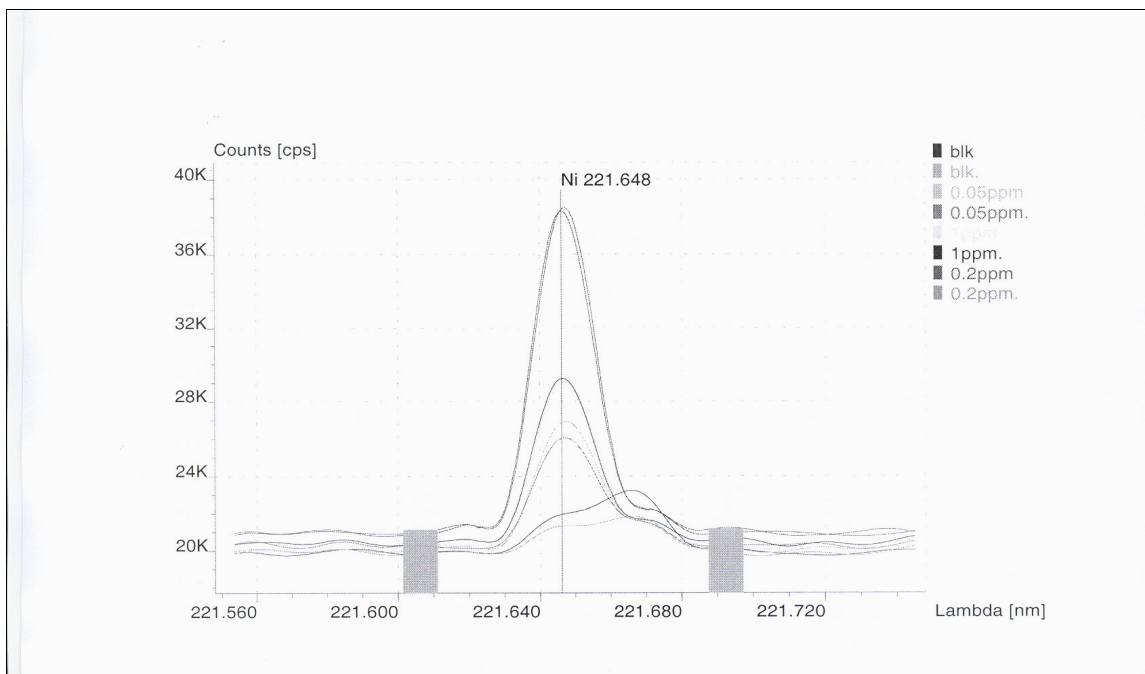


Figure 9.47 Nickel 221.648 wavelength

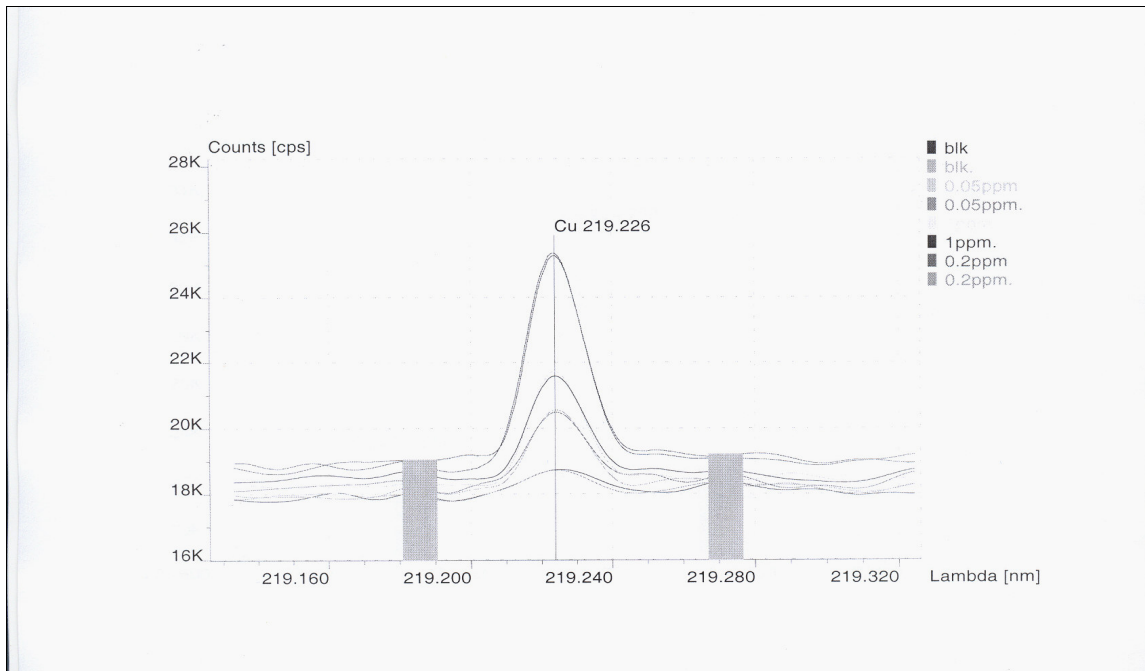


Figure 9.48 Copper 219.226 wavelength

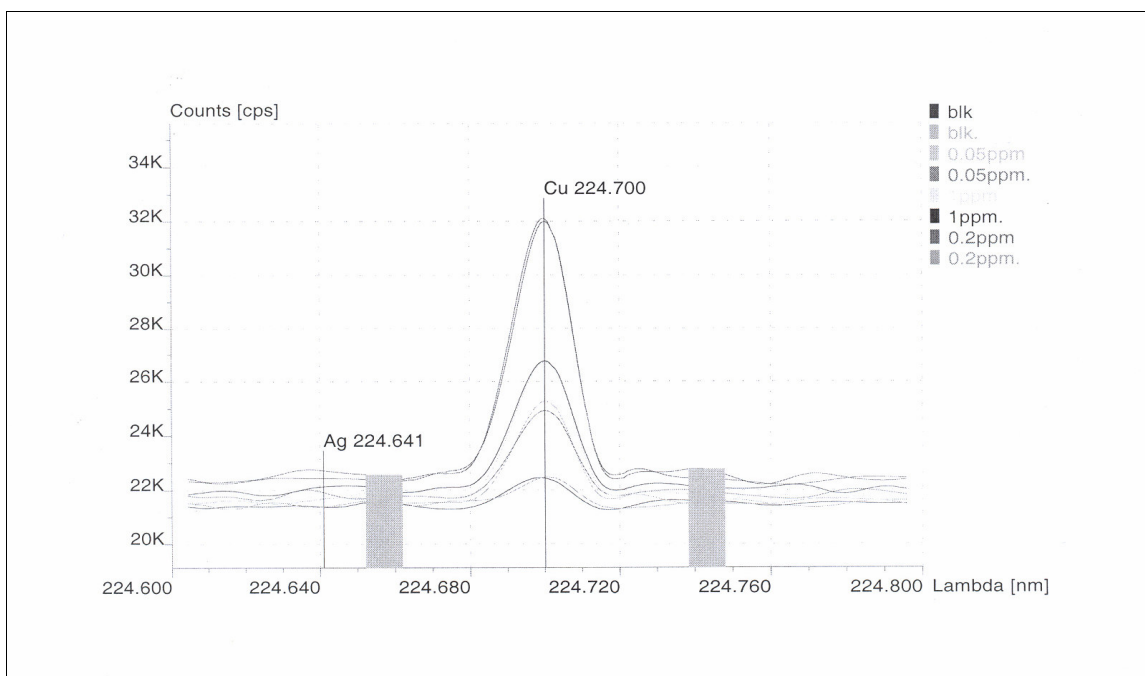


Figure 9.49 Copper 224.700 wavelength

