ATTACHMENT F.1

STATISTICAL ANALYSIS RESULTS FOR DATA SUB-GROUPS

ATTACHMENT 1

Each of the FEMP analytical data sub-groups was evaluated using statistical software packages to determine the best method of representation of the data. This attachment provides the statistical analysis output in table and graphic format to support the interpretation of the FEMP analytical data sets.

Evaluation of Means, Minimums, and Maximums

The table below provides the basic statistical properties for each of the FEMP data sub-groups, including the means, log means, minimums, maximums, and upper confidence limits (UCLs) and other data for each of the various data sub-groups. Since most of the FEMP data sub-groups did not conform well to normal or log-normal distributions, the representation of the data population is not as straight-forward as for distributions of good fit. In cases of data skew, the use of a bootstrap analysis was employed. This analysis is a relatively new form of analysis applicable to data sets such as these. The bootstrap analysis employs a sampling approach to approximate representative values for the data set. The **bold** values in the table are those identified to represent the data set in the calculational tables of the appendix.

Table 1, Statistical Properties of the FEMP Analytical Data Sub-Groups

Sub-Group	Plutonium (ppb U)	Neptunium (ppb U)	Technetium (ppb U)
1A			
Count	25	21	13
Minimum	0.0129	4.55	4.20
Maximum	97.1730	19140.00	29160.00
Median	5.0230	252.54	115.47
Standard Deviation	26.0048	4113.63	8020.56
Average	16.3801	1395.90	2523.99
UCL (Mean)	25.2783	2944.12	6488.69
Log Average	0.9173	5.127	5.0134
Log SD	2.6377	2.276	2.2428
Estimate Mean LN	81.1160	2244.23	1860.45
UCL Mean LN	1249.2876	23573.36	59339.99
Bootstrap Mean	**16.0350**	**1328.11**	**2399.22**
Bootstrap UCL Mean	25.2750	2989.94	6172.73
1B			
Count	39	39	2
Minimum	0.0210	4.72	0.52
Maximum	5.5100	567.82	0.58
Median	0.1378	51.19	0.55
Standard Deviation	1.6062	148.35	0.04
Average	0.9227	107.58	**0.55**
UCL (Mean)	1.3563	147.63	0.74
Log Average	-1.4232	3.956	-0.5919
Log SD	1.6642	1.213	0.0745
Estimate Mean LN	0.9623	**109.07**	0.55
UCL Mean LN	2.2979	183.00	0.68

Bootstrap Mean	**0.8892**	106.45	0.55
Bootstrap UCL Mean	1.3885	151.75	0.58
2			
Count	44	43	26
Minimum	0.0042	4.34	1.98
Maximum	5.0976	462.99	3691.66
Median	0.1153	21.05	9.91
Standard Deviation	0.9691	97.45	745.97
Average	0.5141	57.38	222.45
UCL (Mean)	0.7596	82.37	472.34
Log Average	-2.1438	3.199	2.7198
Log SD	1.8873	1.208	1.9621
Estimate Mean LN	0.6957	50.80	104.02
UCL Mean LN	1.8909	82.39	483.63
Bootstrap Mean	**0.5016**	**54.90**	201.61
Bootstrap UCL Mean	0.7461	82.03	482.62
3			
Count	60	58	58
Minimum	0.0009	1.62	3.78
Maximum	0.0428	5.29	31.64
Median	0.0064	2.34	5.64
Standard Deviation	0.0057	0.79	6.78
Average	0.0073	2.55	9.33
UCL (Mean)	0.0086	2.73	10.82
Log Average	-5.0988	0.901	2.0419
Log SD	0.6005	0.258	0.5813
Estimate Mean LN	**0.0073**	2.54	**9.12**
UCL Mean LN	0.0085	2.70	10.58
Bootstrap Mean	0.0067	**2.54**	9.19
Bootstrap UCL Mean	0.0082	2.71	10.61
4			
Count	747	53	647
Minimum	0.0002	4.47	0.29
Maximum	5.4375	8243.24	5900.00
Median	0.0255	26.54	8.80
Standard Deviation	0.4025	1127.77	249.62
Average	0.0923	214.61	34.09
UCL (Mean)	0.1166	474.03	50.25
Log Average	-3.8150	3.418	2.0642
Log SD	1.5452	1.426	1.3738
Estimate Mean LN	0.0727	84.38	20.24
UCL Mean LN	0.0850	146.39	23.27
Bootstrap Mean	**0.0913**	**67.09**	**26.55**
Bootstrap UCL Mean	0.1173	898.79	65.38
5			
Count	34	34	24
Minimum	0.0072	3.98	0.52
Maximum	7.1050	467.26	13000.00
Median	0.0631	13.90	145.83
Standard Deviation	2.3189	146.60	4349.38
Average	1.2754	81.80	2156.32
UCL (Mean)	1.9484	124.35	3677.92
Log Average	-2.0029	3.179	4.6587
Log SD	2.2964	1.425	2.9955
Estimate Mean LN	1.8847	66.32	9367.86
UCL Mean LN	10.1947	137.83	338531.50
Bootstrap Mean	**1.2585**	**81.39**	**2109.61**
Bootstrap UCL Mean	1.9244	123.23	3644.18
6A			
Count	206	206	147

Minimum	0.6000	54.77	800.00
Maximum	14.7000	3245.00	19100.00
Median	2.4143	345.00	9200.00
Standard Deviation	2.1569	377.42	3829.63
Average	2.8818	389.76	8526.19
UCL (Mean)	3.1301	433.21	9049.06
Log Average	0.8919	5.606	8.9175
Log SD	0.5330	0.873	0.5675
Estimate Mean LN	2.8122	398.09	8765.03
UCL Mean LN	3.0128	452.34	9570.17
Bootstrap Mean	**2.8839**	**388.97**	**8552.23**
Bootstrap UCL Mean	3.1377	435.09	9084.85
6B			
Count	209	209	178
Minimum	0.0287	4.91	7.00
Maximum	11.4811	957.00	195197.00
Median	1.7835	357.28	8520.00
Standard Deviation	1.8480	157.80	14534.90
Average	2.3283	332.87	9071.06
UCL (Mean)	2.5395	350.91	10872.45
Log Average	0.5720	5.583	8.7374
Log SD	0.8116	0.877	1.1440
Estimate Mean LN	2.4629	390.50	11989.29
UCL Mean LN	2.7633	443.64	14667.10
Bootstrap Mean	**2.3205**	**332.94**	**8934.58**
Bootstrap UCL Mean	2.5316	350.10	11413.47
6C			
Count	1368	1283	683
Minimum	0.0073	2.81	0.37
Maximum	1957.5000	322311.00	207619.00
Median	5.1665	293.00	1312.20
Standard Deviation	104.4670	11271.80	13218.90
Average	24.4117	1370.58	3177.23
UCL (Mean)	29.0607	1888.57	4010.34
Log Average	1.6229	5.730	6.9729
Log SD	1.6803	1.312	1.5139
Estimate Mean LN	20.7916	727.79	3356.99
UCL Mean LN	23.7398	797.95	3932.32
Bootstrap Mean	**23.9694**	**1045.29**	**2789.56**
Bootstrap UCL Mean	29.2849	2935.92	5662.11
6D			
Count	13	13	7
Minimum	0.5956	29.70	47.70
Maximum	14.5000	299.86	3149.28
Median	2.6825	121.22	742.00
Standard Deviation	4.5236	87.50	1230.09
Average	4.3200	141.83	1097.69
UCL (Mean)	6.5561	185.09	2001.13
Log Average	0.9964	4.754	6.2170
Log SD	1.0198	0.711	1.5407
Estimate Mean LN	**4.5557**	149.41	1642.38
UCL Mean LN	10.6805	244.20	46356.55
Bootstrap Mean	4.2525	**143.75**	**1085.45**
Bootstrap UCL Mean	6.3137	181.72	1825.18
6E			
Count	8	0	0
Minimum	8.0475	N/A	N/A
Maximum	29.1450	N/A	N/A
Median	15.3700	N/A	N/A
Standard Deviation	6.5578	N/A	N/A

Average	16.3578	N/A	N/A
UCL (Mean)	20.7505	N/A	N/A
Log Average	2.7261	N/A	N/A
Log SD	0.3971	N/A	N/A
Estimate Mean LN	**16.5269**	N/A	N/A
UCL Mean LN	23.0398	N/A	N/A
Bootstrap Mean	16.2672	N/A	N/A
Bootstrap UCL Mean	19.7744	N/A	N/A
6F			
Count	38	0	0
Minimum	0.3300	N/A	N/A
Maximum	9.5200	N/A	N/A
Median	1.9250	N/A	N/A
Standard Deviation	2.2616	N/A	N/A
Average	2.7605	N/A	N/A
UCL (Mean)	3.3795	N/A	N/A
Log Average	0.7223	N/A	N/A
Log SD	0.7864	N/A	N/A
Estimate Mean LN	**2.8053**	N/A	N/A
UCL Mean LN	3.7077	N/A	N/A
Bootstrap Mean	2.7584	N/A	N/A
Bootstrap UCL Mean	3.3563	N/A	N/A
7A			
Count	58	40	6
Minimum	0.7352	83.00	898.00
Maximum	37.0000	766.00	2641.00
Median	5.0025	178.82	1690.00
Standard Deviation	11.6855	250.38	760.60
Average	9.3526	313.84	1707.8300
UCL (Mean)	11.9181	380.54	2333.5333
Log Average	1.3269	5.461	7.3531
Log SD	1.4200	0.751	0.4723
Estimate Mean LN	10.3313	311.80	1745.15
UCL Mean LN	17.3714	404.01	3112.89
Bootstrap Mean	**9.3051**	**311.97**	**1721.00**
Bootstrap UCL Mean	11.9676	375.14	2218.00
7B			
Count	105	18	30
Minimum	0.3358	172.26	0.70
Maximum	7.9750	472.12	6625.00
Median	0.7439	210.77	2.75
Standard Deviation	1.4251	83.98	1530.10
Average	1.1773	263.10	466.94
UCL (Mean)	1.4081	297.53	941.61
Log Average	-0.1177	5.529	1.5353
Log SD	0.6026	0.297	2.3900
Estimate Mean LN	1.0660	263.23	80.76
UCL Mean LN	1.1922	300.81	584.01
Bootstrap Mean	**1.1651**	**263.48**	**447.81**
Bootstrap UCL Mean	1.4086	298.59	989.78
8			
Count	402	396	131
Minimum	0.0073	8.29	1.80
Maximum	8408.9900	192557.00	67709.00
Median	50.0250	1263.96	1207.22
Standard Deviation	444.8160	9844.59	6044.95
Average	99.9270	2191.33	1971.33
UCL (Mean)	136.5032	3006.97	2846.29
Log Average	3.2662	6.734	6.6379
Log SD	2.0351	1.524	1.6139

Estimate Mean LN	207.8704	2685.24	2808.15
UCL Mean LN	291.8460	3313.06	4199.09
Bootstrap Mean	**96.6184**	**1881.53**	**1651.23**
Bootstrap UCL Mean	137.9506	3731.44	3551.44
9			
Count	36	34	2
Minimum	0.0218	17.70	159.21
Maximum	591.3000	38280.00	367.42
Median	4.8180	367.99	263.32
Standard Deviation	115.5890	7978.10	147.22
Average	48.2627	3203.53	**263.32**
UCL (Mean)	80.8120	5519.07	920.58
Log Average	1.3263	5.986	5.4884
Log SD	2.7636	2.028	0.5913
Estimate Mean LN	171.5917	3110.48	288.07
UCL Mean LN	1699.9386	11951.29	27234.68
Bootstrap Mean	**47.6157**	**3164.53**	263.31
Bootstrap UCL Mean	82.4802	5686.70	367.42
10A			
Count	39	39	22
Minimum	0.5945	70.15	163.30
Maximum	3504.6000	75837.80	11932.30
Median	94.2500	3139.91	1659.20
Standard Deviation	841.8570	13873.60	3144.10
Average	425.3290	7975.14	2666.80
UCL (Mean)	652.6041	11720.58	3820.26
Log Average	4.1589	7.826	7.4307
Log SD	2.3668	1.693	0.9707
Estimate Mean LN	1053.2506	**10503.53**	2702.04
UCL Mean LN	5376.4460	25743.50	4600.60
Bootstrap Mean	**412.1768**	7745.05	**2618.36**
Bootstrap UCL Mean	656.4297	11886.73	3791.85
10B			
Count	146	145	7
Minimum	2.5214	92.90	711.50
Maximum	53.1312	1080.06	3679.99
Median	18.5564	533.39	2466.94
Standard Deviation	12.6230	277.01	1036.78
Average	20.6520	498.13	**2405.28**
UCL (Mean)	22.3814	536.21	3166.75
Log Average	2.8150	6.029	7.6717
Log SD	0.6894	0.648	0.5699
Estimate Mean LN	21.1718	511.98	2525.16
UCL Mean LN	23.6760	567.99	4635.11
Bootstrap Mean	**20.7719**	**498.17**	2405.28
Bootstrap UCL Mean	22.4884	535.93	3020.98
11			
Count	100	94	53
Minimum	0.0123	2.74	0.93
Maximum	3407.5000	113757.00	145800.00
Median	3.3008	369.53	758.16
Standard Deviation	466.7190	13609.40	20079.70
Average	89.6353	4199.92	4302.61
UCL (Mean)	167.1289	6532.04	8921.67
Log Average	1.1541	6.044	6.2794
Log SD	2.5978	2.338	2.0373
Estimate Mean LN	92.6064	6484.43	4250.43
UCL Mean LN	266.8421	16127.36	11670.81
Bootstrap Mean	**84.8165**	**3999.32**	**4110.05**
Bootstrap UCL Mean	166.9657	6648.15	9885.39

Probability Plots and Histograms

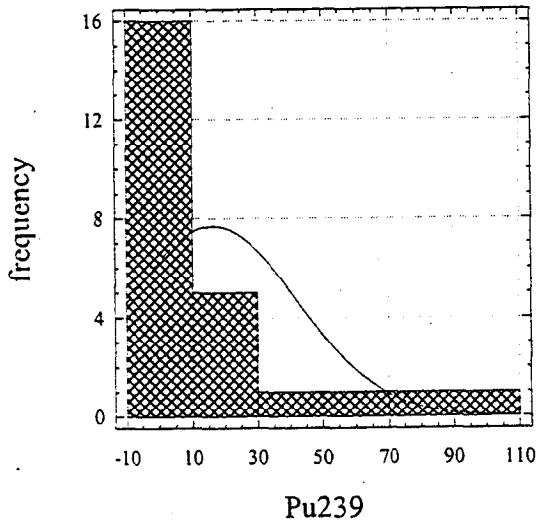
For each of the FEMP analytical data sub-groups, corresponding probability plots and histograms have been presented (one page per constituent per sub-group). The graphic nature of these charts aids the reader in evaluating the data sets.

Box and Whiskers Chart

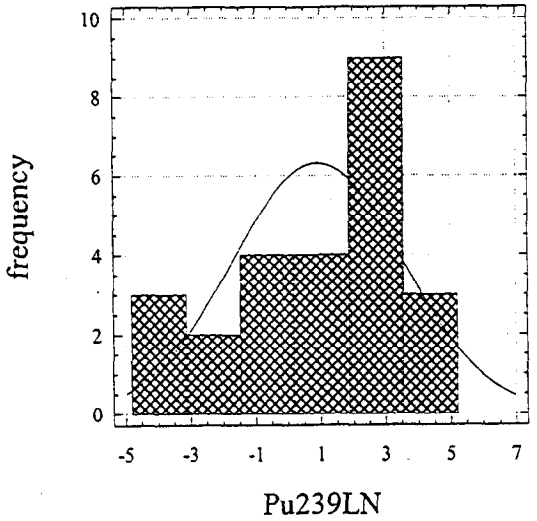
Three "Box & Whiskers" charts are also included (one for each constituent representing the full data set divided by data sub-groups). The box and whiskers charts are useful for visualizing the data set ranges in juxtaposition with each other.