APPENDIX E: Standard additioin calibration curves for PGMs and gold

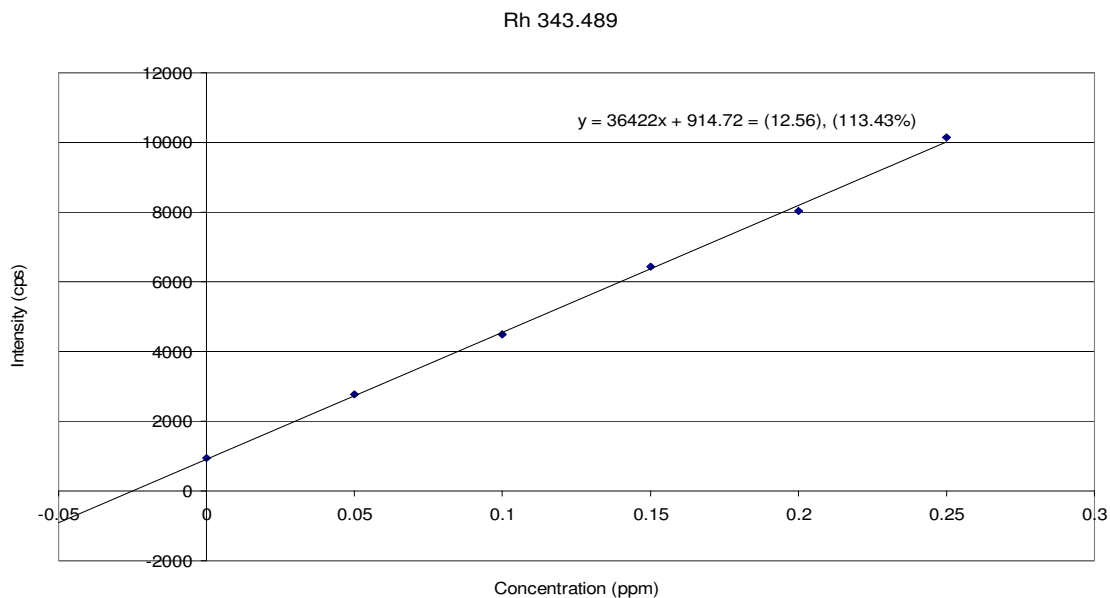


Figure 9.50 Standard addition calibration line for gold 191.948

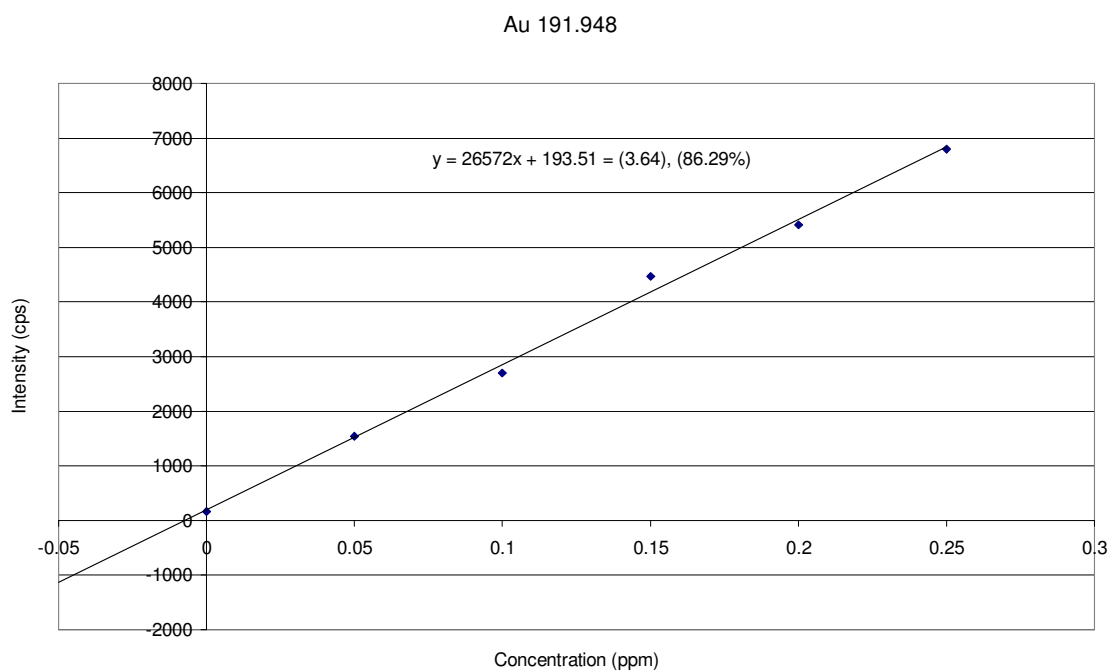