SORT = 1A

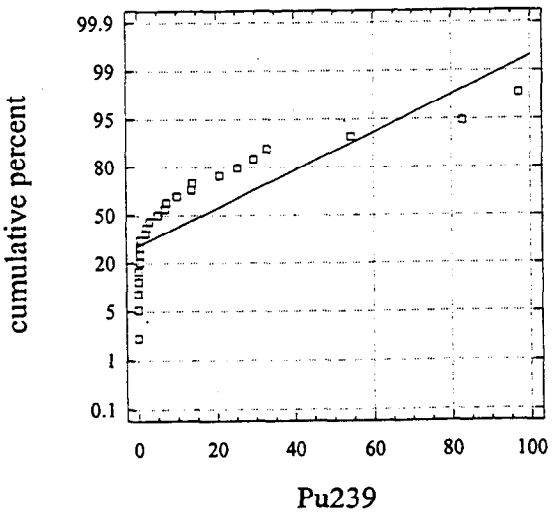
Histogram for Pu239



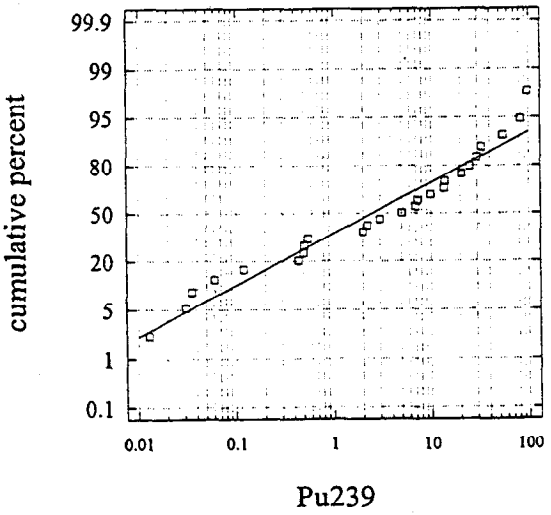
Histogram for Pu239LN



Normal Probability Plot

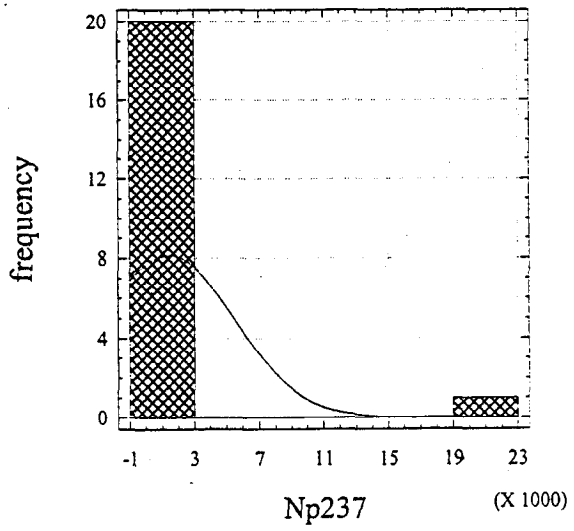


Lognormal Probability Plot

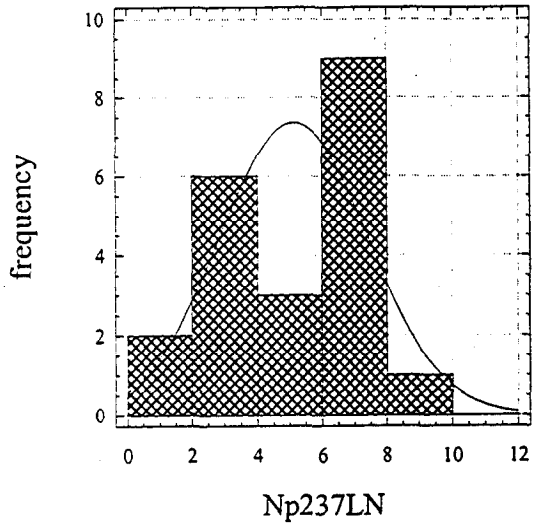


SORT = 1A

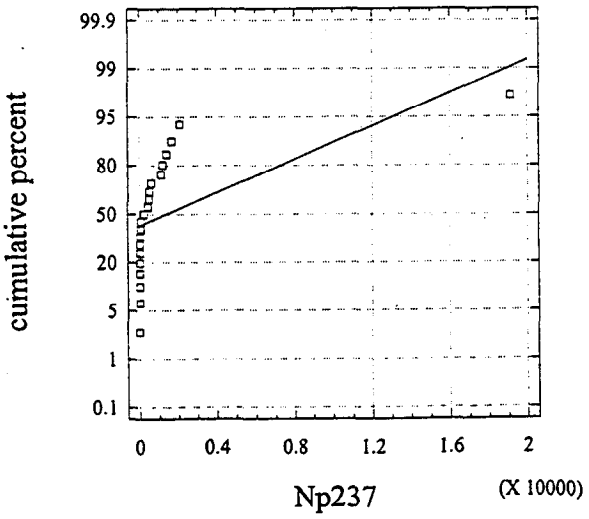
Histogram for Np237



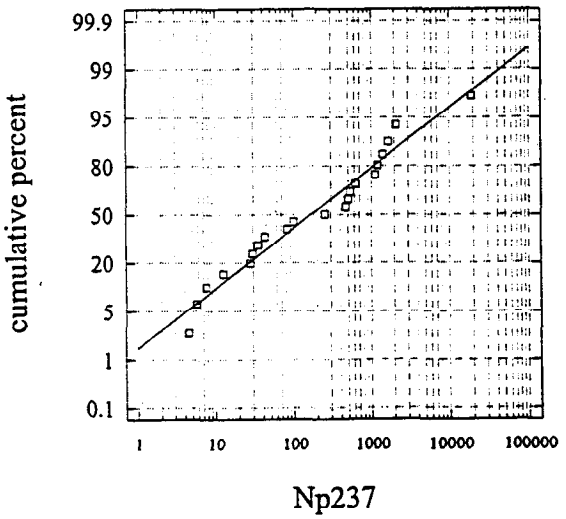
Histogram for Np237LN



Normal Probability Plot

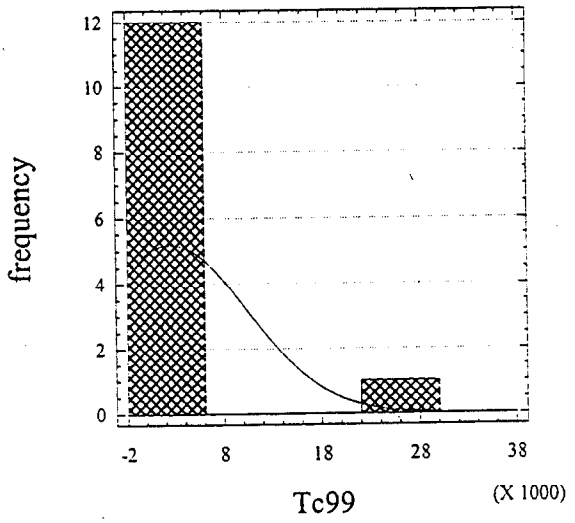


Lognormal Probability Plot

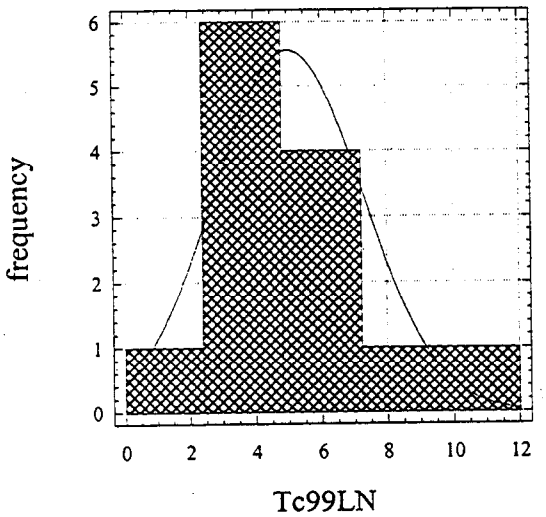


SORT = 1A

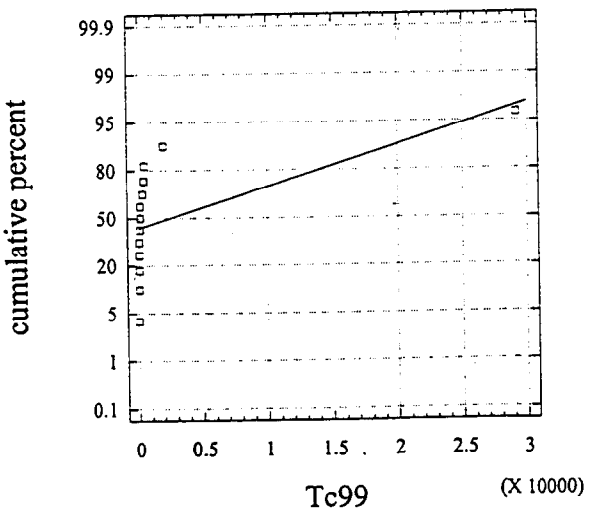
Histogram for Tc99



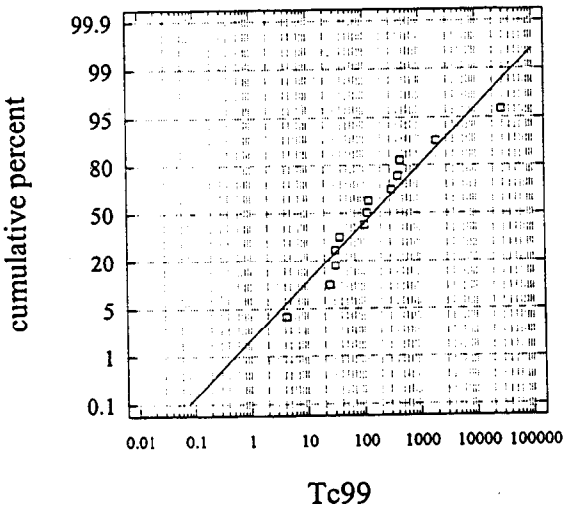
Histogram for Tc99LN



Normal Probability Plot

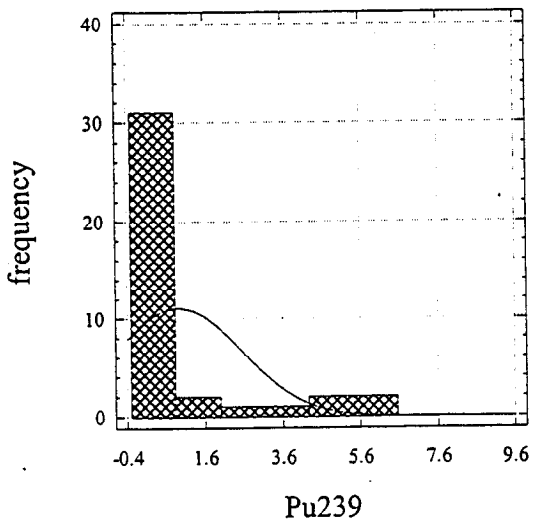


Lognormal Probability Plot

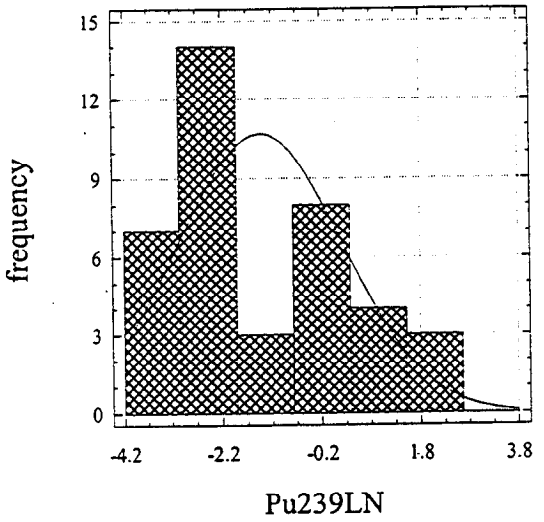


SORT = 1B

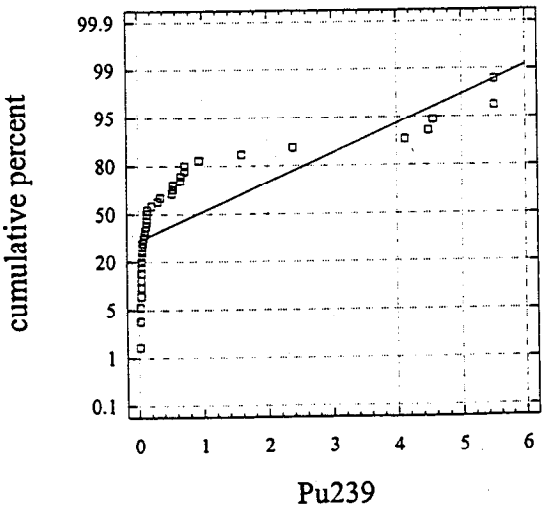
Histogram for Pu239



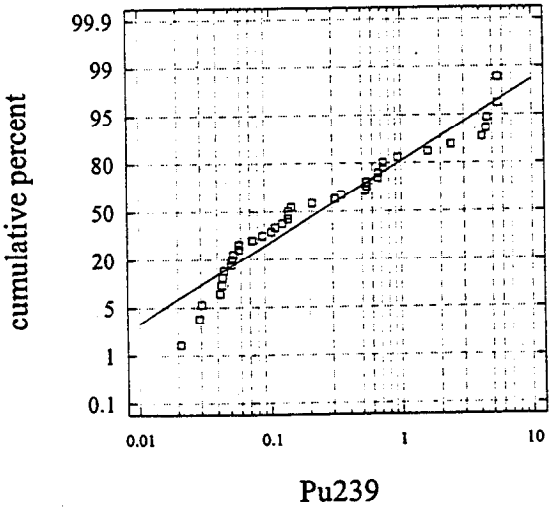
Histogram for Pu239LN



Normal Probability Plot

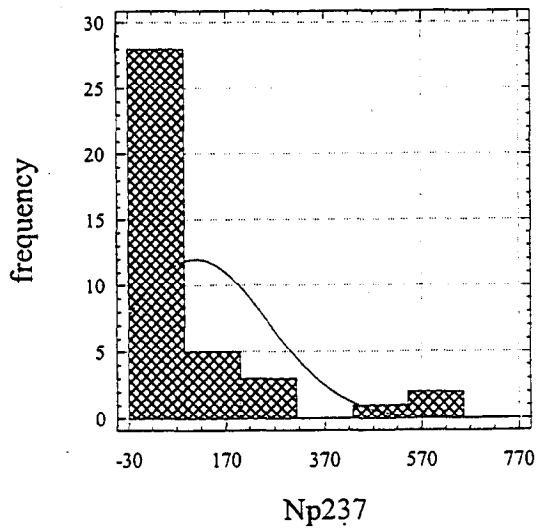


Lognormal Probability Plot

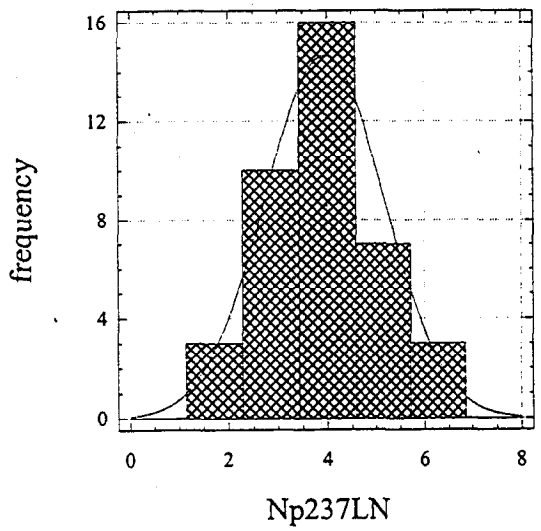


SORT = 1B

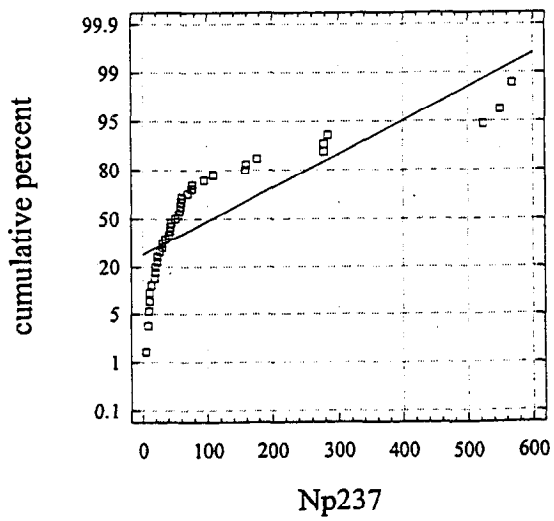
Histogram for Np237



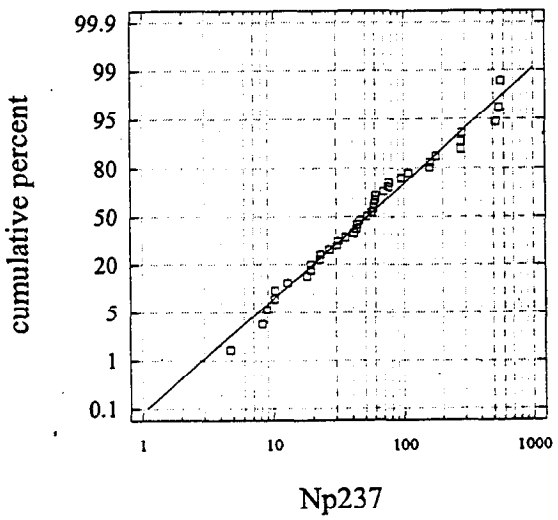
Histogram for Np237LN



Normal Probability Plot

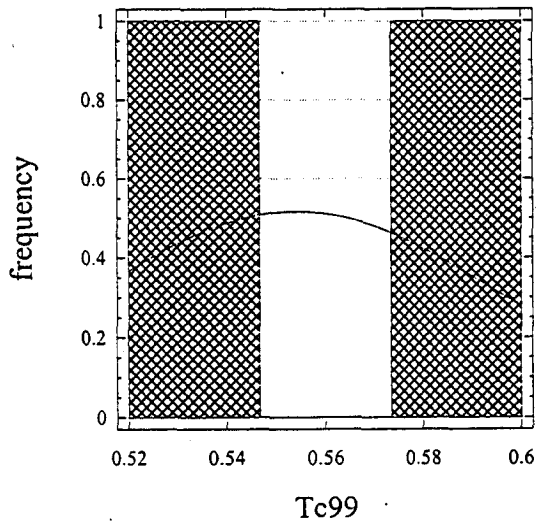


Lognormal Probability Plot

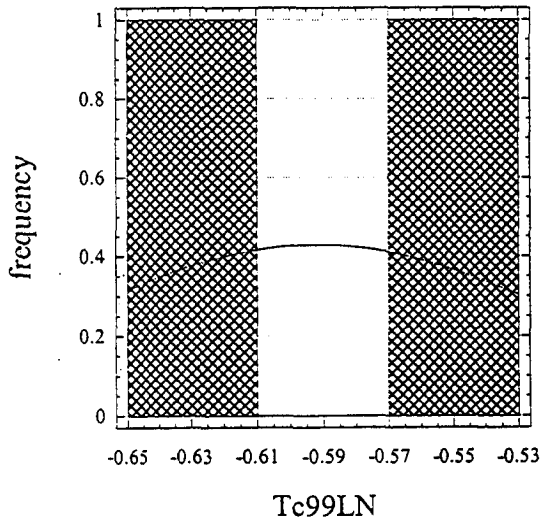


SORT = 1B

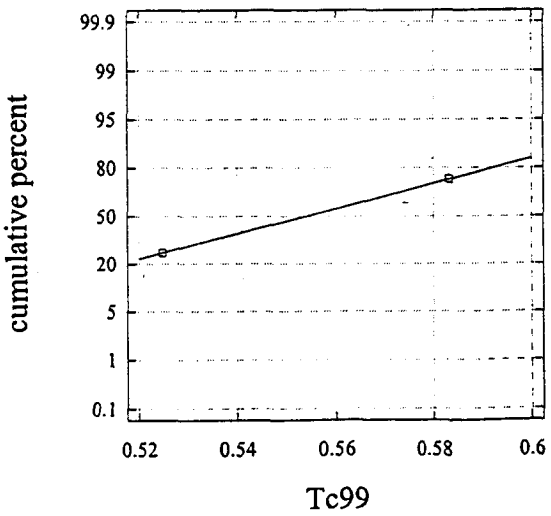
Histogram for Tc99



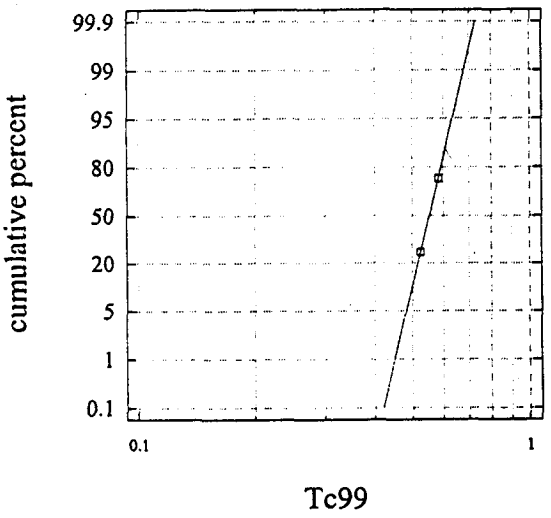
Histogram for Tc99LN



Normal Probability Plot

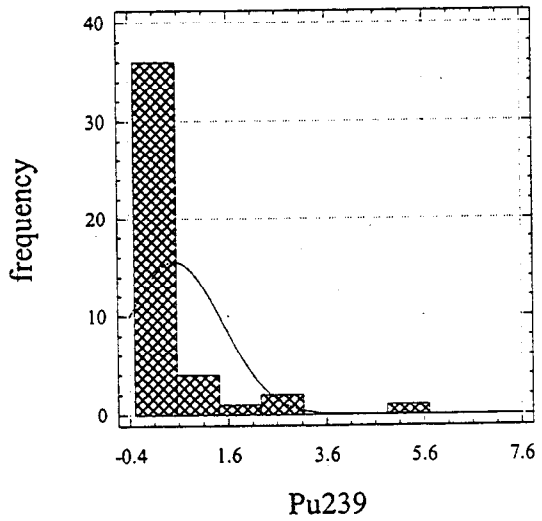


Lognormal Probability Plot

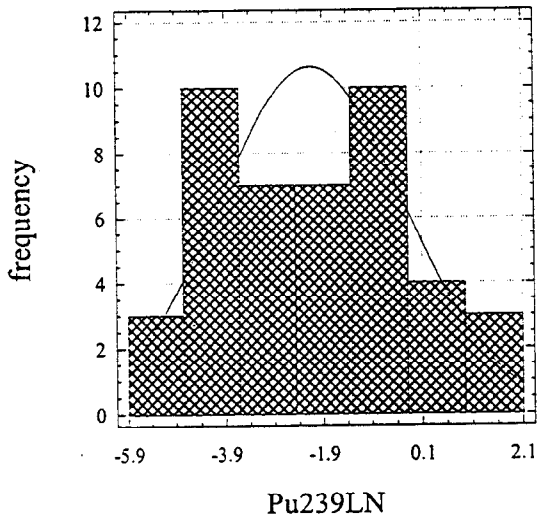


SORT = 2

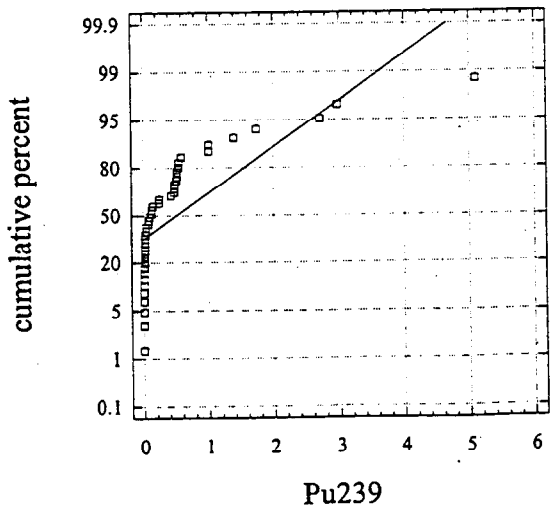
Histogram for Pu239



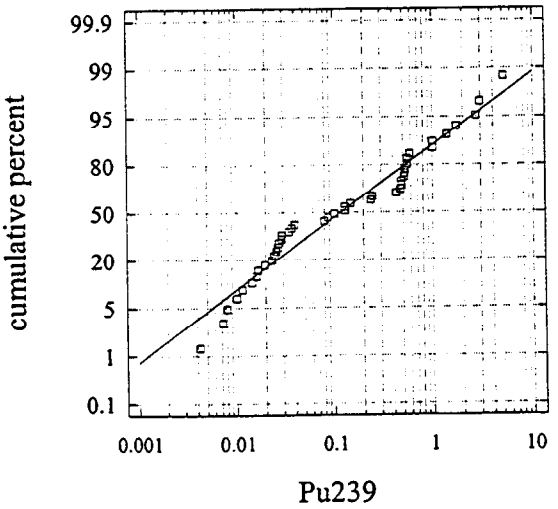
Histogram for Pu239LN



Normal Probability Plot

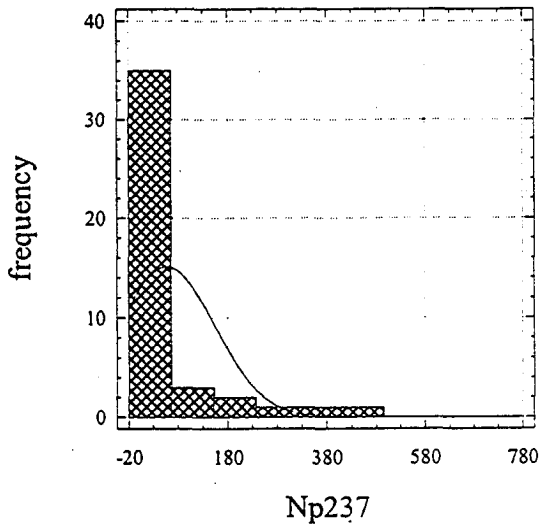


Lognormal Probability Plot



SORT = 2

Histogram for Np237



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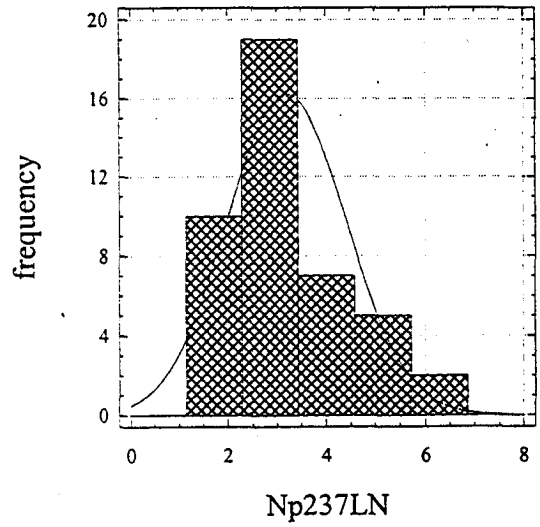
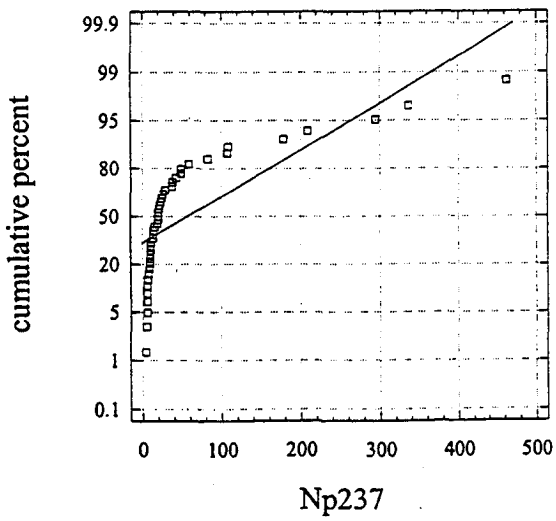
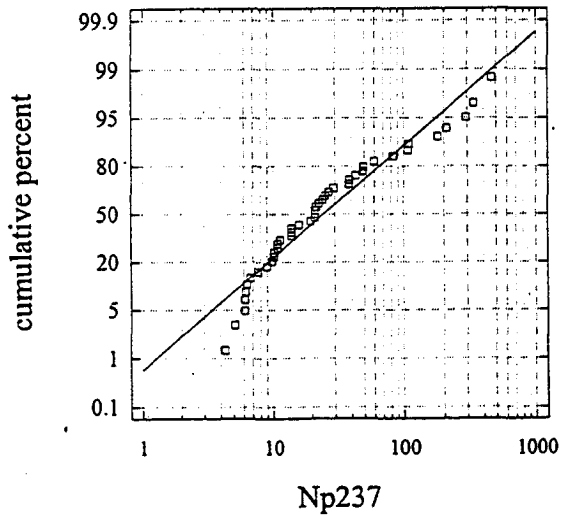


Normal Probability Plot

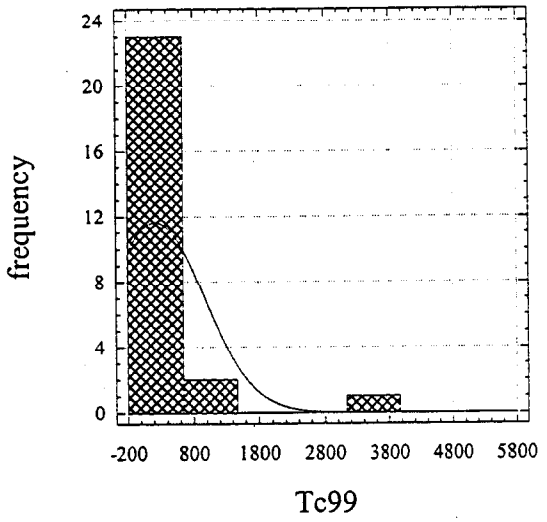


Lognormal Probability Plot

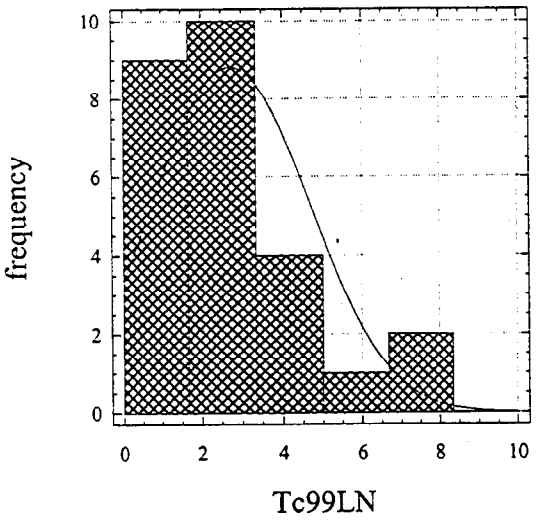


SORT = 2

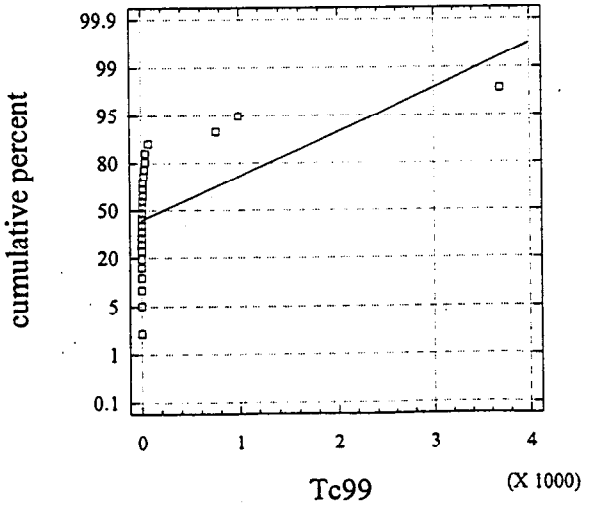
Histogram for Tc99



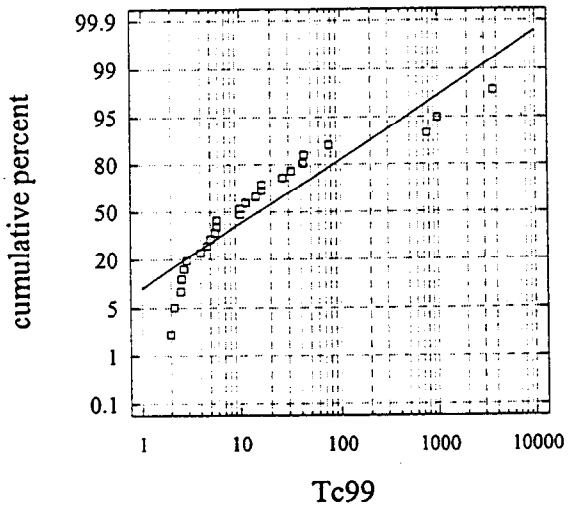
Histogram for Tc99LN



Normal Probability Plot

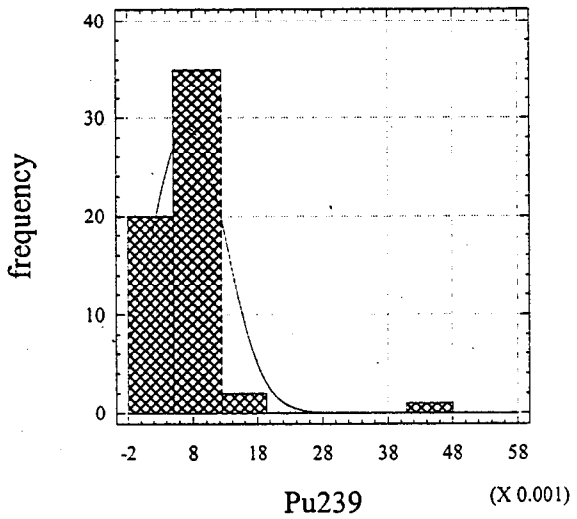


Lognormal Probability Plot

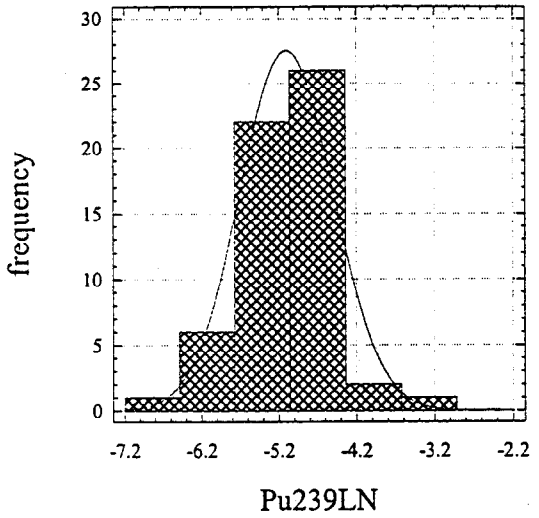


SORT = 3

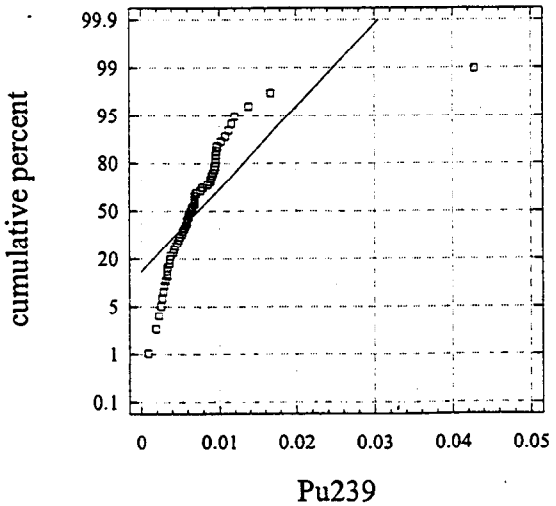
Histogram for Pu239



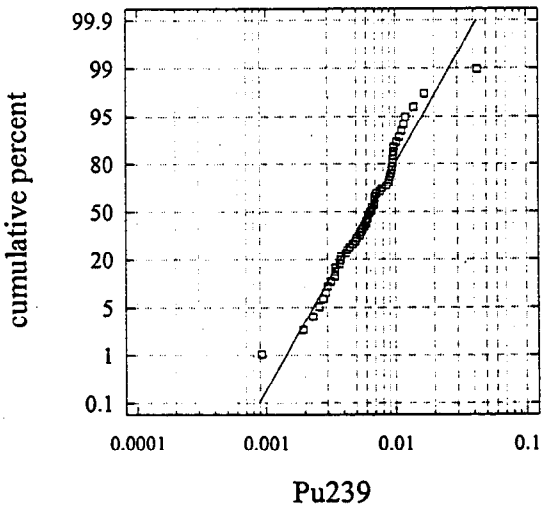
Histogram for Pu239LN



Normal Probability Plot

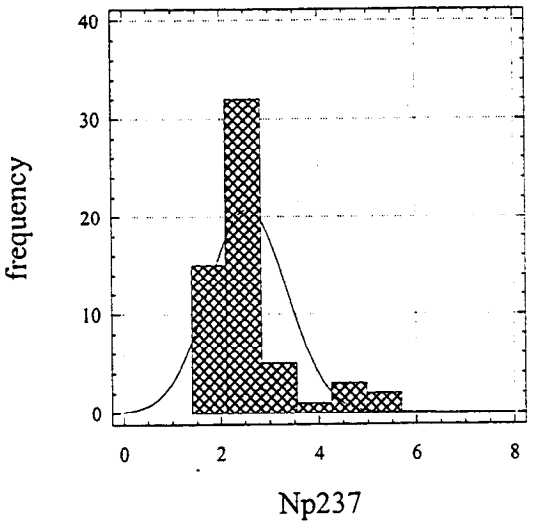


Lognormal Probability Plot

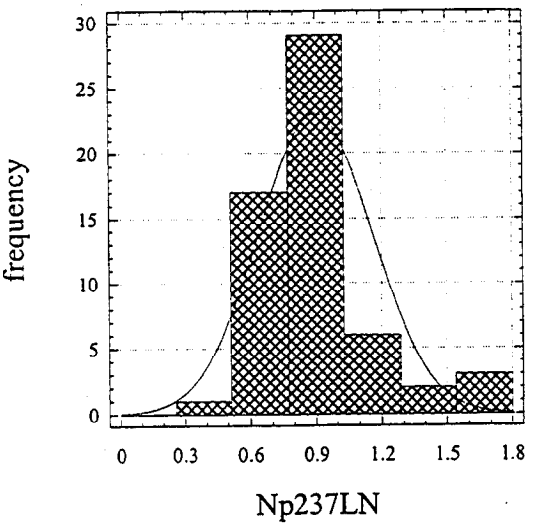


SORT = 3

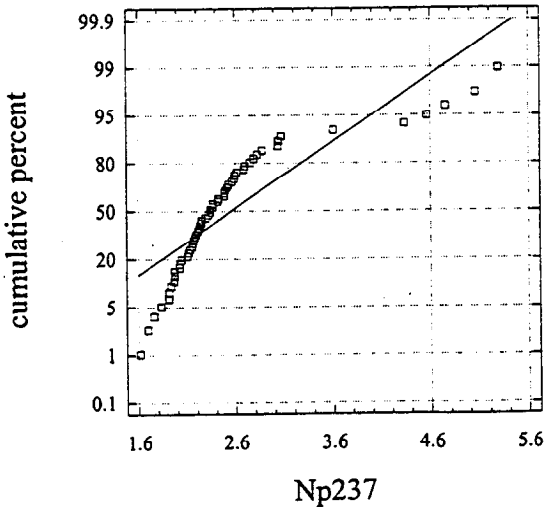
Histogram for Np237



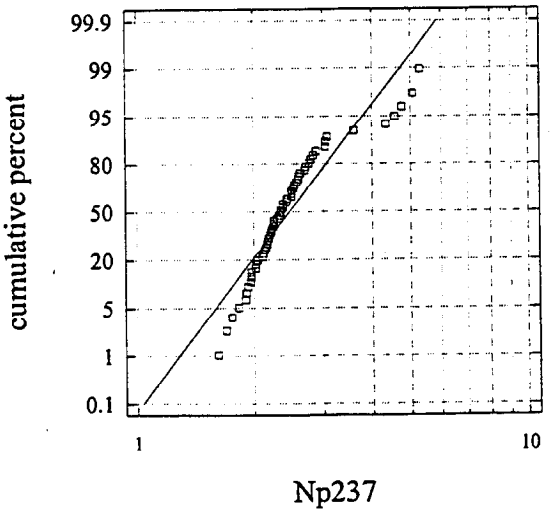
Histogram for Np237LN



Normal Probability Plot

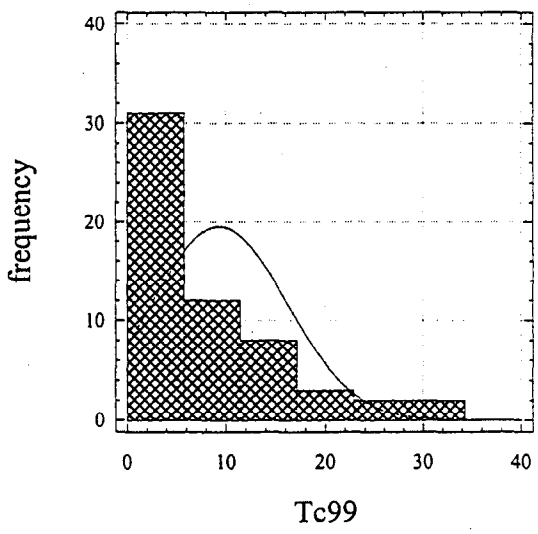


Lognormal Probability Plot

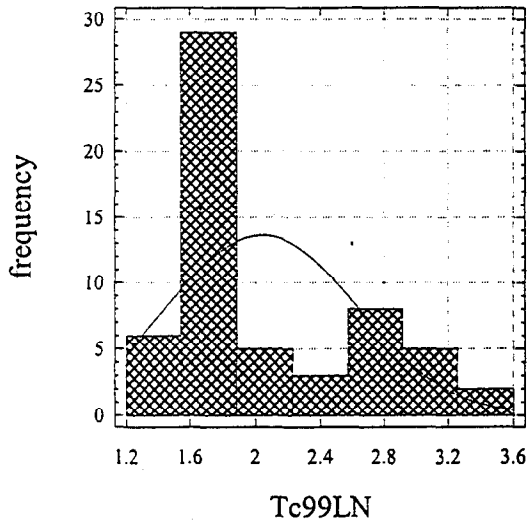


SORT = 3

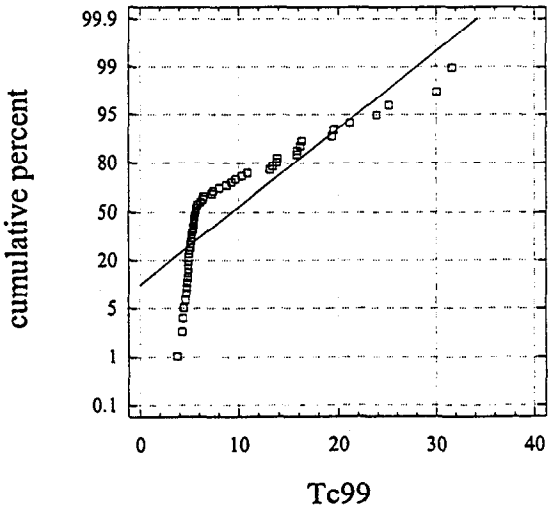
Histogram for Tc99



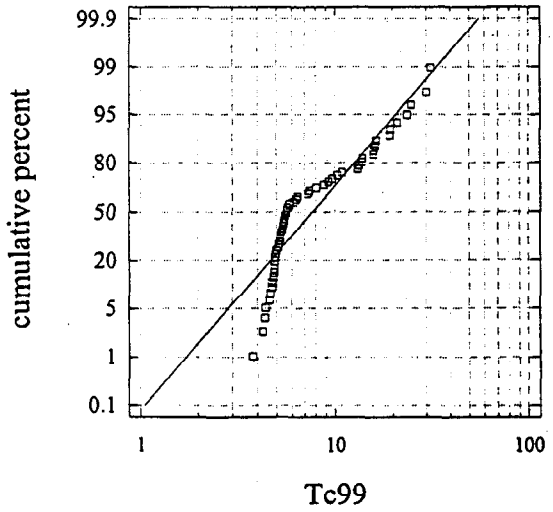
Histogram for Tc99LN



Normal Probability Plot

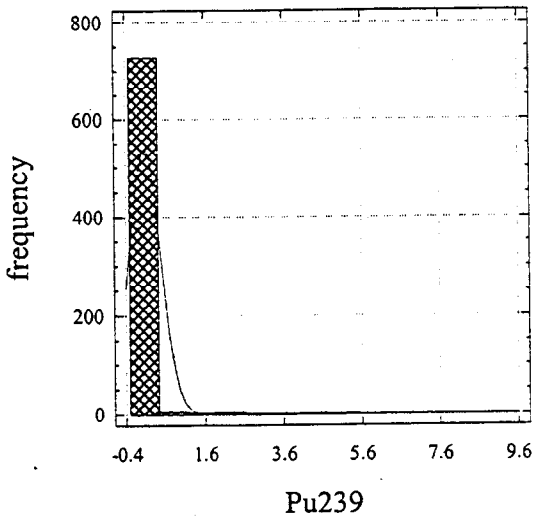


Lognormal Probability Plot

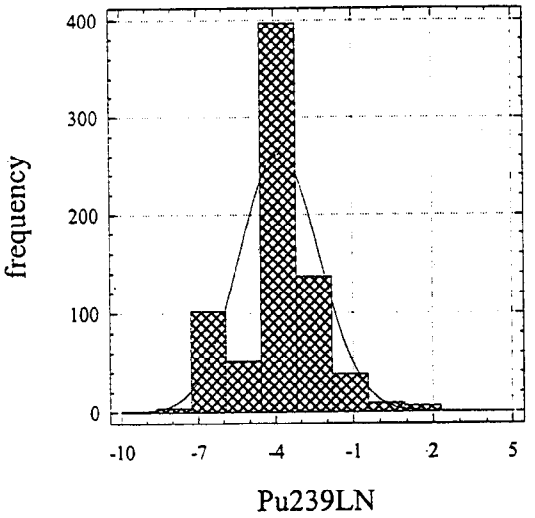


SORT = 4

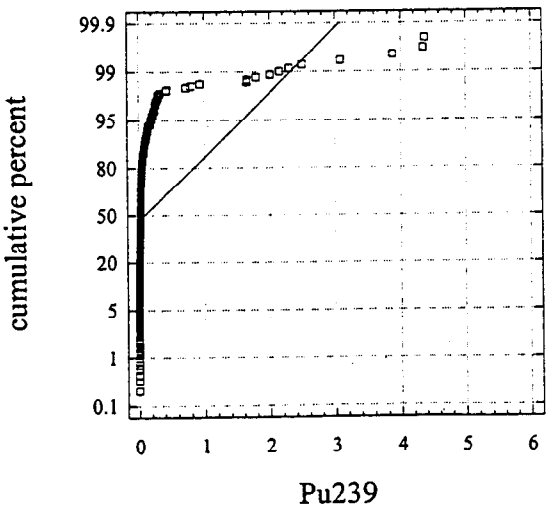
Histogram for Pu239



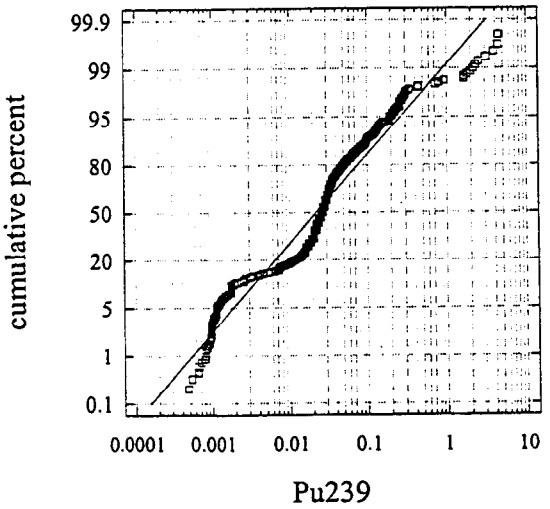
Histogram for Pu239LN



Normal Probability Plot

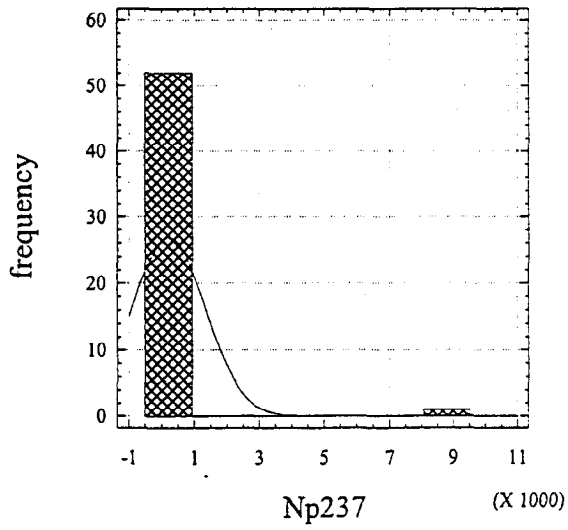


Lognormal Probability Plot

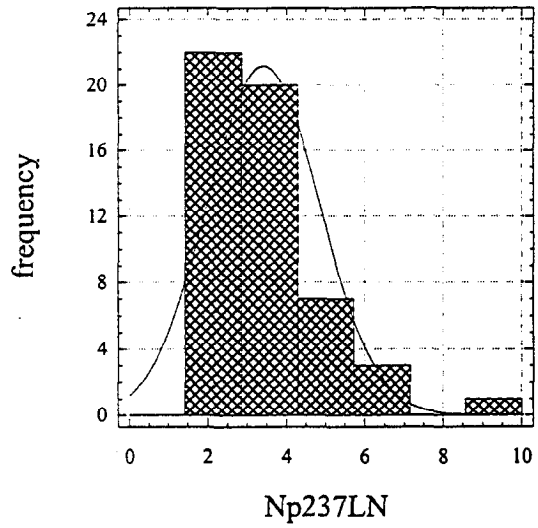


SORT = 4

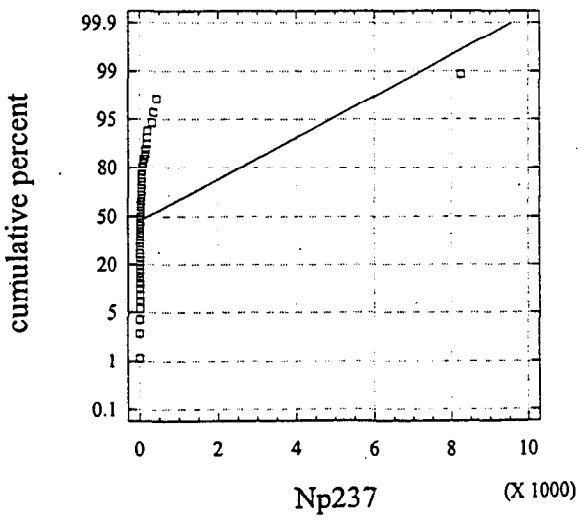
Histogram for Np237



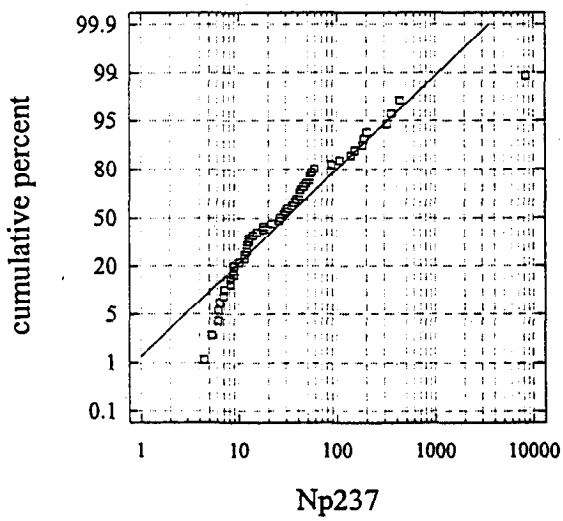
Histogram for Np237LN



Normal Probability Plot

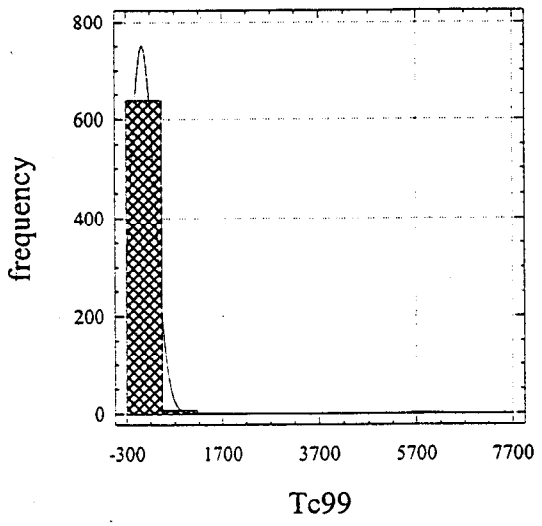