Figure 9.51 Standard addition calibration line for Au 191.948 LUC QC 02

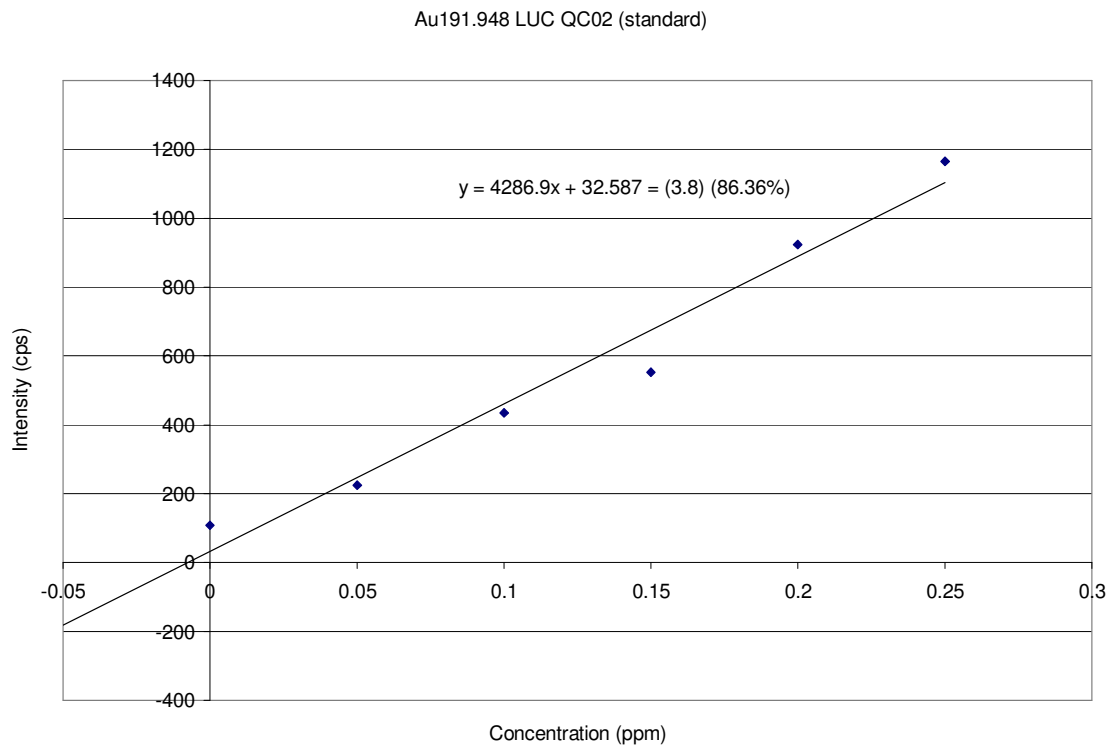


Figure 9.52 Standard addition calibration line for Au 191.948 LUC QC02

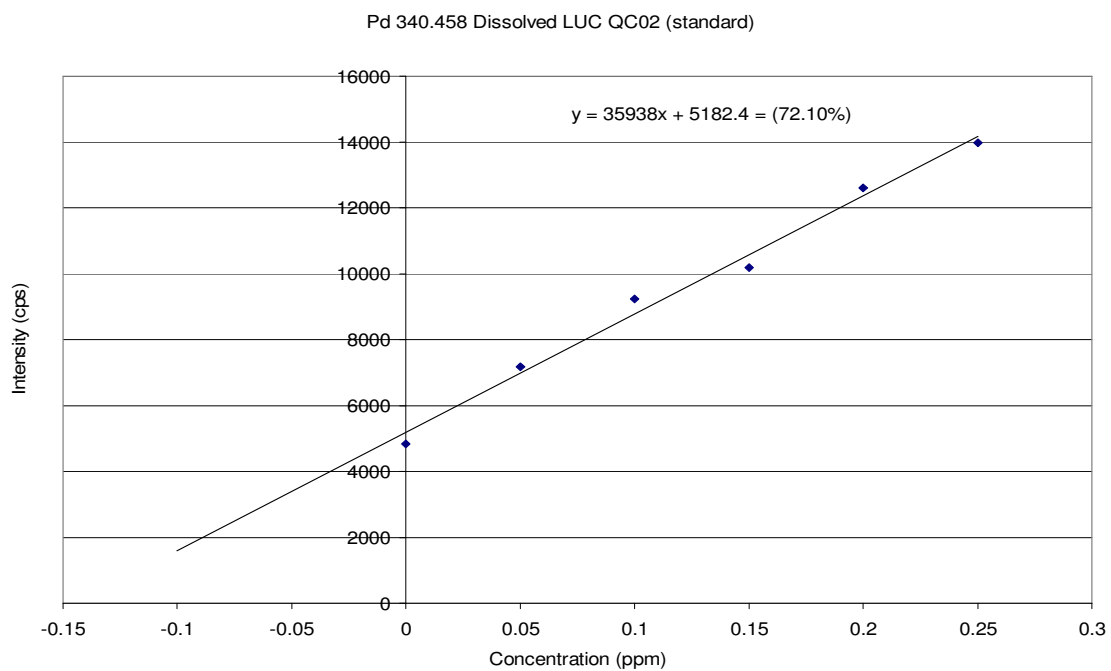