Lognormal Probability Plot

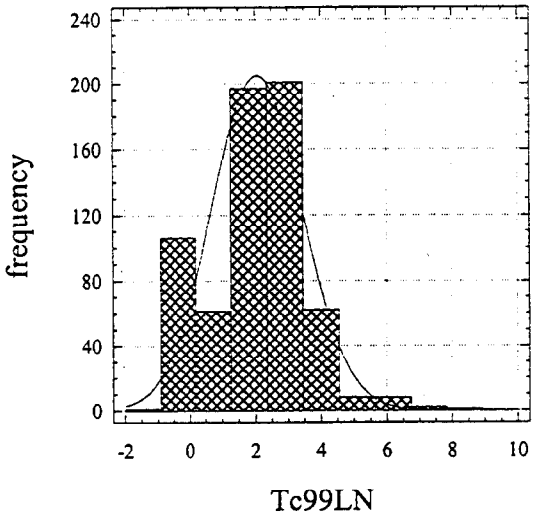


SORT = 4

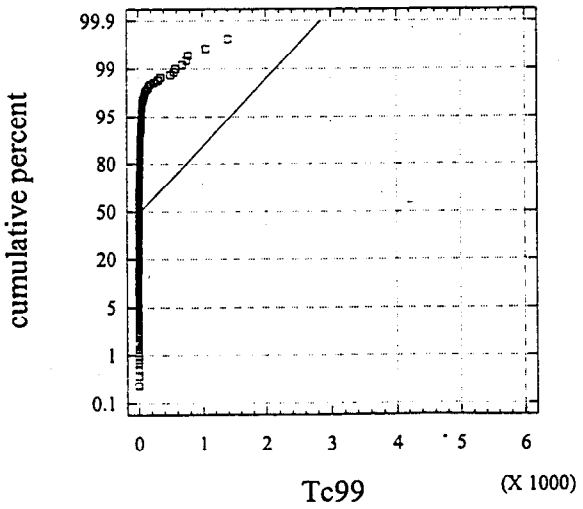
Histogram for Tc99



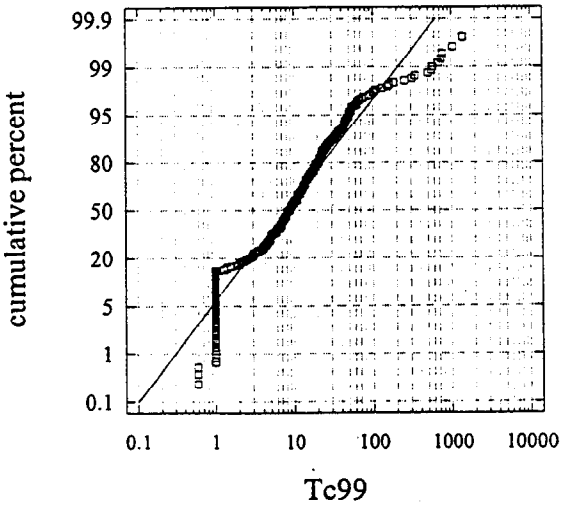
Histogram for Tc99LN



Normal Probability Plot

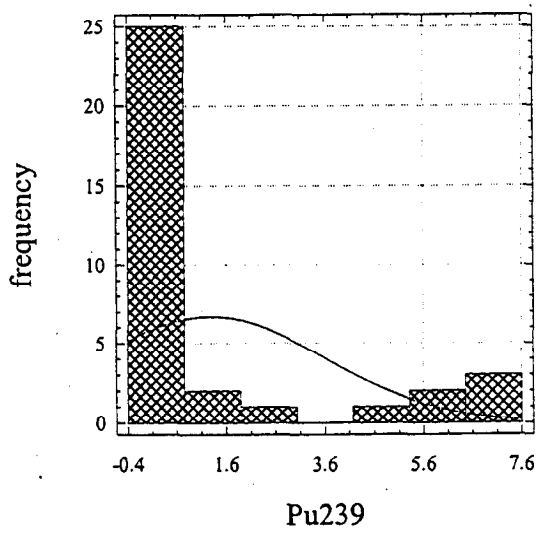


Lognormal Probability Plot

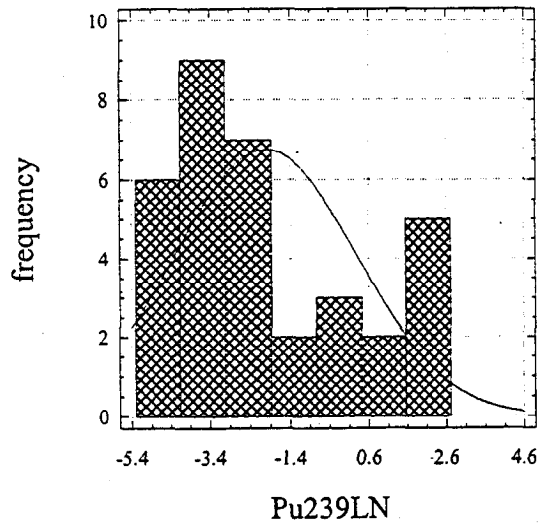


SORT = 5

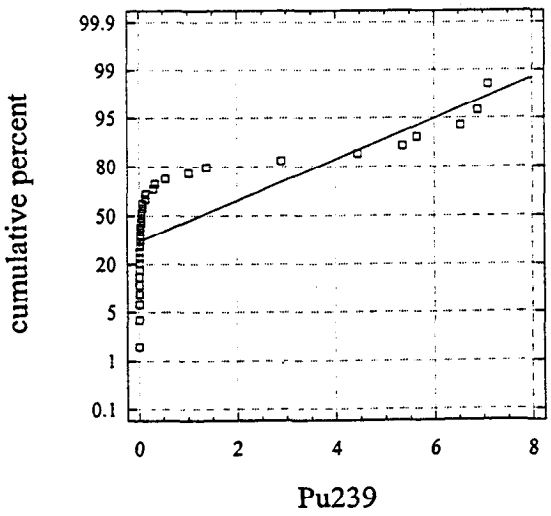
Histogram for Pu239



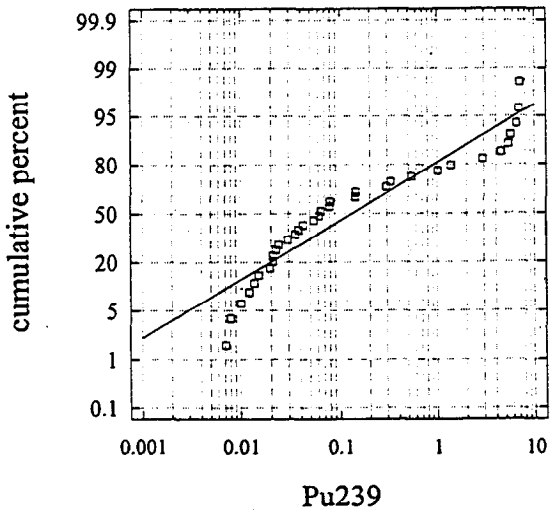
Histogram for Pu239LN



Normal Probability Plot

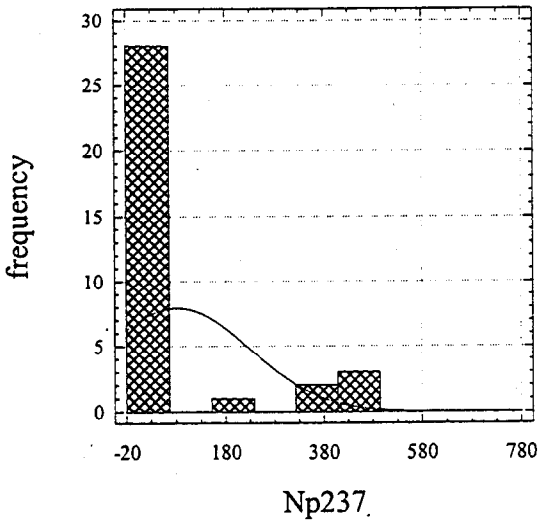


Lognormal Probability Plot

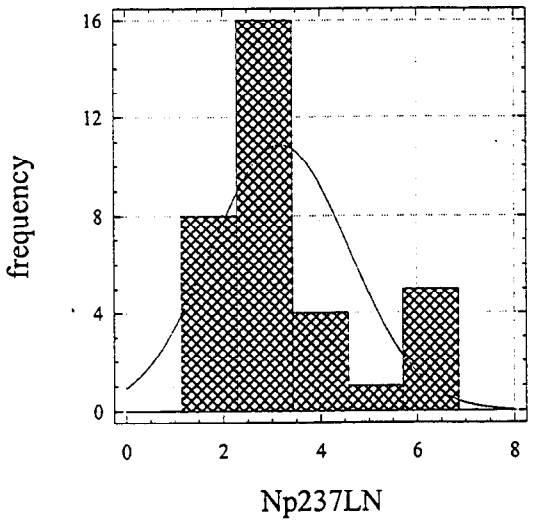


SORT = 5

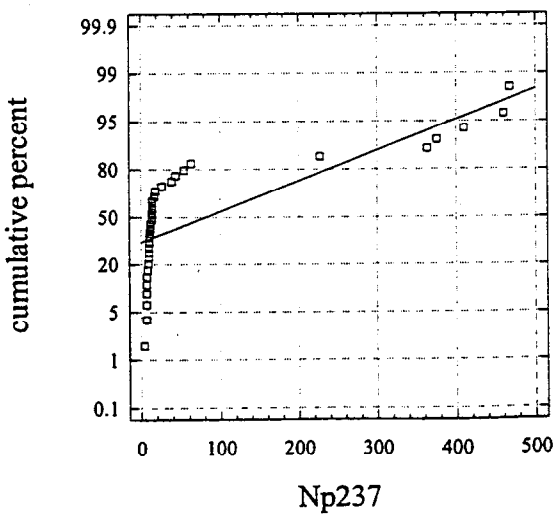
Histogram for Np237



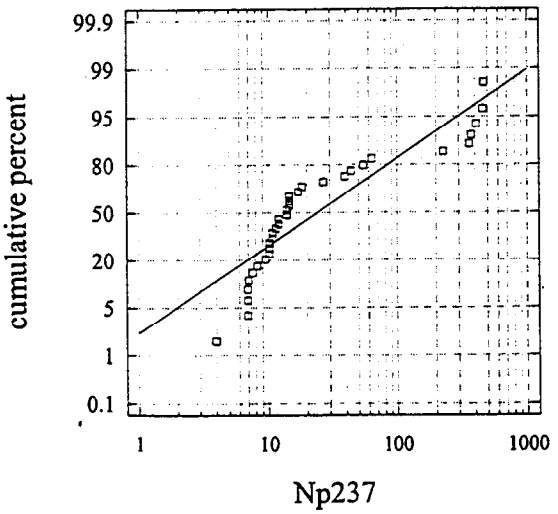
Histogram for Np237LN



Normal Probability Plot

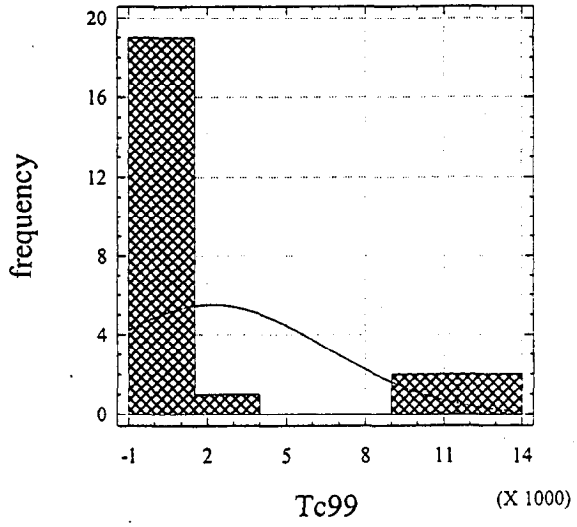


Lognormal Probability Plot

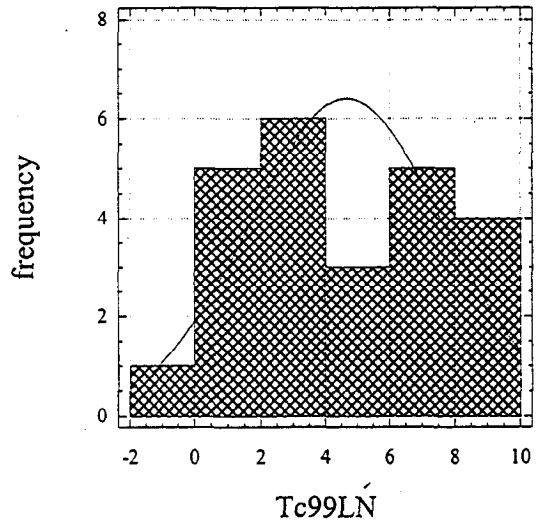


SORT = 5

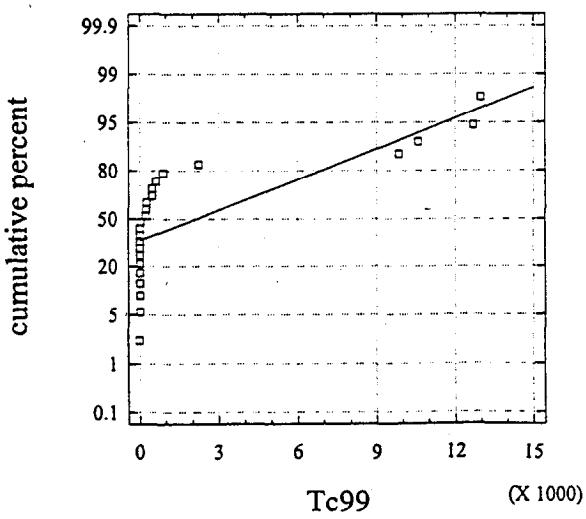
Histogram for Tc99



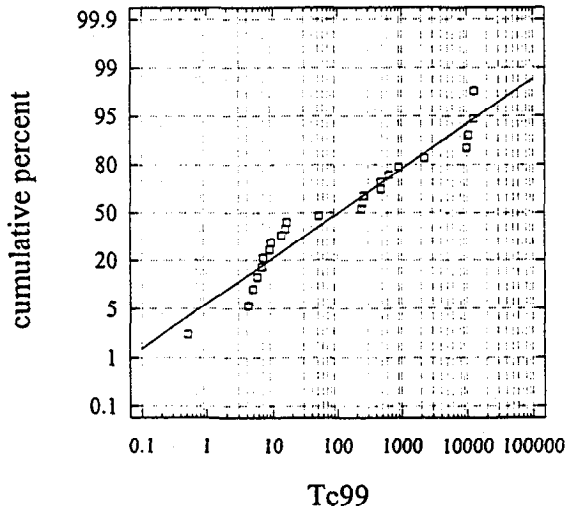
Histogram for Tc99LN



Normal Probability Plot

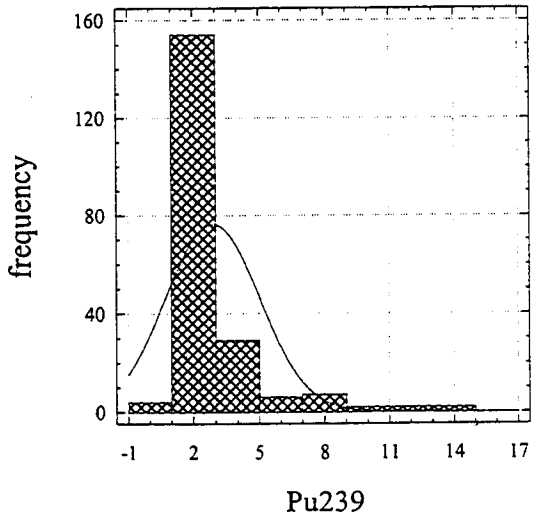


Lognormal Probability Plot

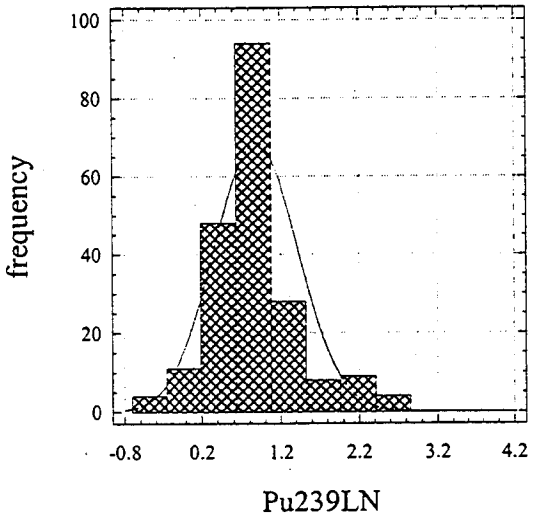


SORT = 6A

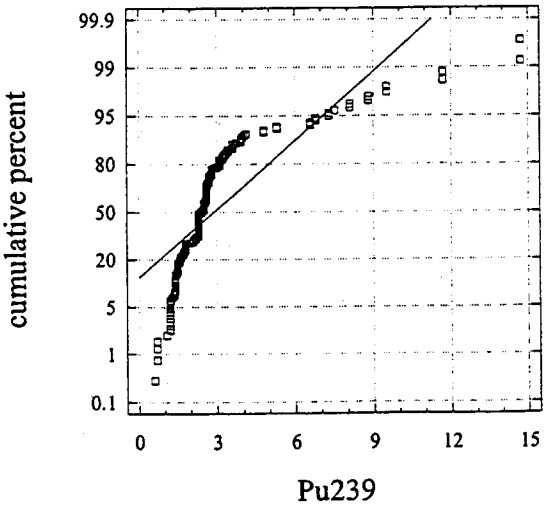
Histogram for Pu239



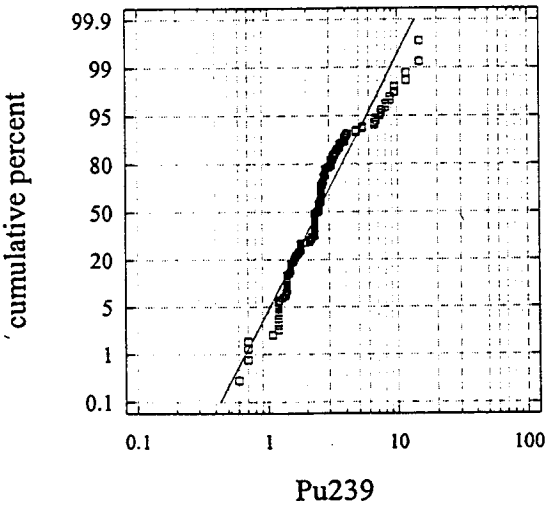
Histogram for Pu239LN



Normal Probability Plot

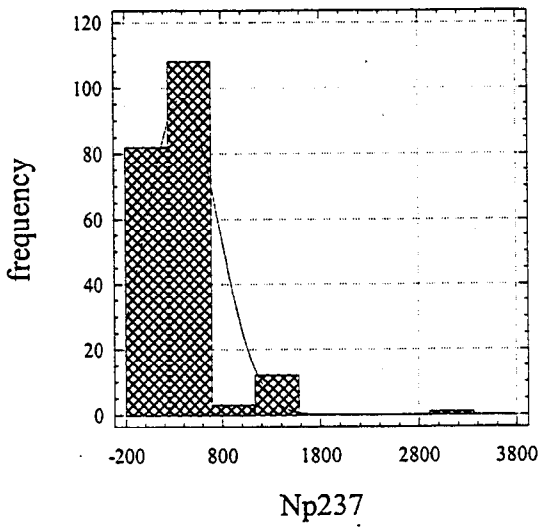


Lognormal Probability Plot

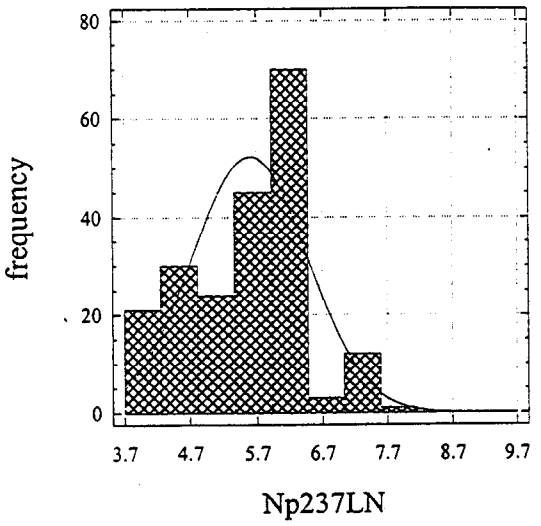


SORT = 6A

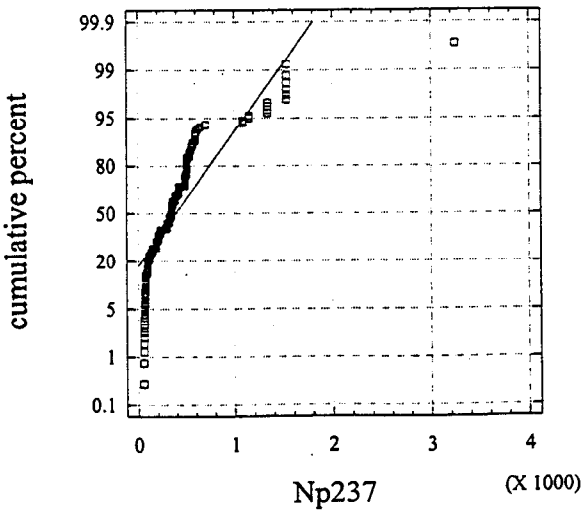
Histogram for Np237



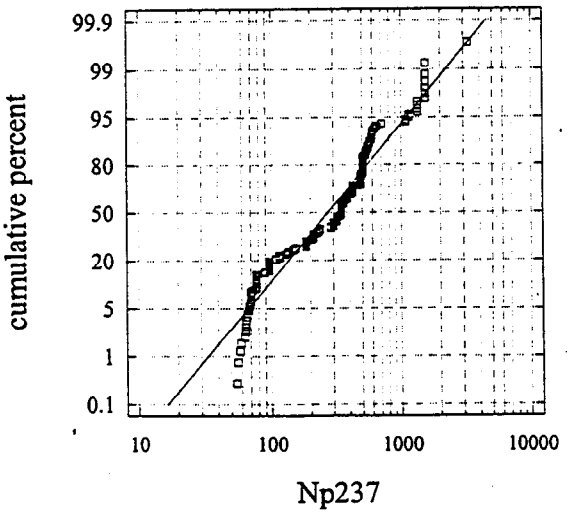
Histogram for Np237LN



Normal Probability Plot

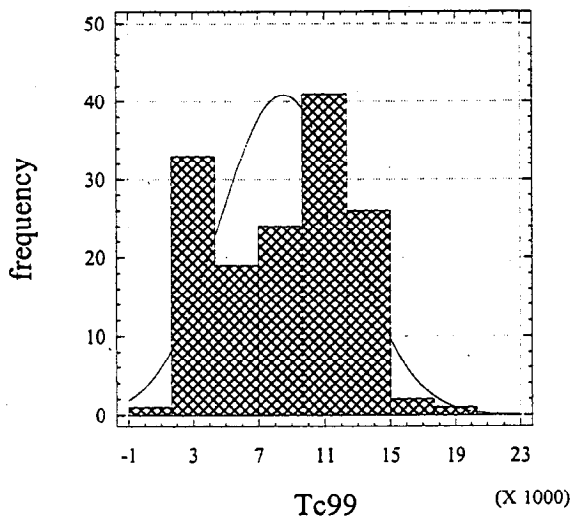


Lognormal Probability Plot

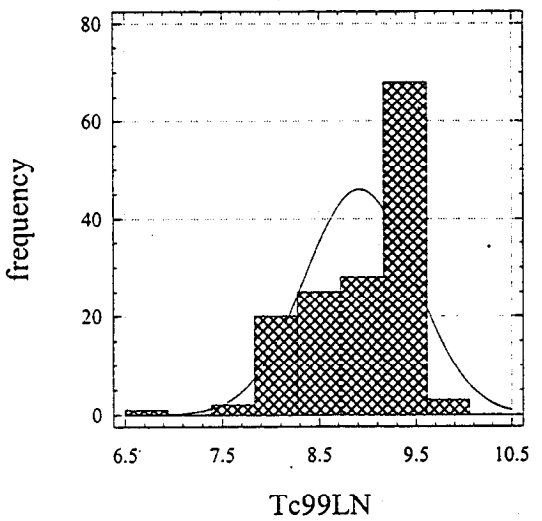


SORT = 6A

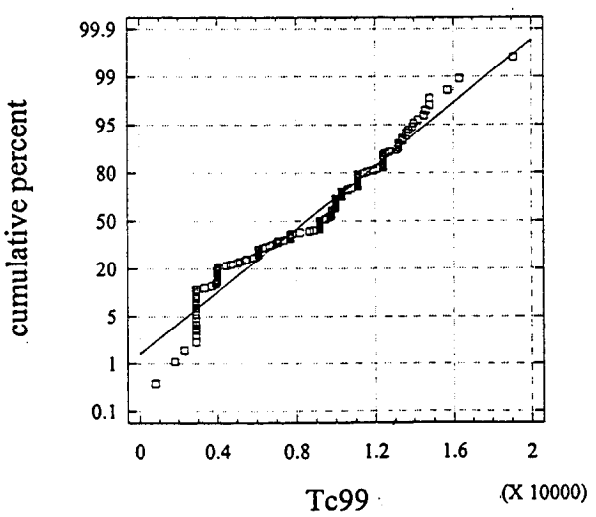
Histogram for Tc99



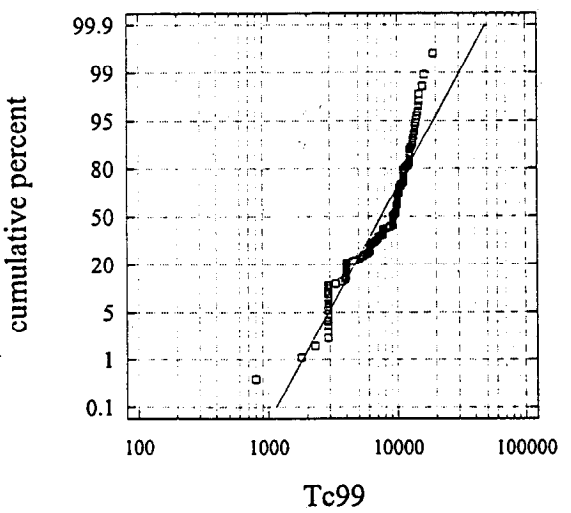
Histogram for Tc99LN



Normal Probability Plot

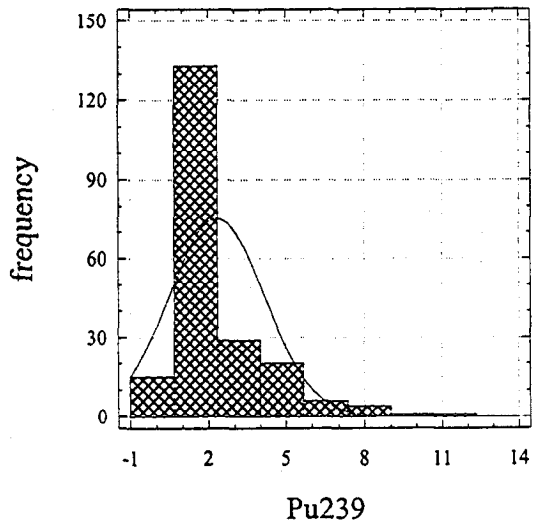


Lognormal Probability Plot

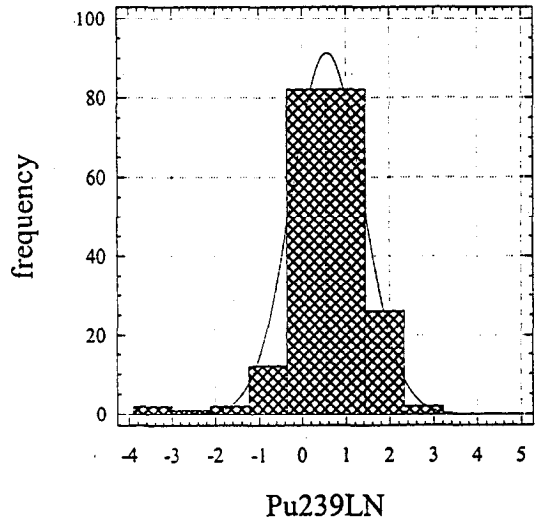


SORT = 6B

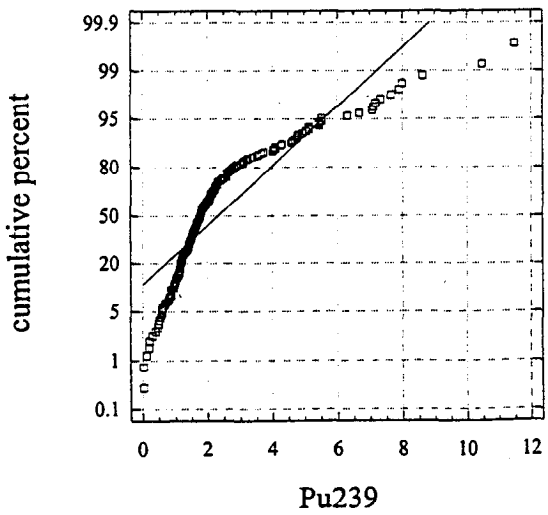
Histogram for Pu239



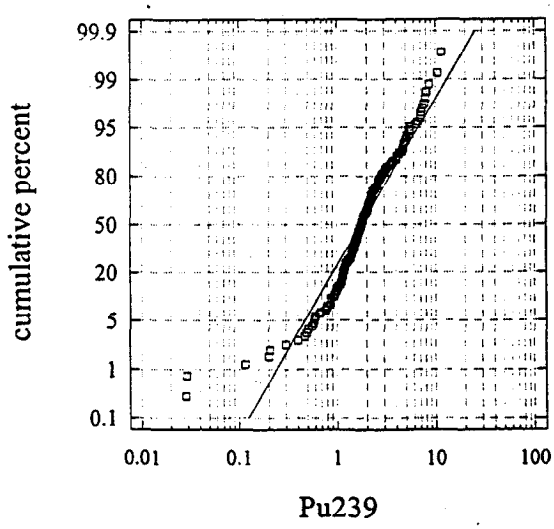
Histogram for Pu239LN



Normal Probability Plot

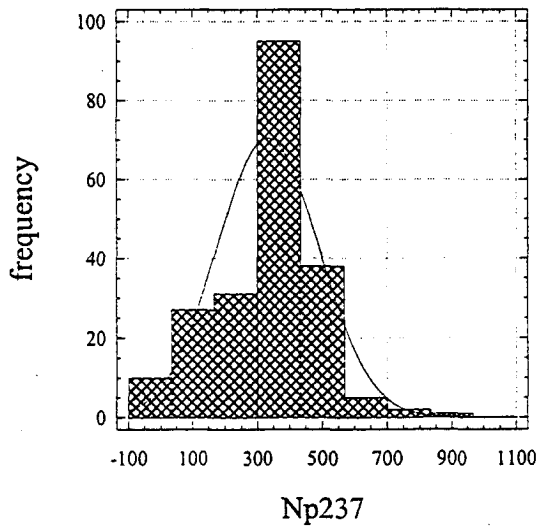


Lognormal Probability Plot

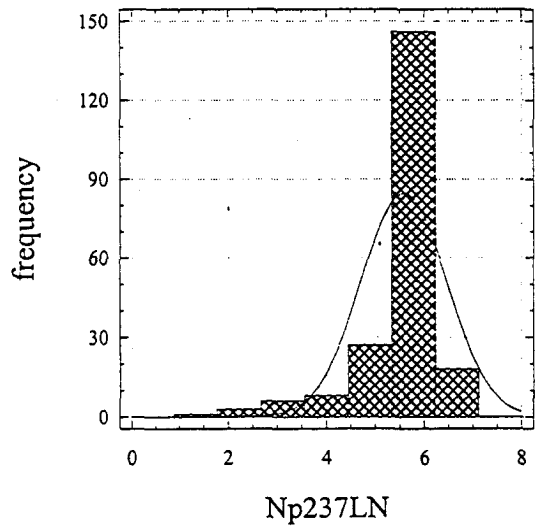


SORT = 6B

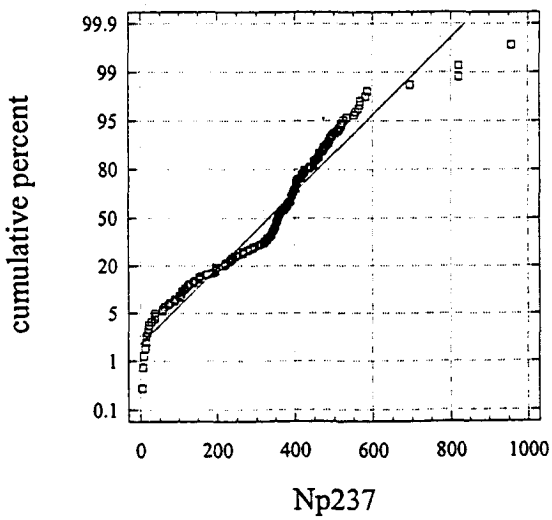
Histogram for Np237



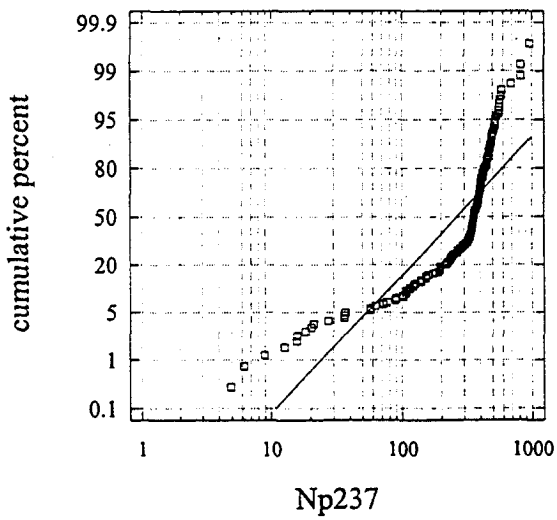
Histogram for Np237LN



Normal Probability Plot

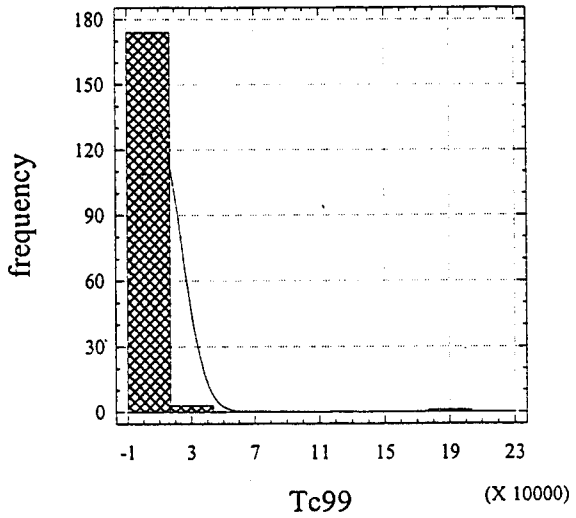


Lognormal Probability Plot

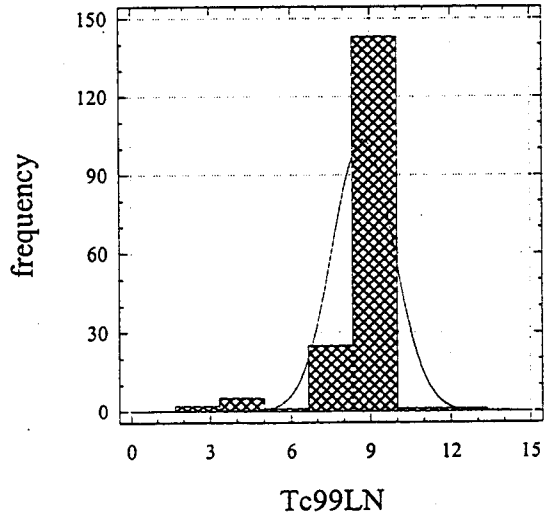


SORT = 6B

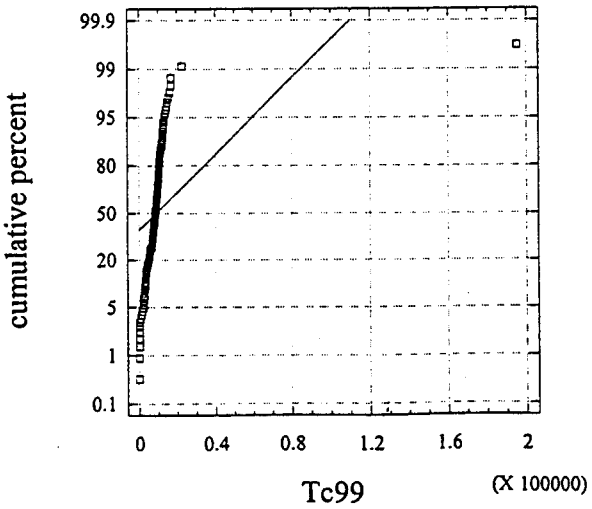
Histogram for Tc99



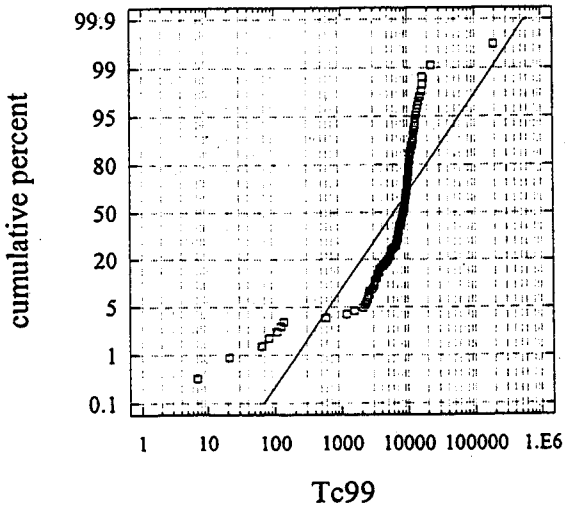
Histogram for Tc99LN



Normal Probability Plot

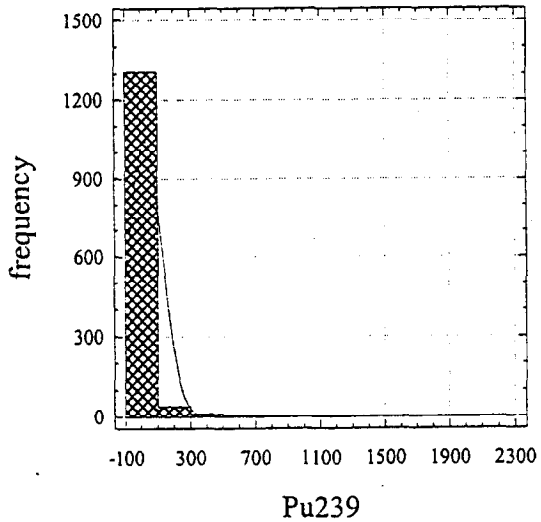


Lognormal Probability Plot

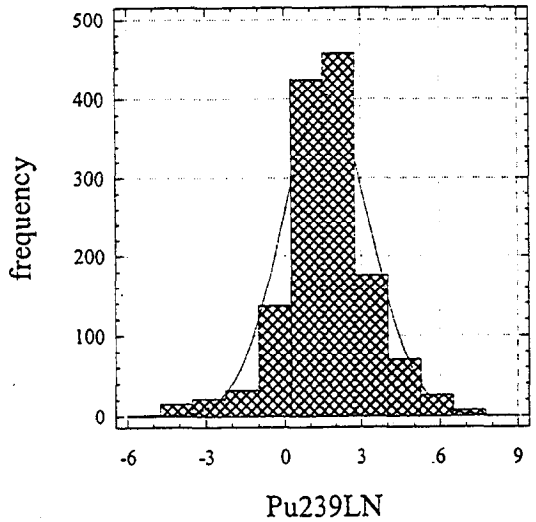


SORT = 6C

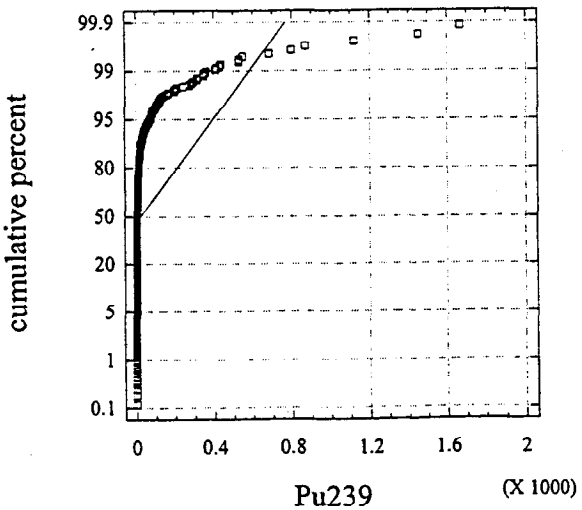
Histogram for Pu239



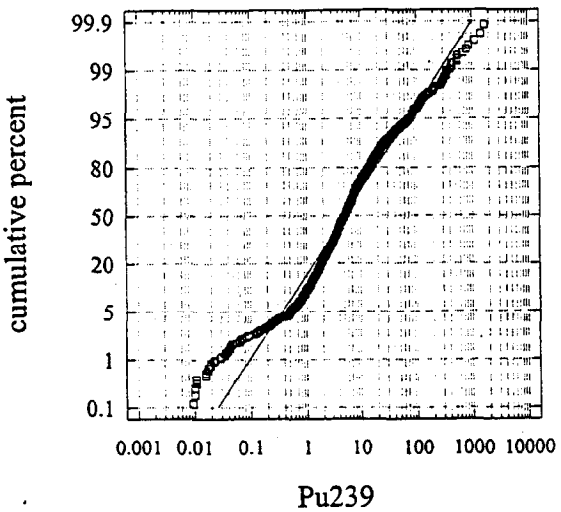
Histogram for Pu239LN



Normal Probability Plot

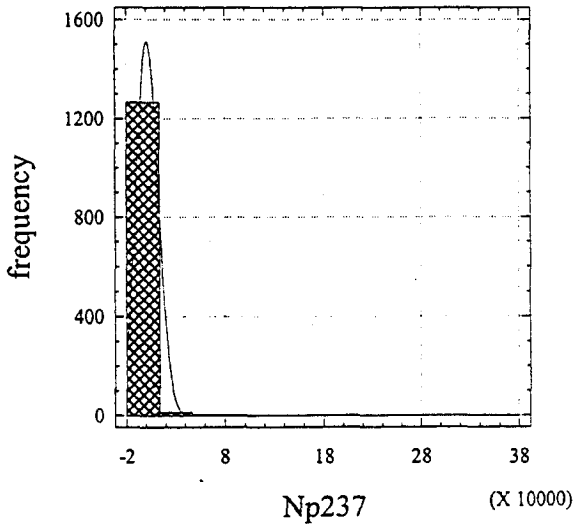


Lognormal Probability Plot

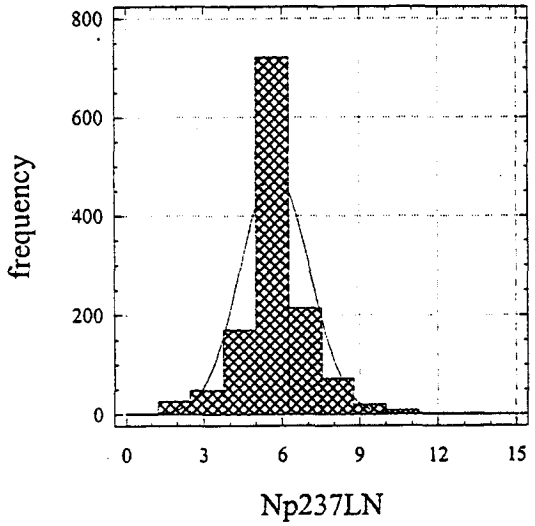


SORT = 6C

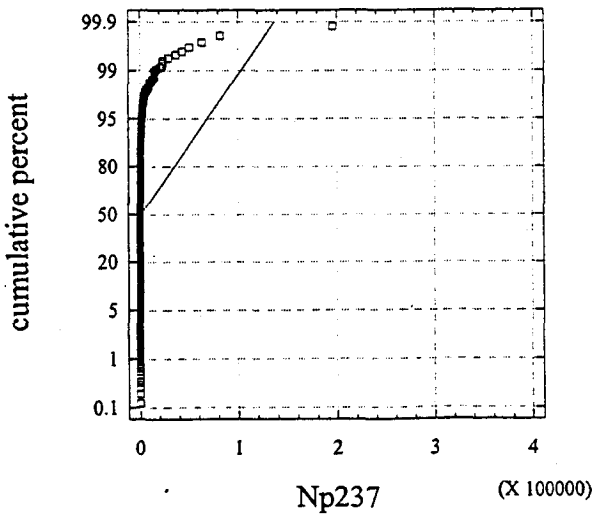
Histogram for Np237



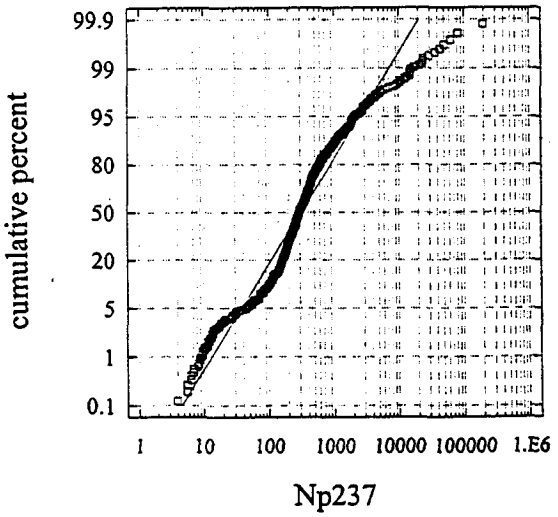
Histogram for Np237LN



Normal Probability Plot

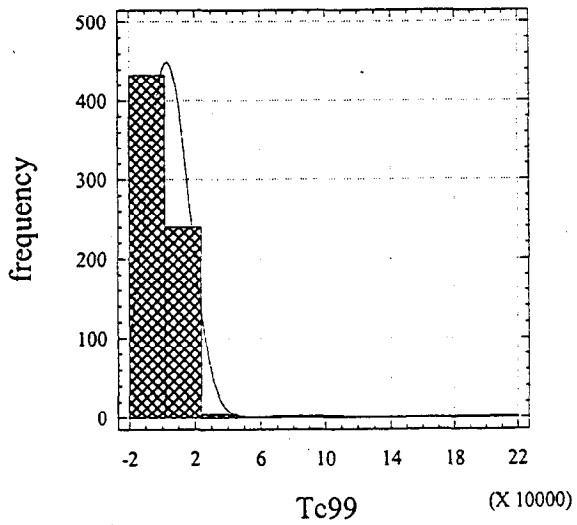


Lognormal Probability Plot

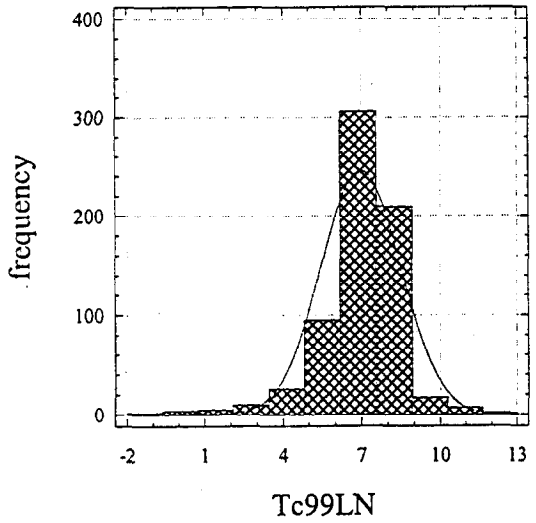


SORT = 6C

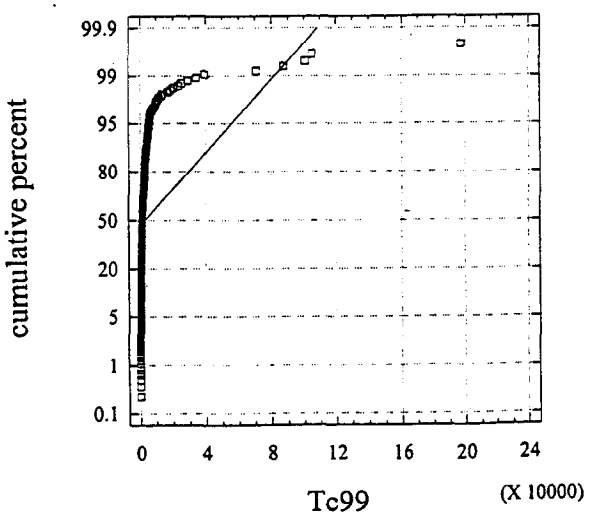
Histogram for Tc99