Figure 9.53 Standard addition calibration line for Pd 340.458 LUC QC 02

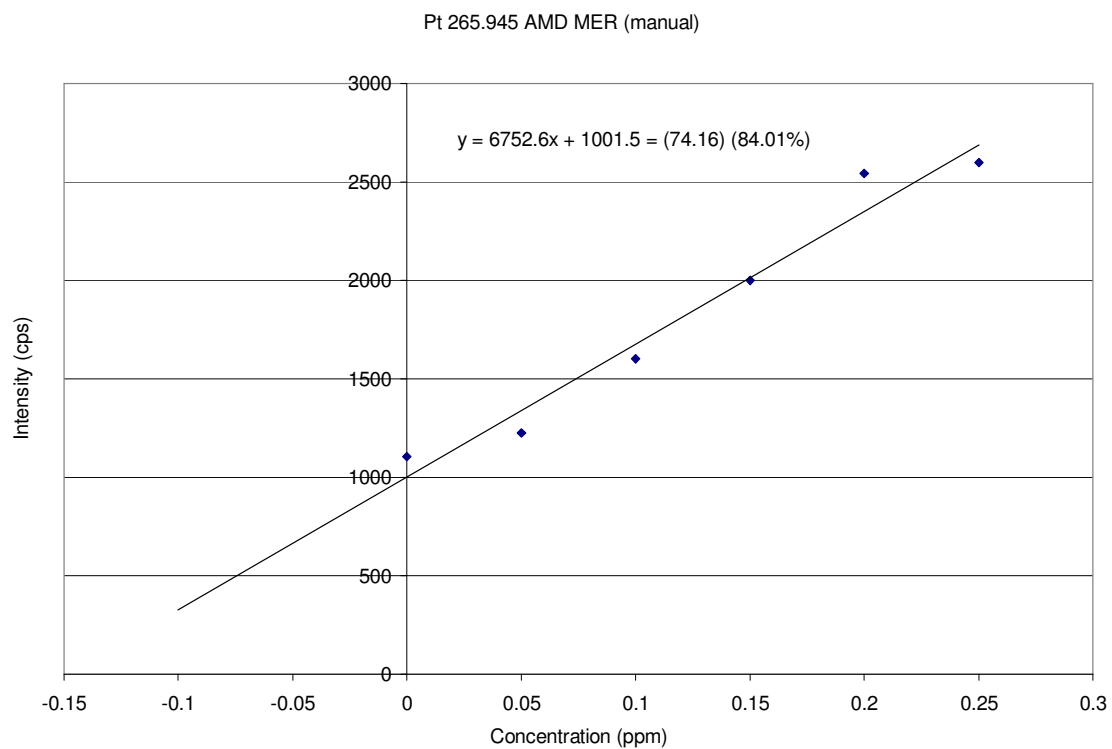


Figure 9.54 Standard addition calibration line for Pt 265.945 AMD MER QC 01

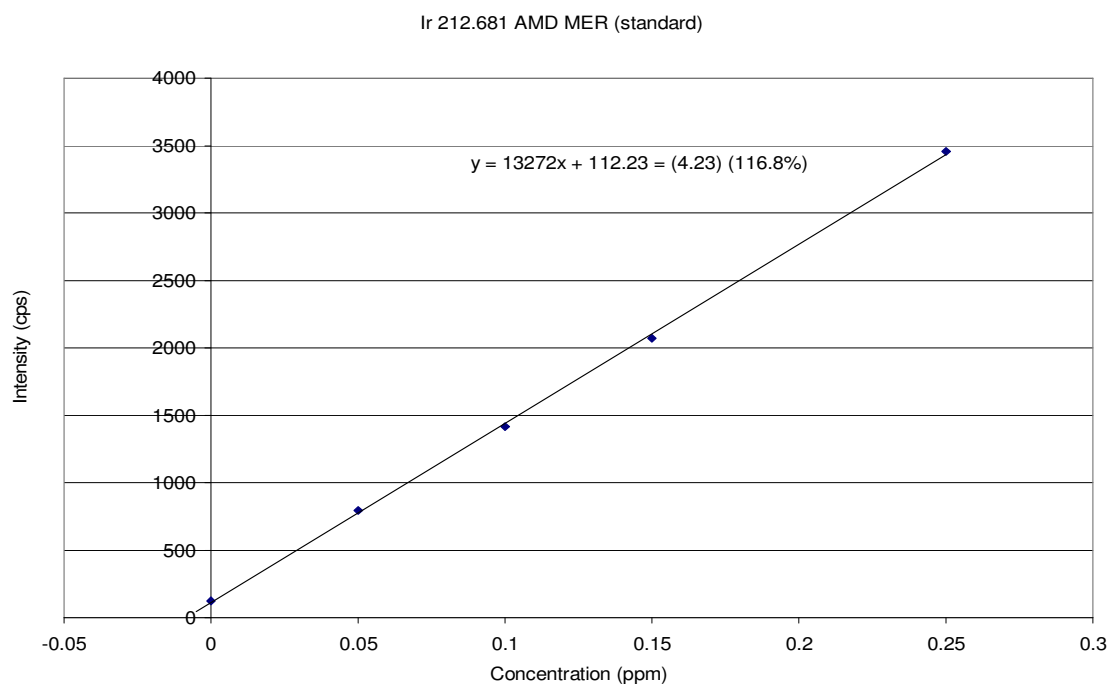


Figure 9.55 Standard addition calibration line for Ir 212.681 AMD MER QC 01

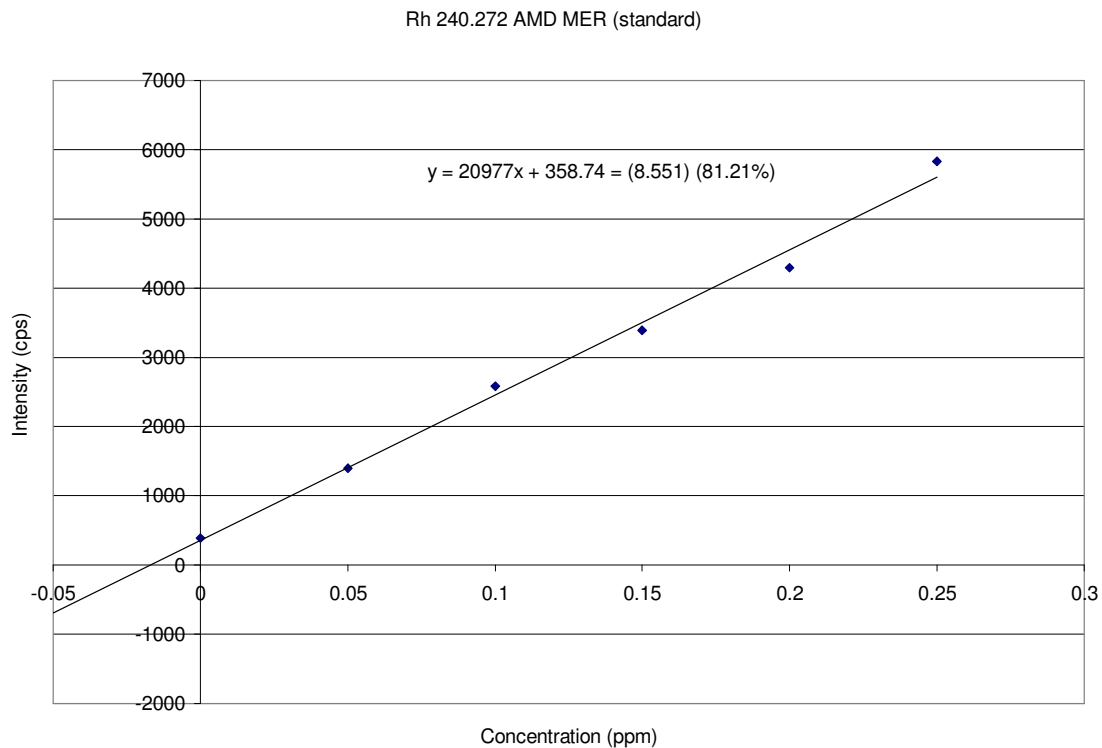


Figure 9.56 Standard addition calibration line for Rh 240.272 AMD MER QC 01