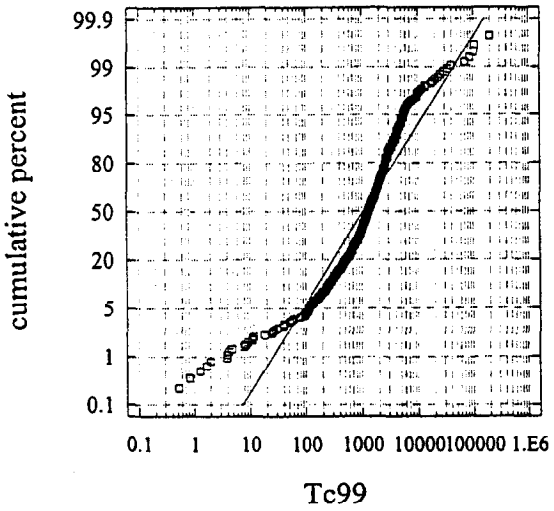
Histogram for Tc99LN



Normal Probability Plot

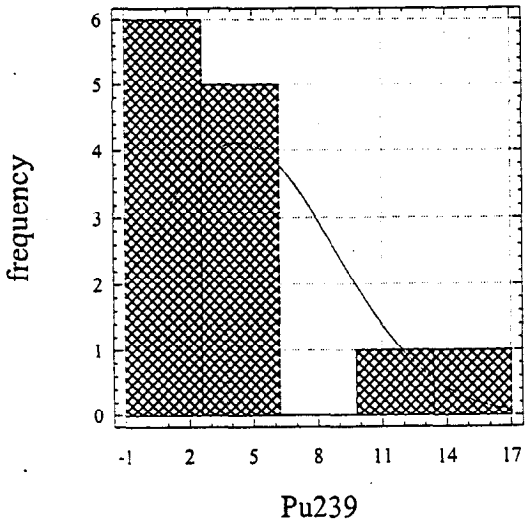


Lognormal Probability Plot

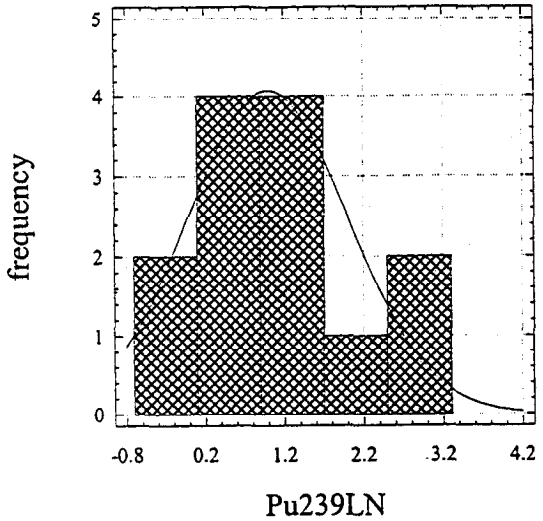


SORT = 6D

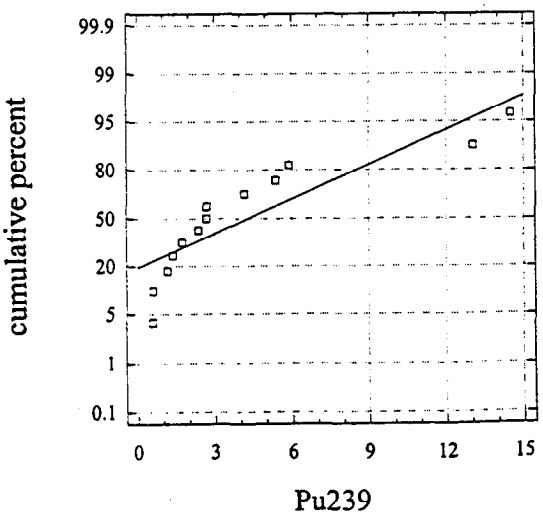
Histogram for Pu239



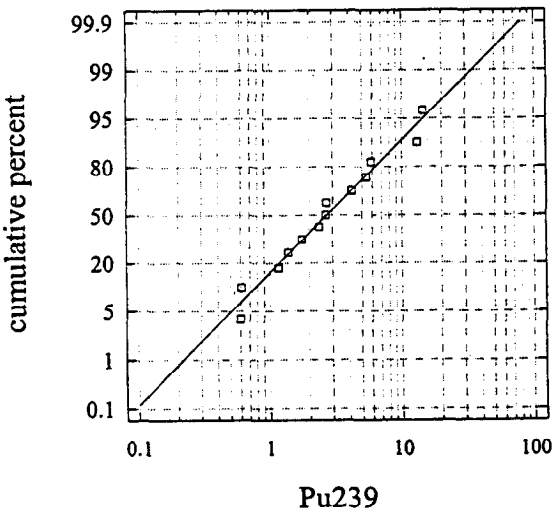
Histogram for Pu239LN



Normal Probability Plot

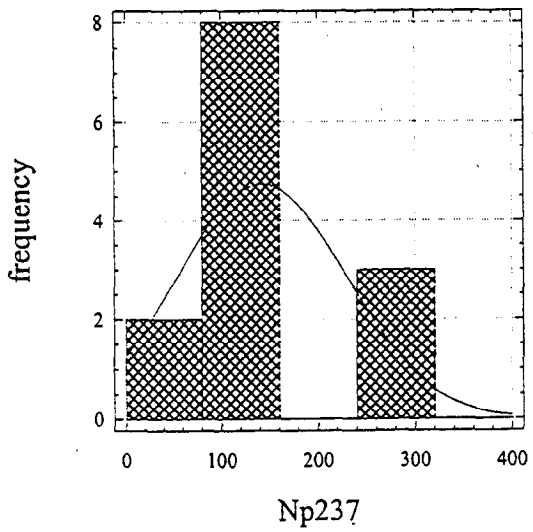


Lognormal Probability Plot

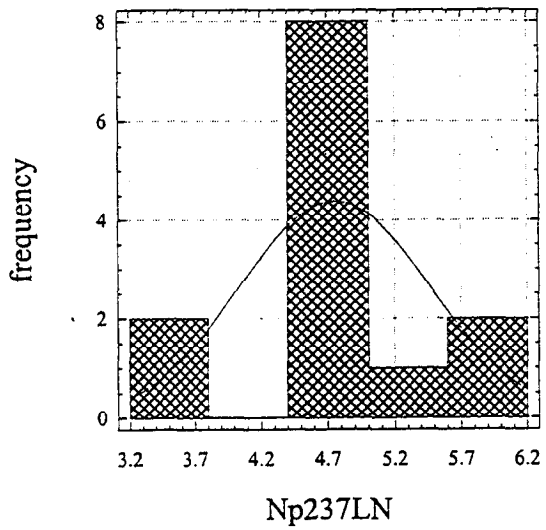


SORT = 6D

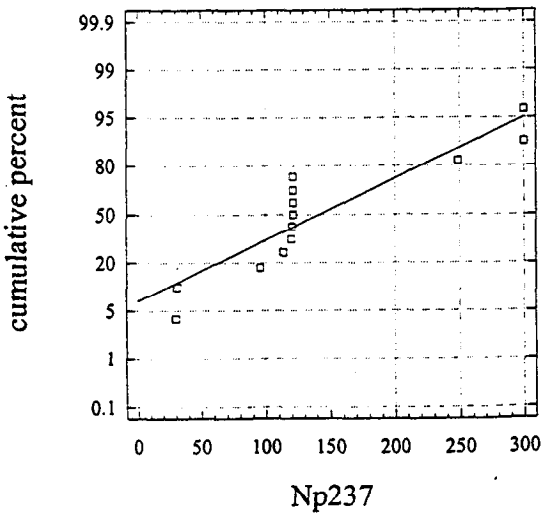
Histogram for Np237



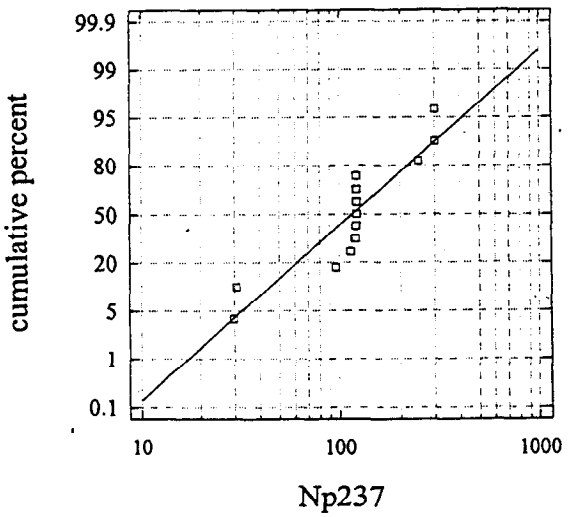
Histogram for Np237LN



Normal Probability Plot

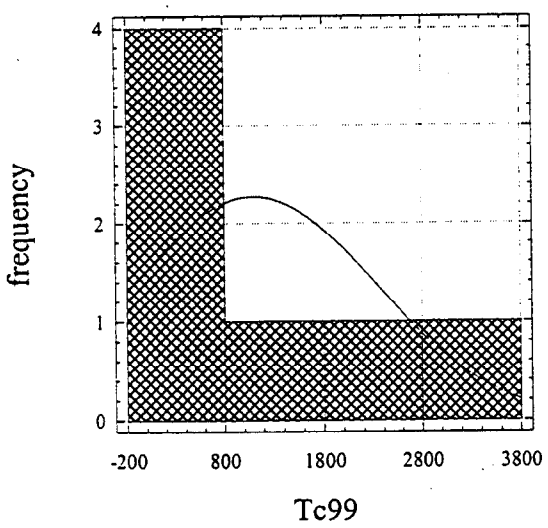


Lognormal Probability Plot

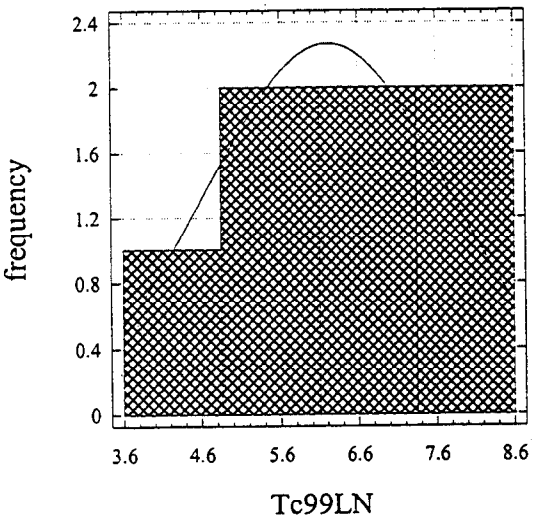


SORT .= 6D

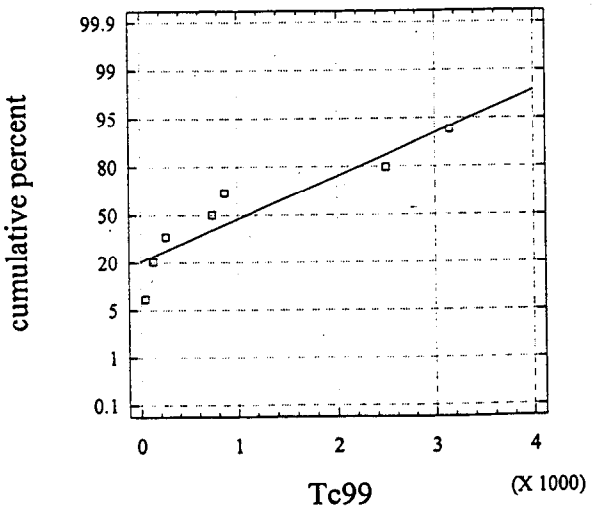
Histogram for Tc99



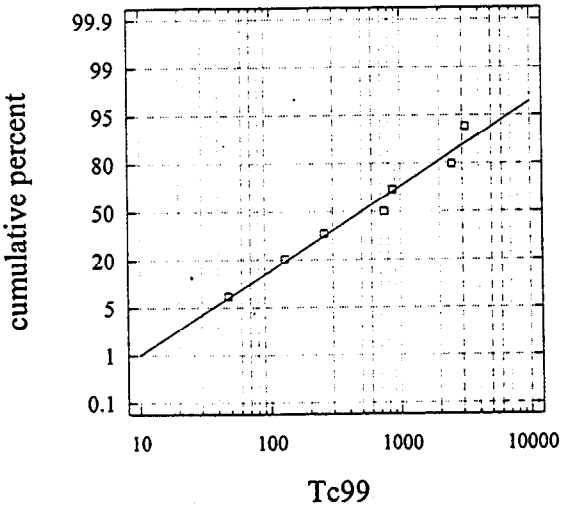
Histogram for Tc99LN



Normal Probability Plot

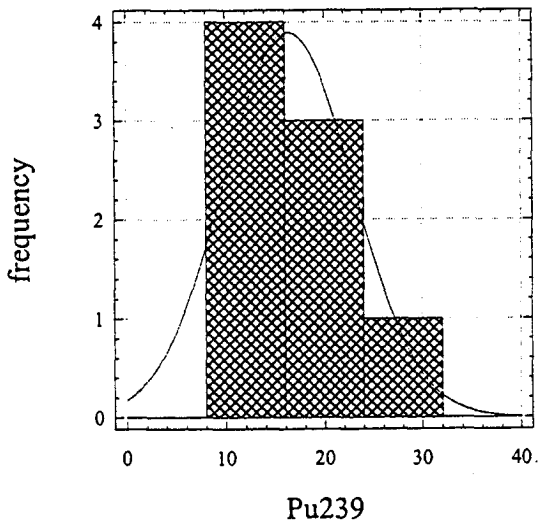


Lognormal Probability Plot

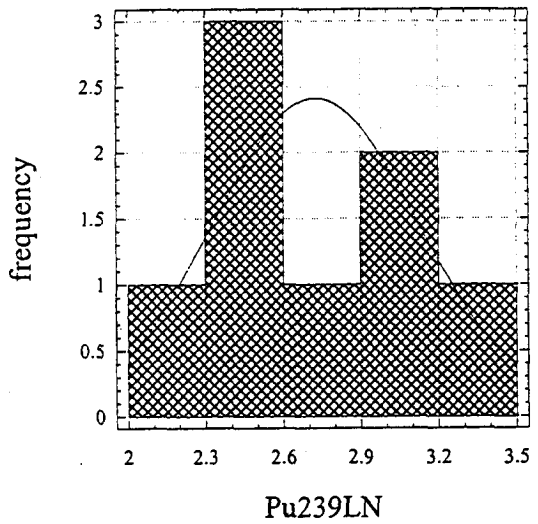


SORT = 6E

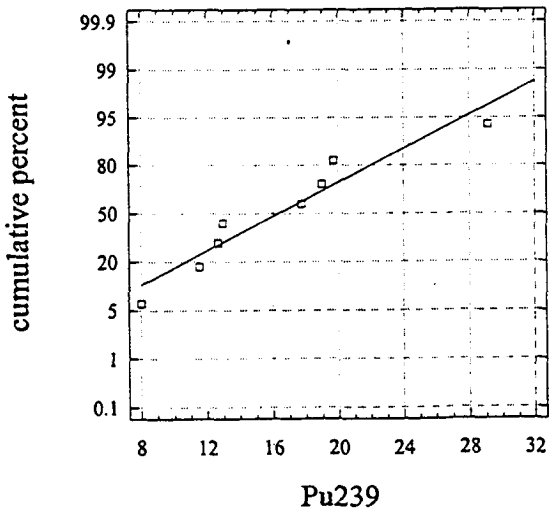
Histogram for Pu239



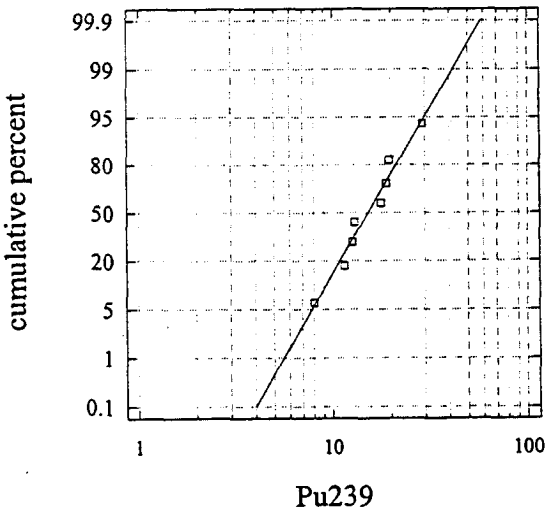
Histogram for Pu239LN



Normal Probability Plot

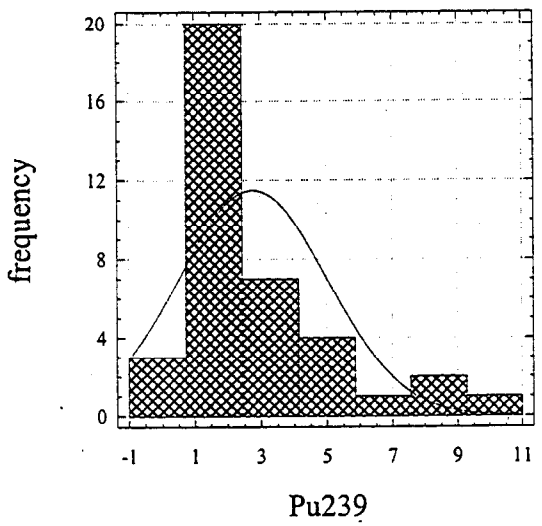


Lognormal Probability Plot

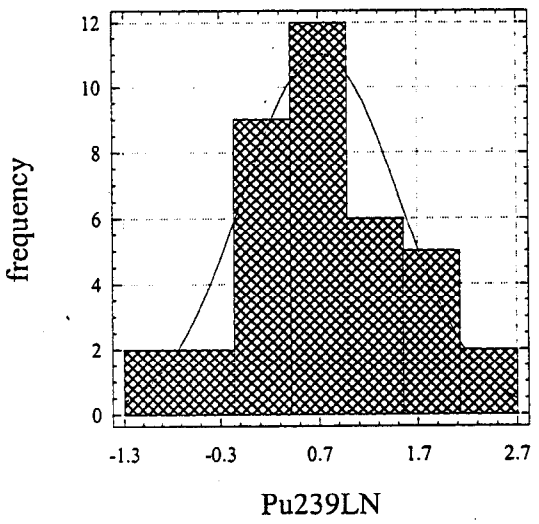


SORT = 6F

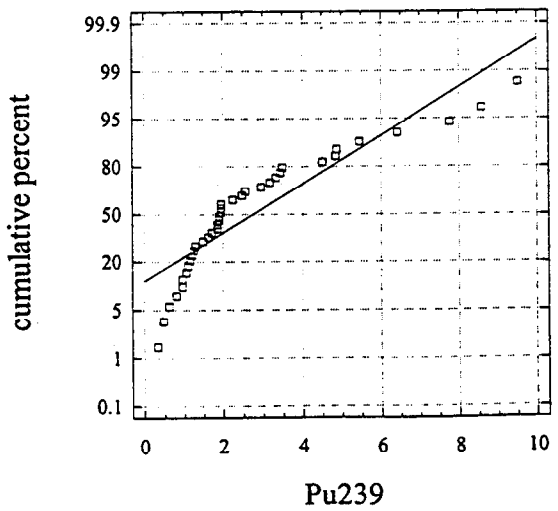
Histogram for Pu239



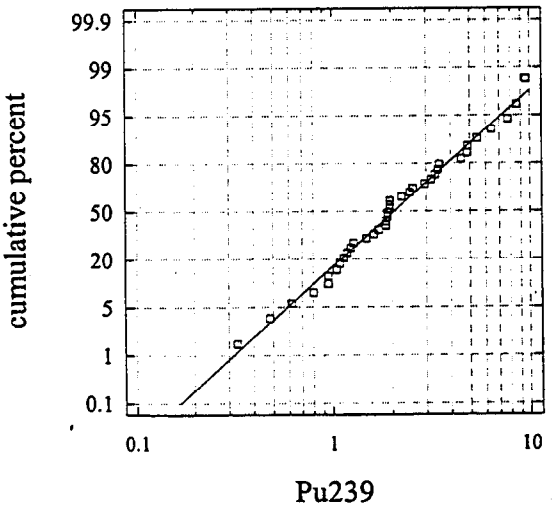
Histogram for Pu239LN



Normal Probability Plot

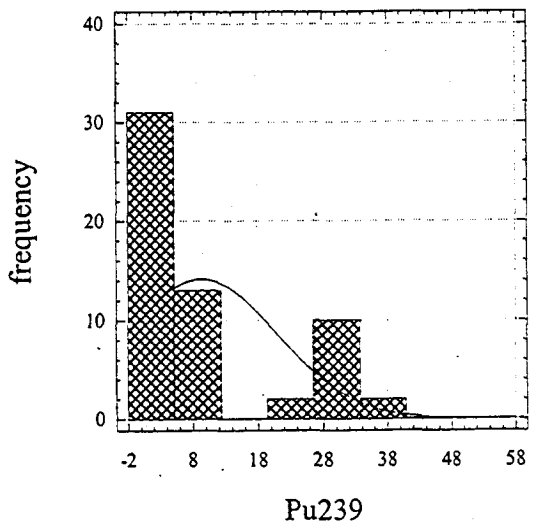


Lognormal Probability Plot

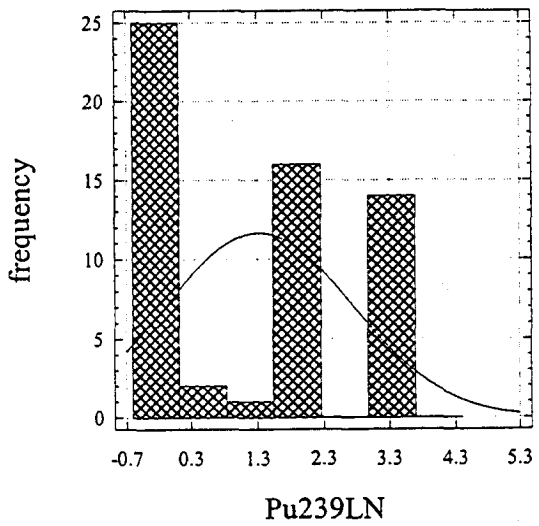


SORT = 7A

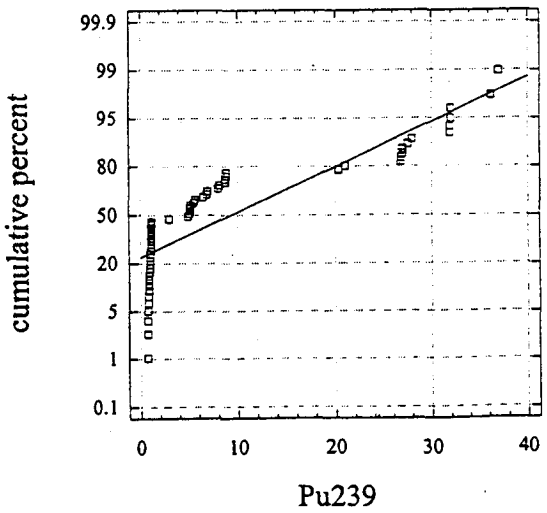
Histogram for Pu239



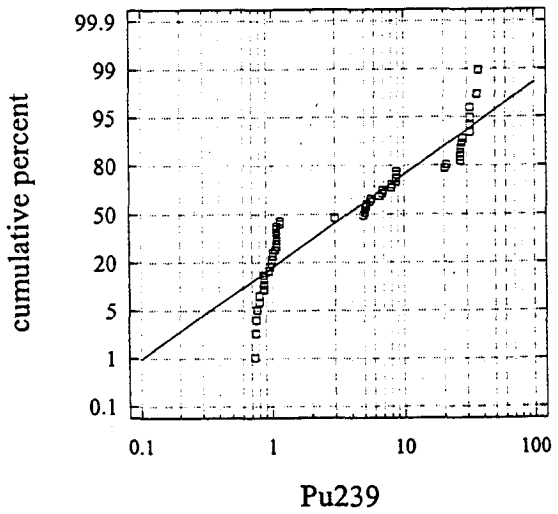
Histogram for Pu239LN