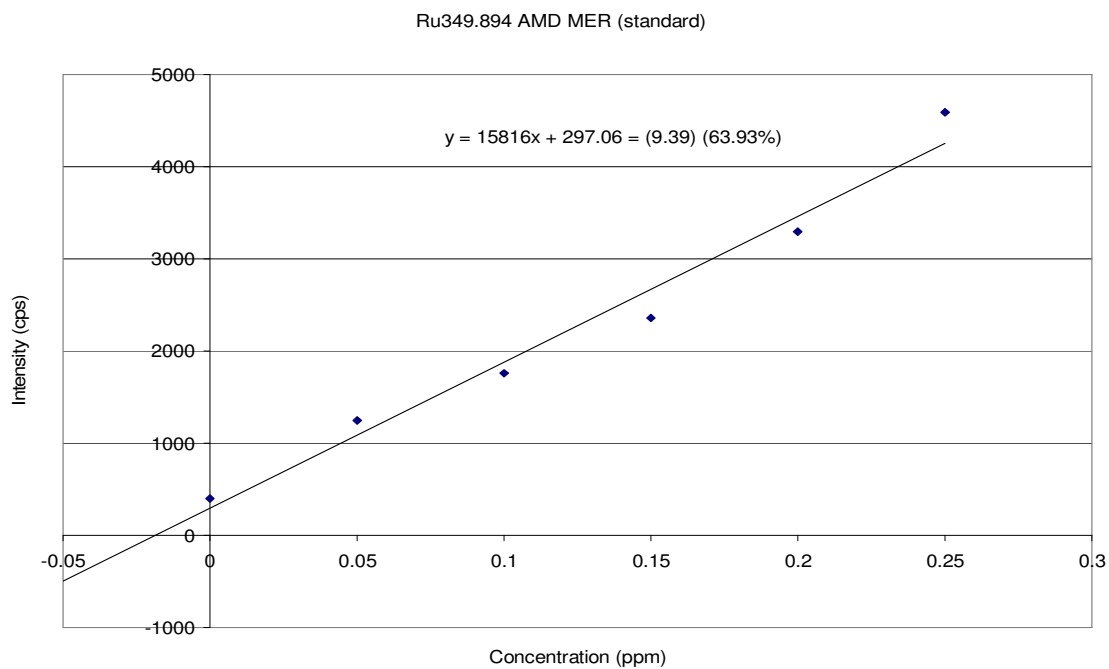


Figure 9.57 Standard addition calibration line for Ru349.894 AMD MER QC 01

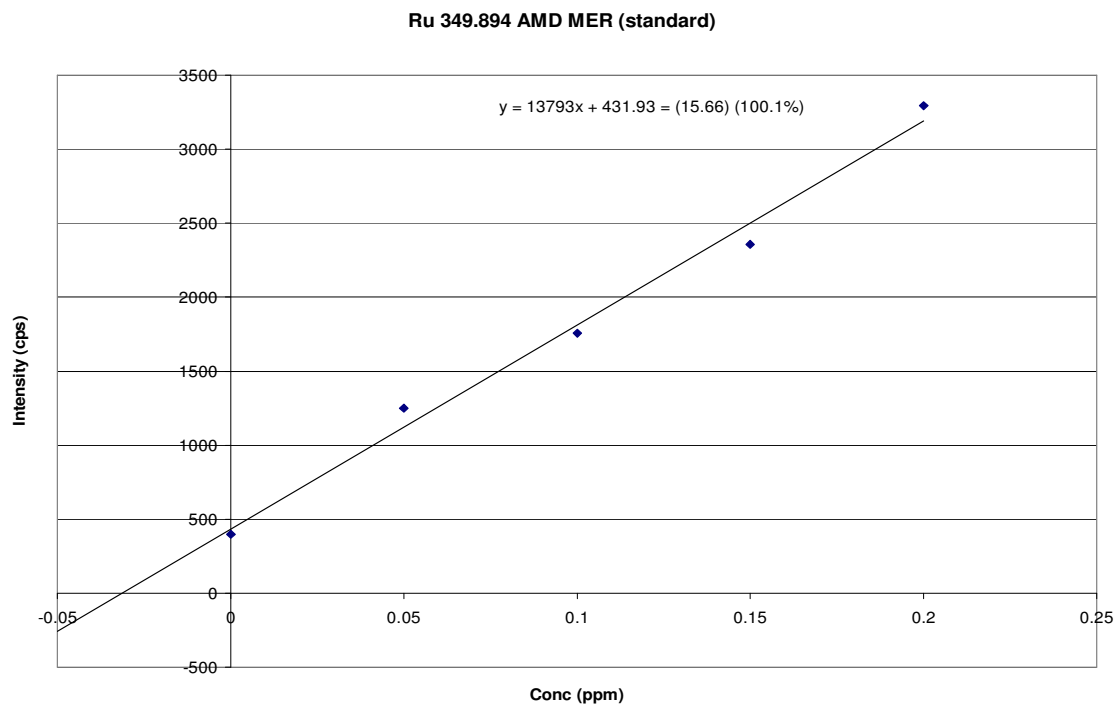


Figure 9.58 Standard addition calibration line for Ru 349.894 AMD MER QC 01

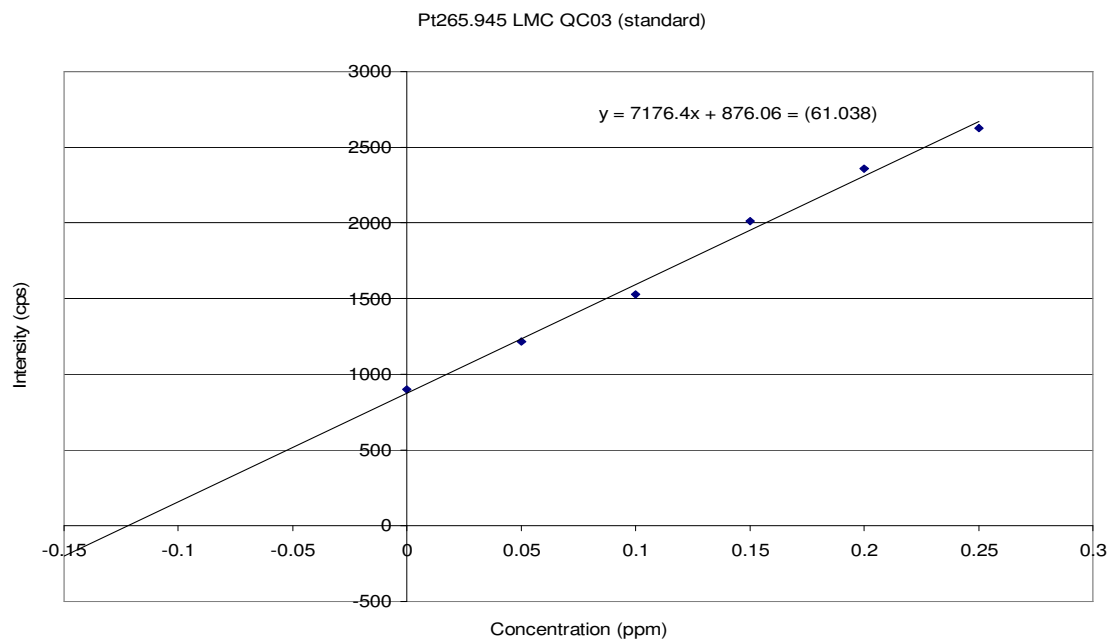


Figure 9.59 Standard addition calibration line for Pt 265.945 LMC QC 03

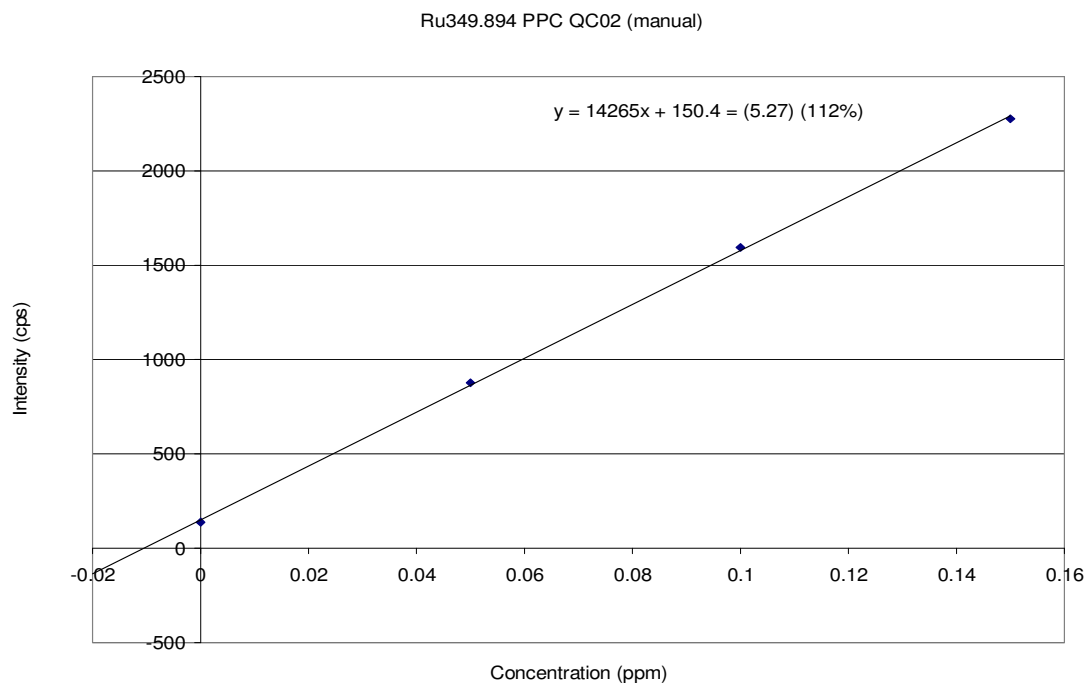


Figure 9.60 Standard addition calibration line for Ru 349.894 PPC QC02