Normal Probability Plot

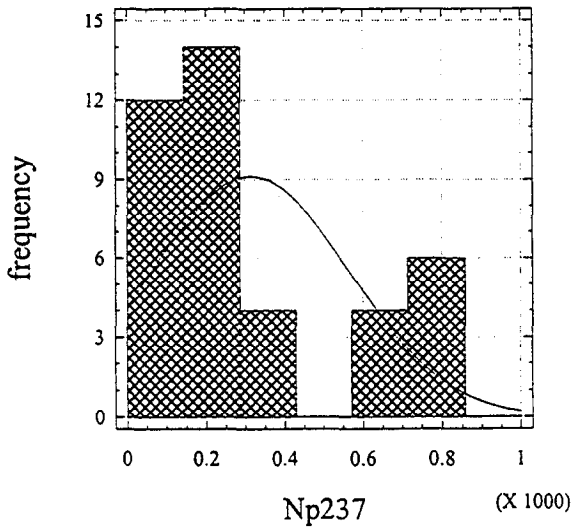


Lognormal Probability Plot

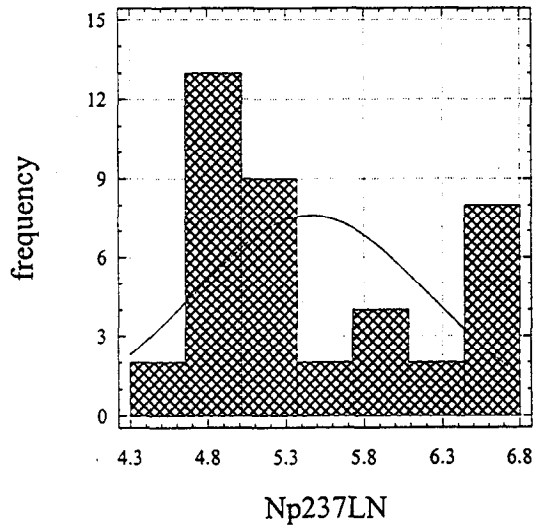


SORT = 7A

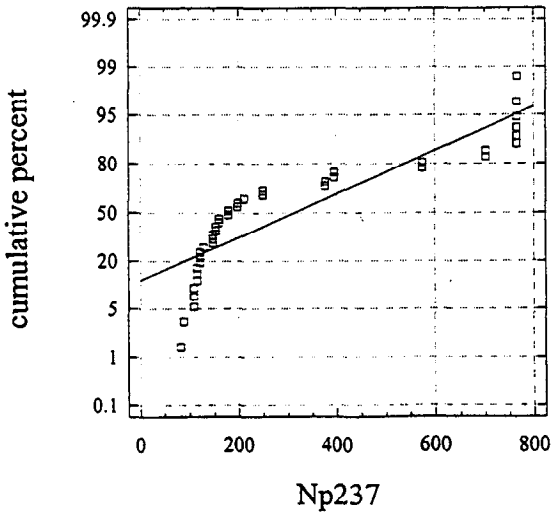
Histogram for Np237



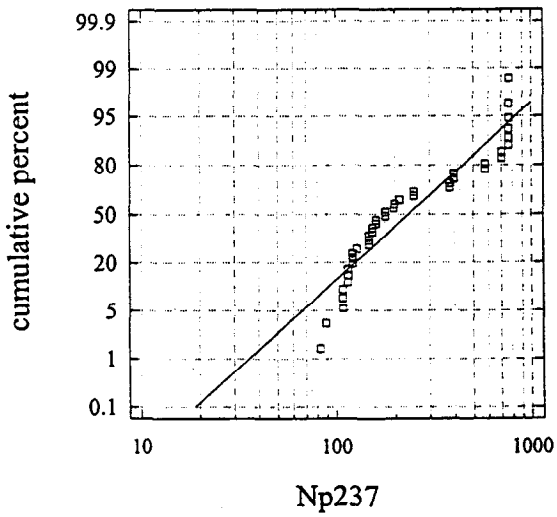
Histogram for Np237LN



Normal Probability Plot

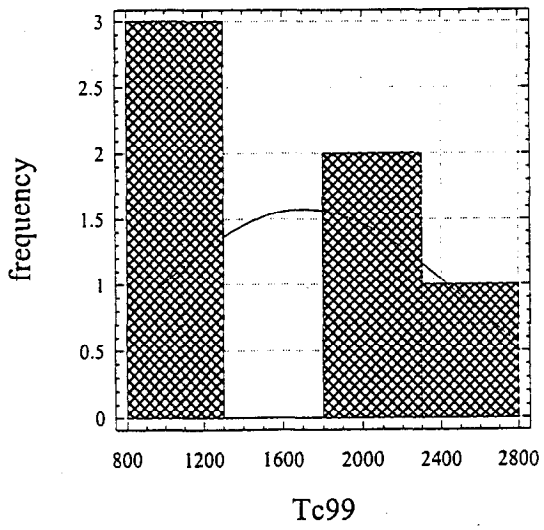


Lognormal Probability Plot

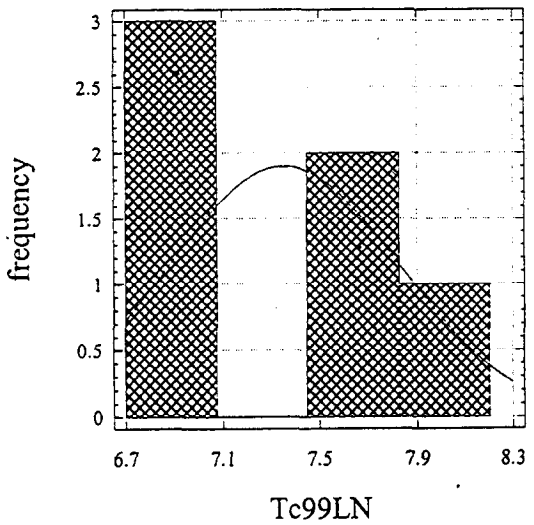


SORT = 7A

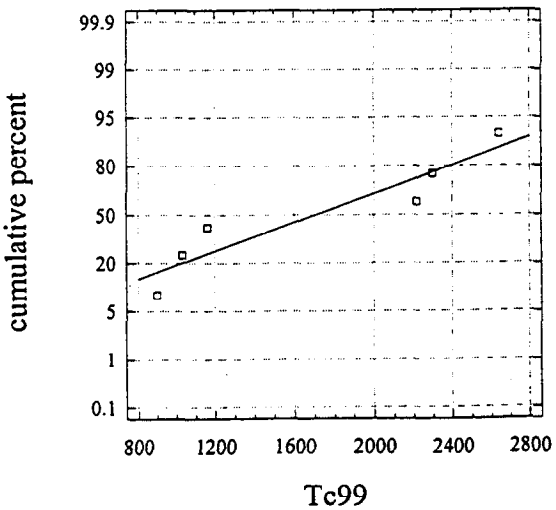
Histogram for Tc99



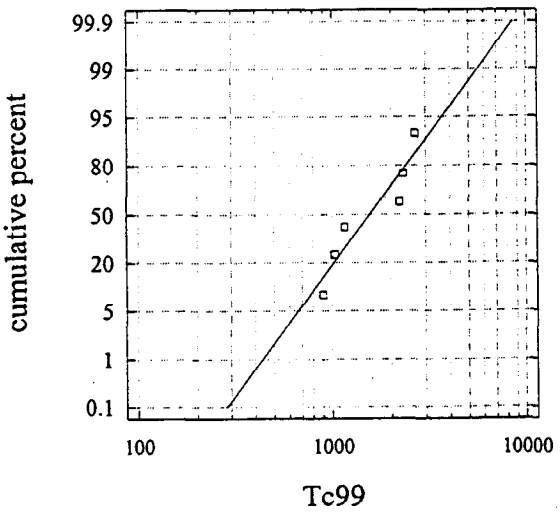
Histogram for Tc99LN



Normal Probability Plot

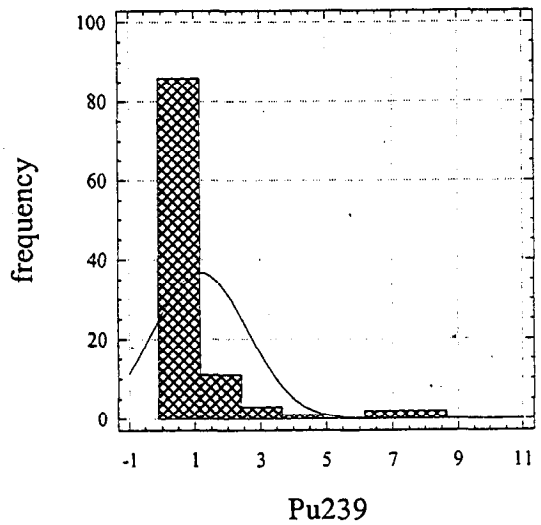


Lognormal Probability Plot

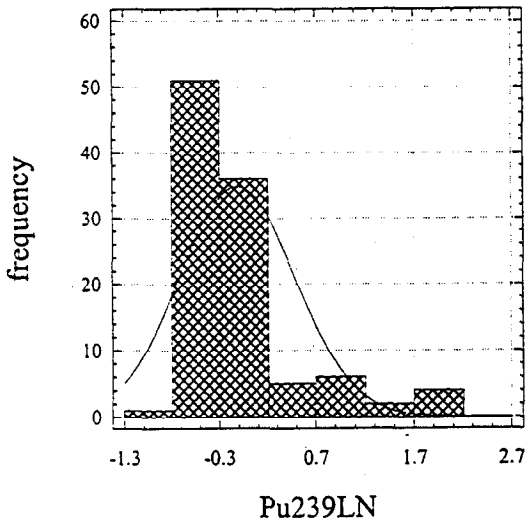


SORT = 7B

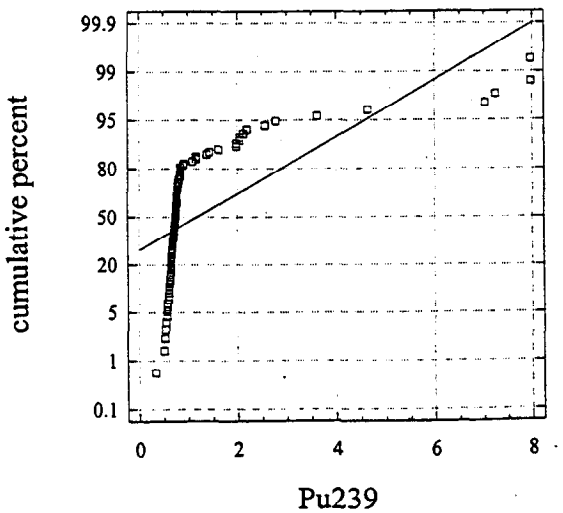
Histogram for Pu239



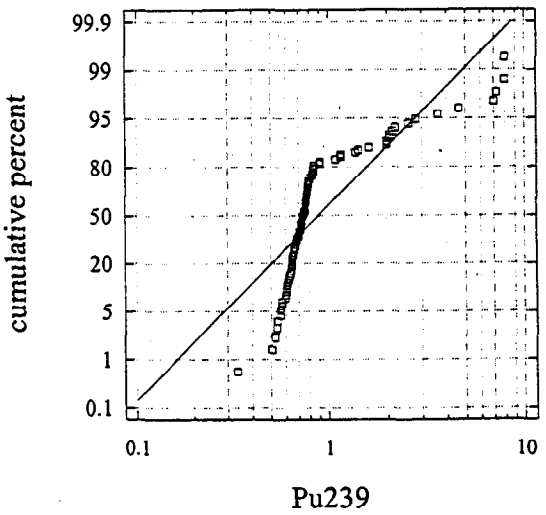
Histogram for Pu239LN



Normal Probability Plot

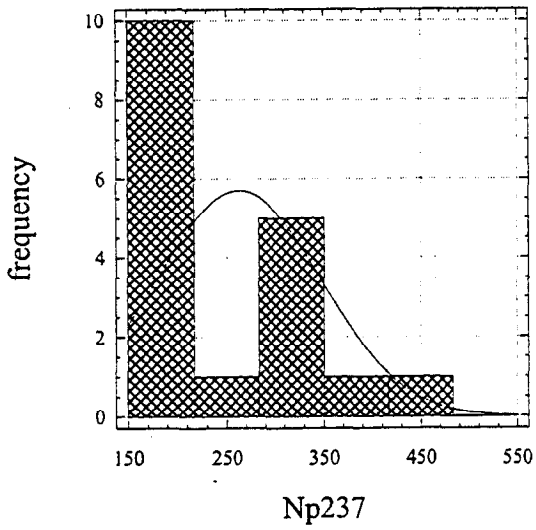


Lognormal Probability Plot



SORT = 7B

Histogram for Np237



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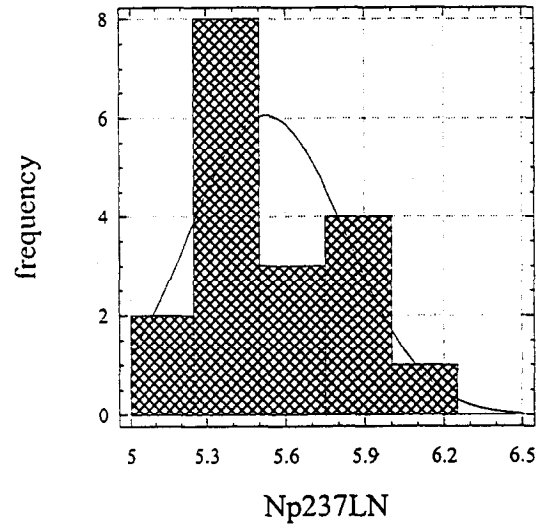
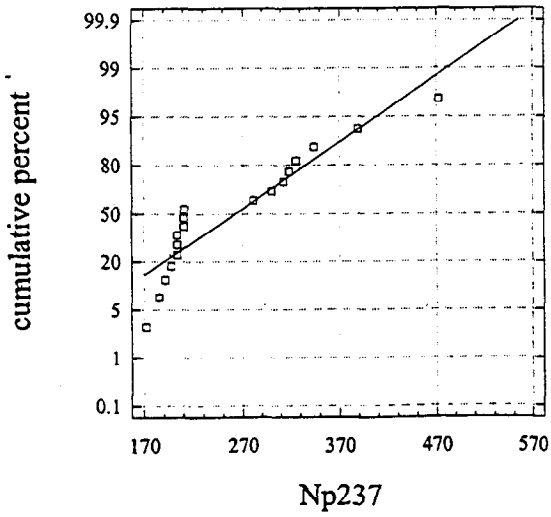
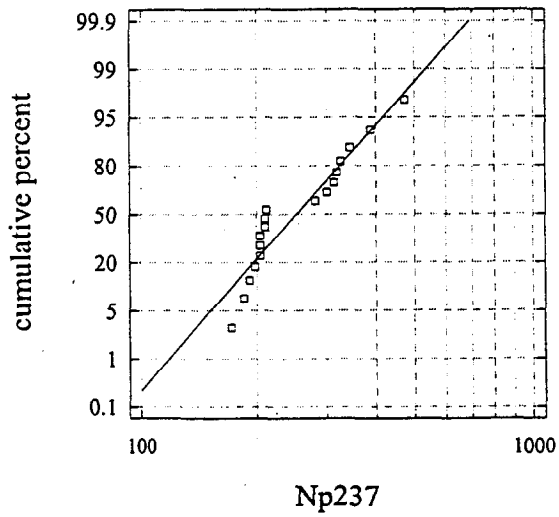


Normal Probability Plot

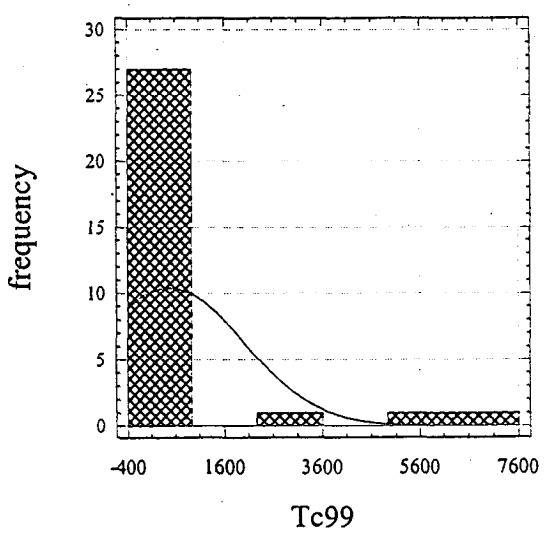


Lognormal Probability Plot

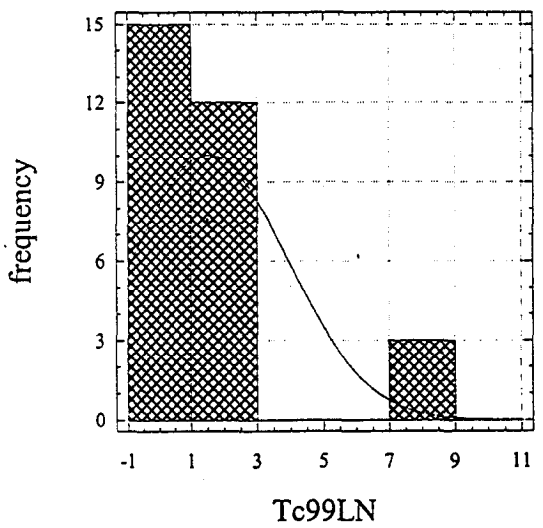


SORT = 7B

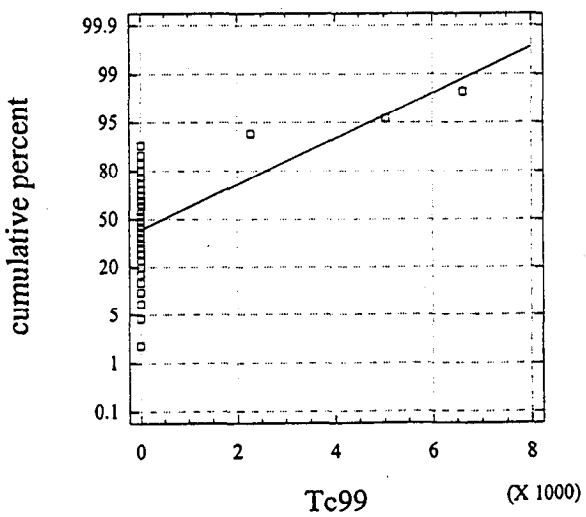
Histogram for Tc99



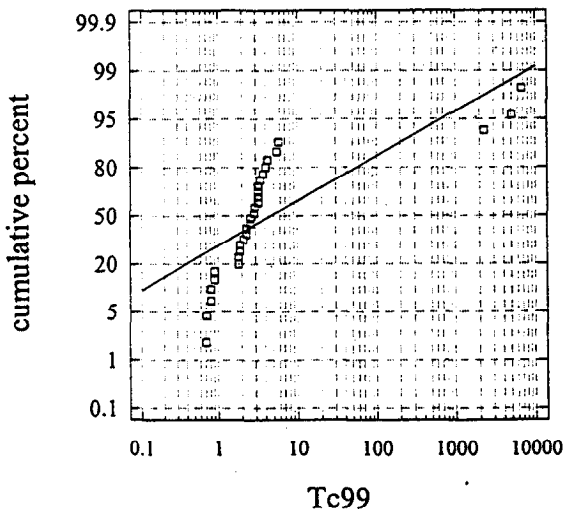
Histogram for Tc99LN



Normal Probability Plot

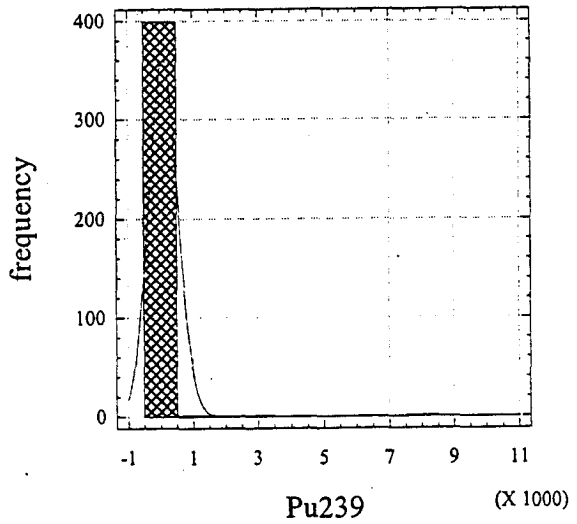


Lognormal Probability Plot



SORT = 8

Histogram for Pu239



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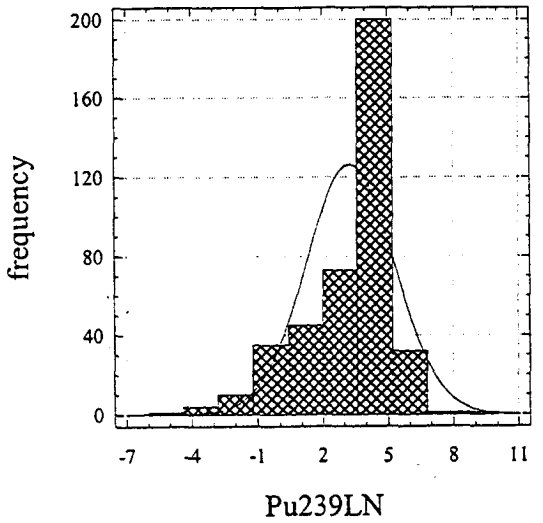
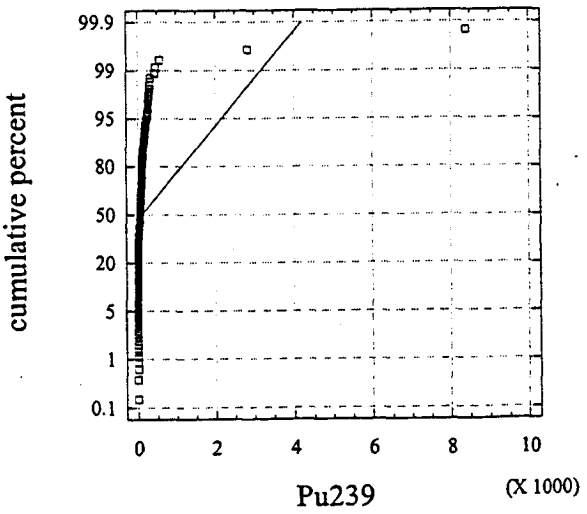
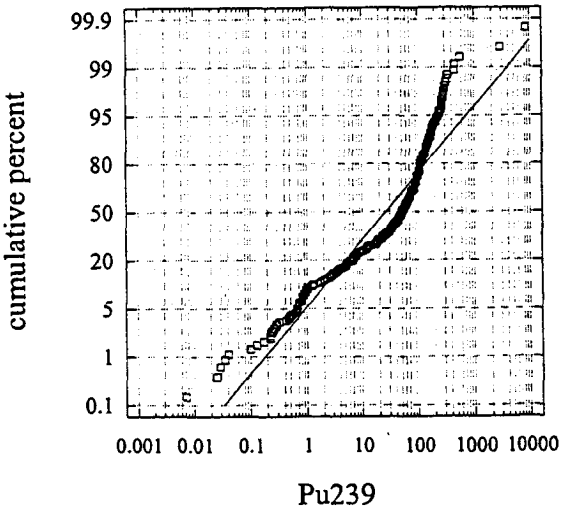