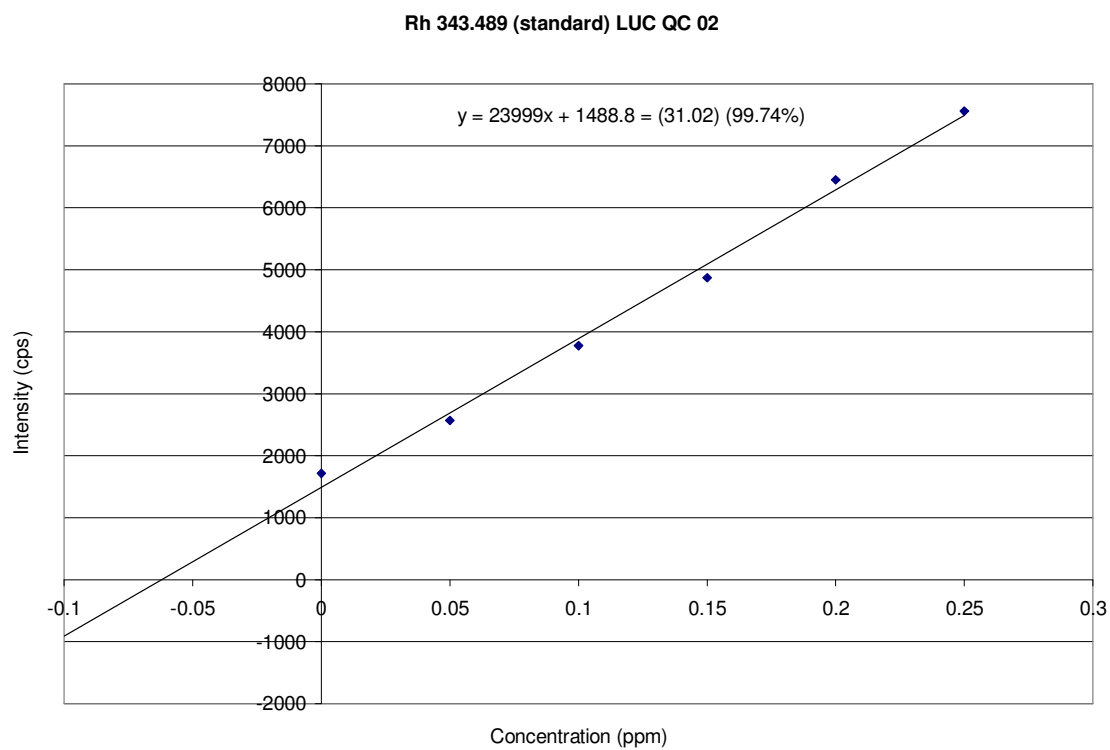


Figure 9.61 Standard addition calibration line for Rh 343.489 LUC QC 02

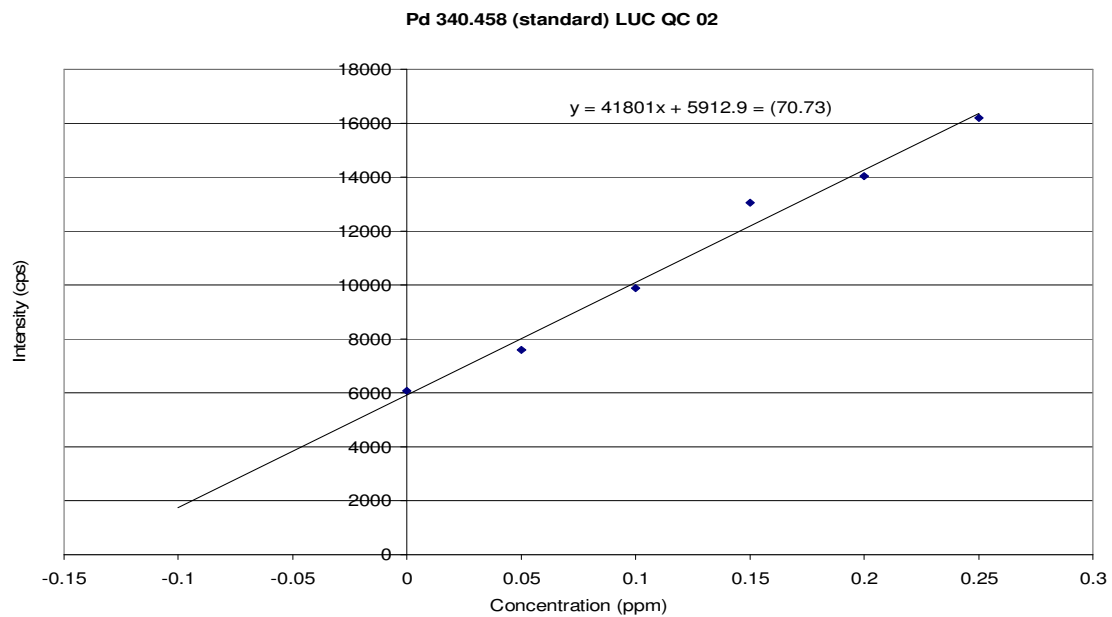


Figure 9.62 Standard addition calibration line for Pd 340.458LUC QC 02