Normal Probability Plot

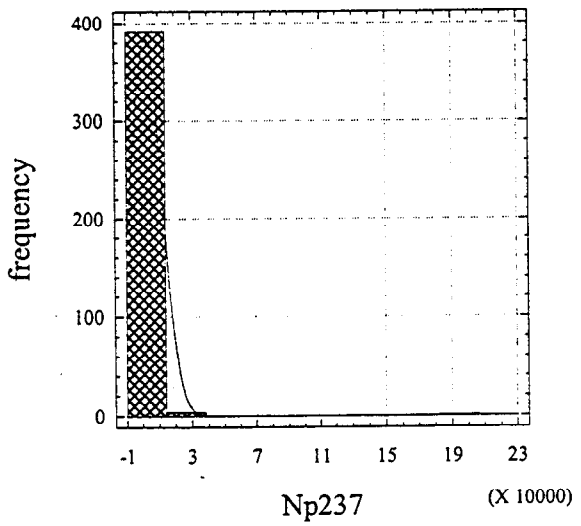


Lognormal Probability Plot

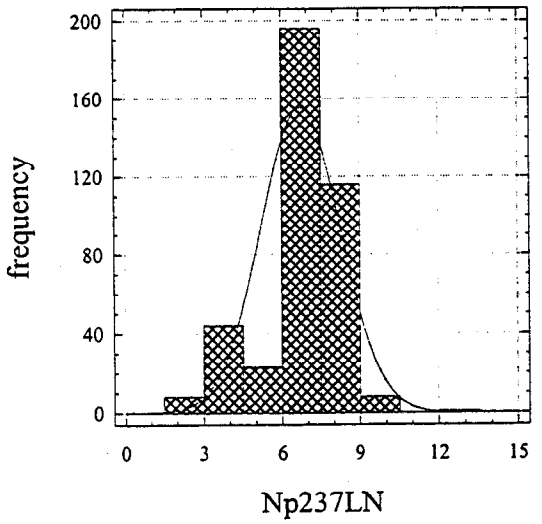


SORT = 8

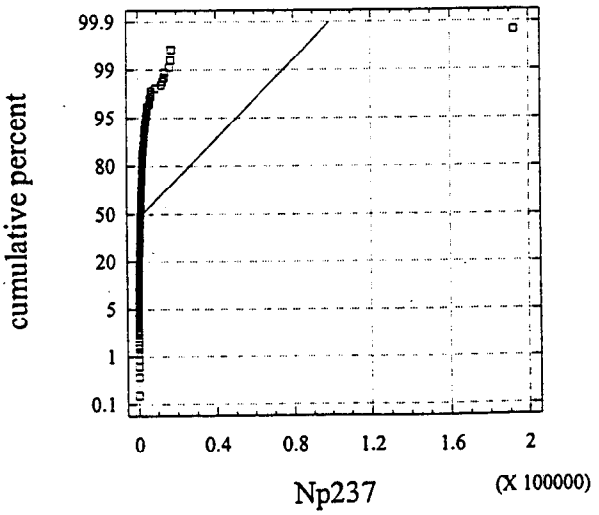
Histogram for Np237



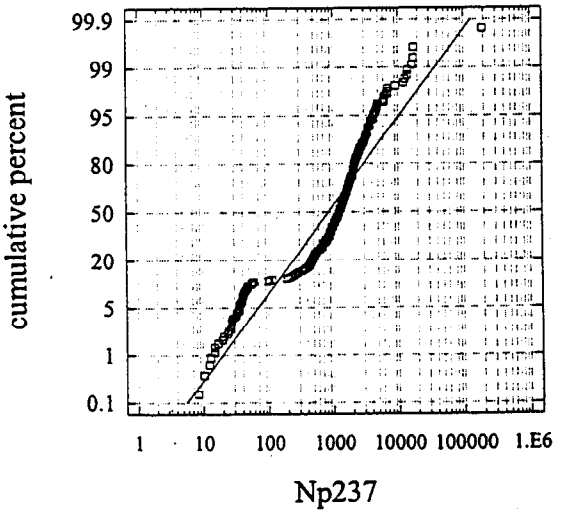
Histogram for Np237LN



Normal Probability Plot

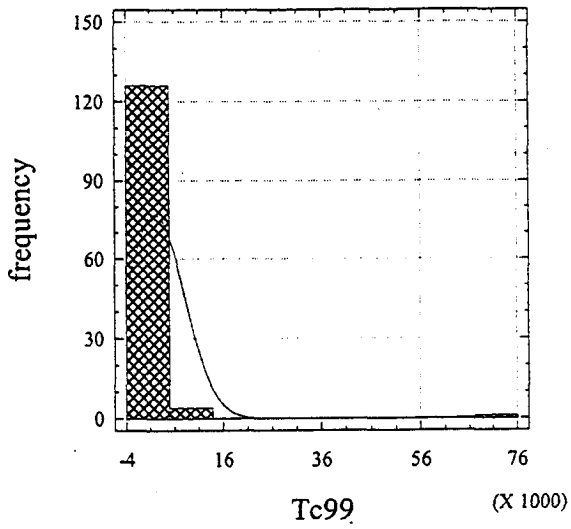


Lognormal Probability Plot

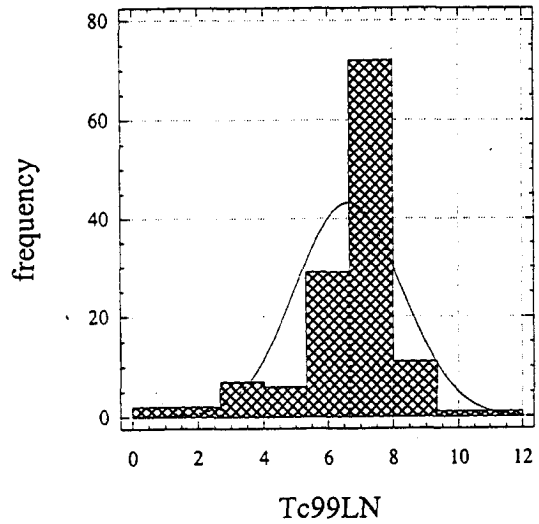


SORT = 8

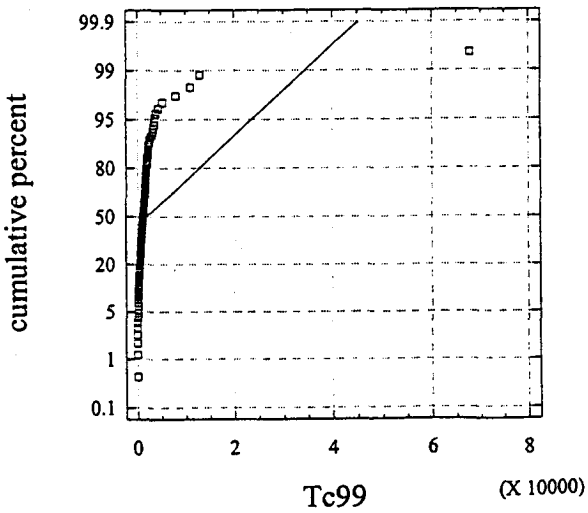
Histogram for Tc99



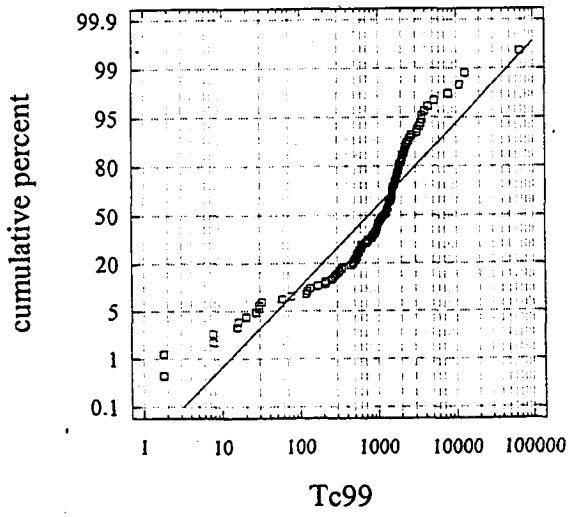
Histogram for Tc99LN



Normal Probability Plot

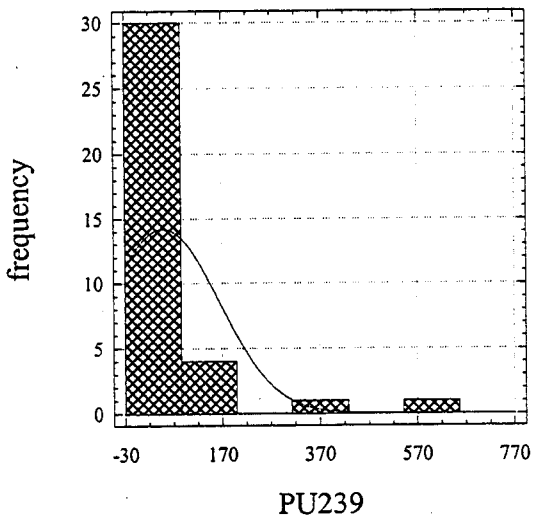


Lognormal Probability Plot

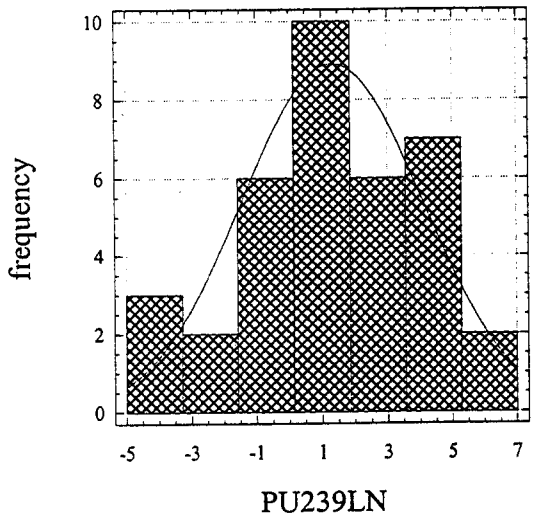


SORT = 9

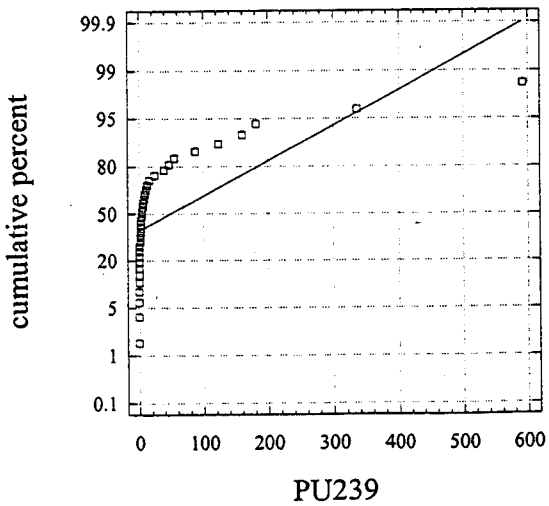
Histogram for PU239



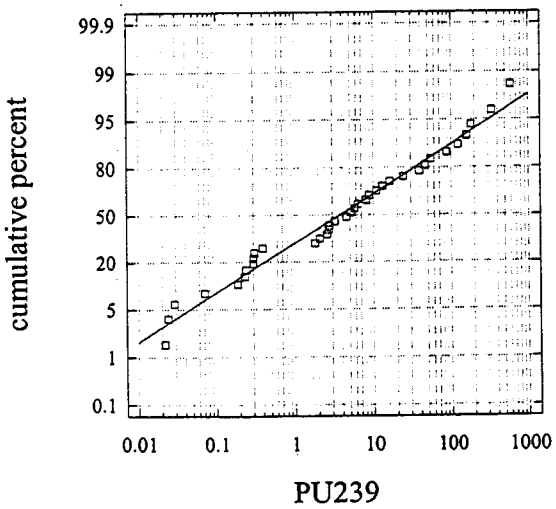
Histogram for PU239LN



Normal Probability Plot

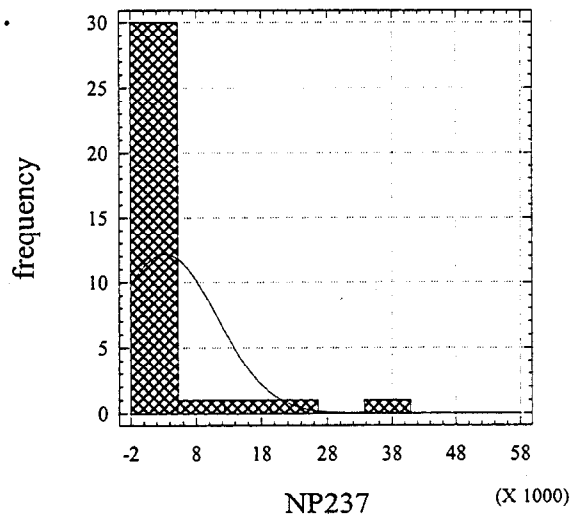


Lognormal Probability Plot

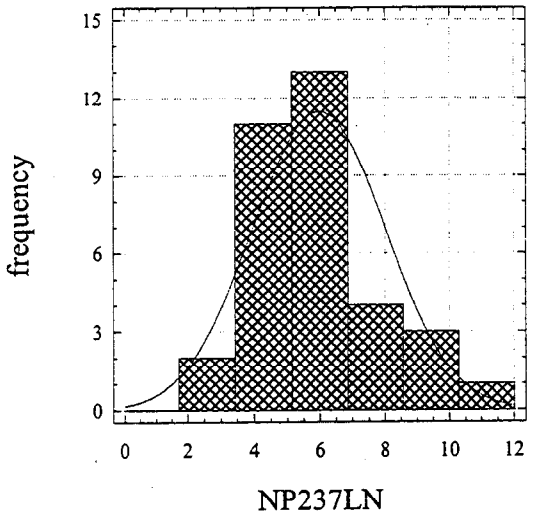


SORT = 9

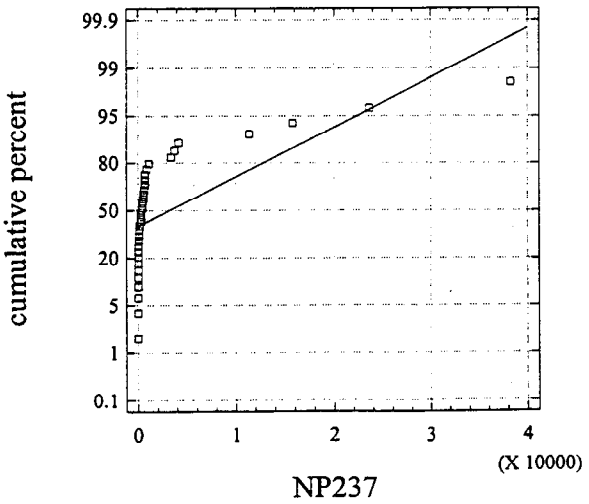
Histogram for NP237



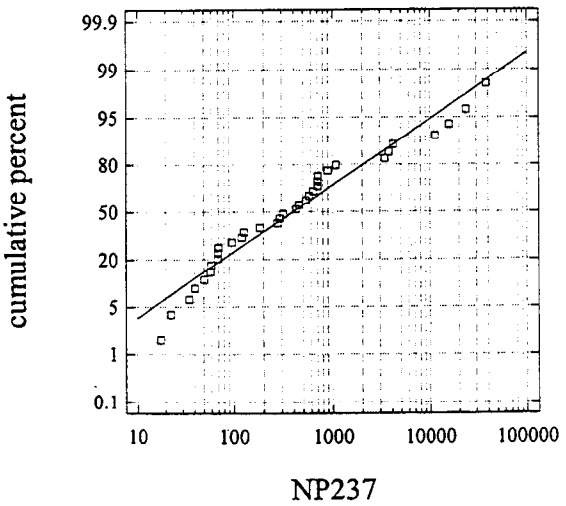
Histogram for NP237LN



Normal Probability Plot

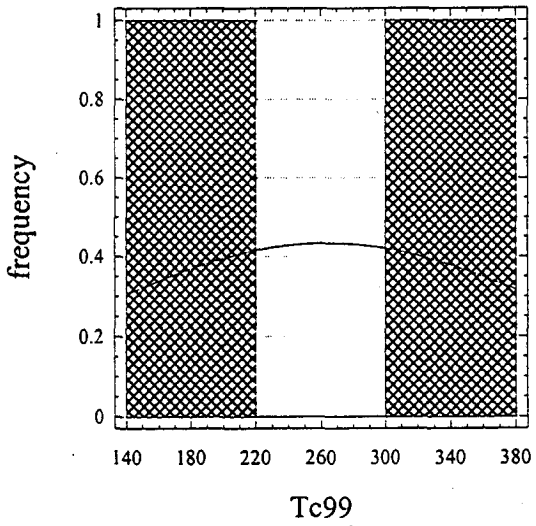


Lognormal Probability Plot

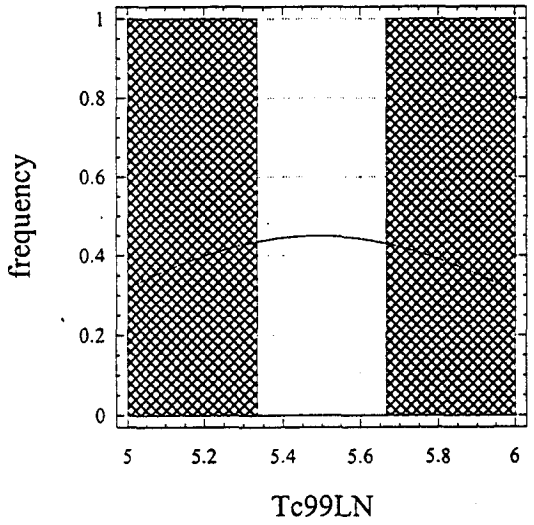


SORT = 9

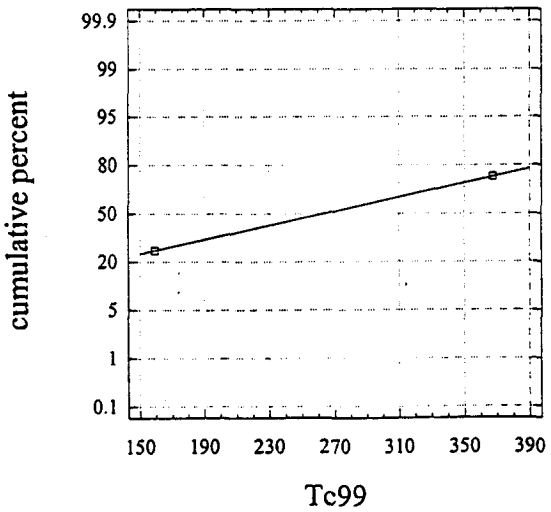
Histogram for Tc99



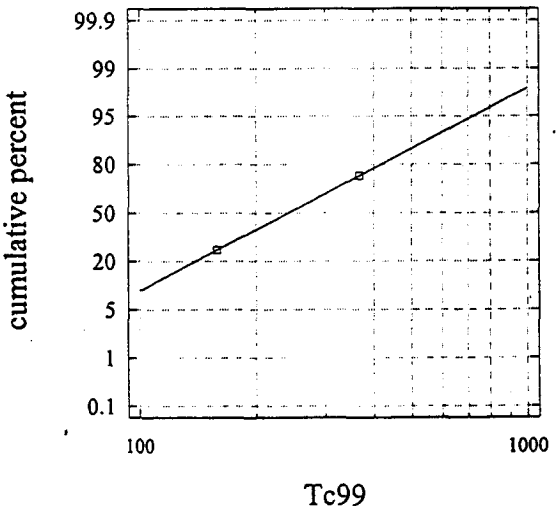
Histogram for Tc99LN



Normal Probability Plot

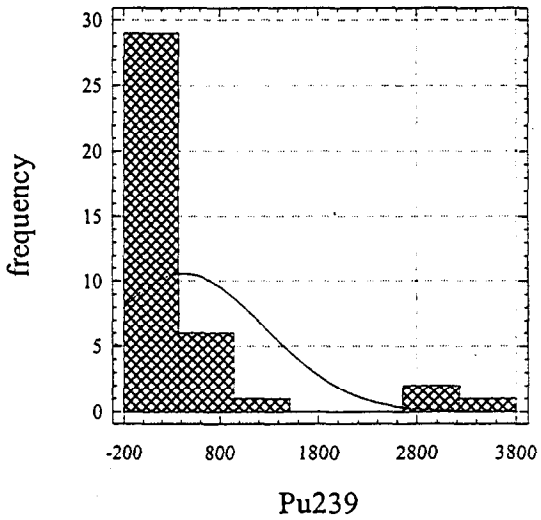


Lognormal Probability Plot

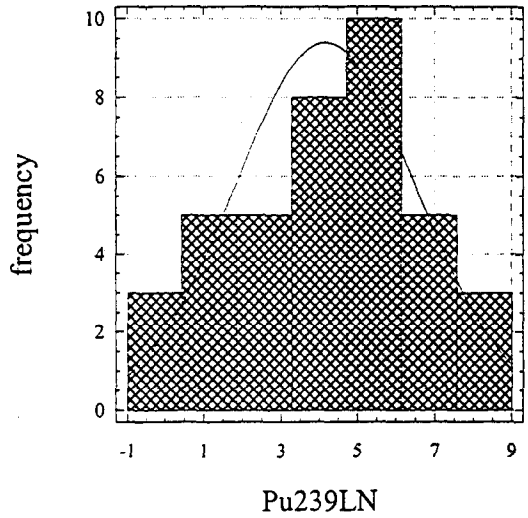


SORT = 10A

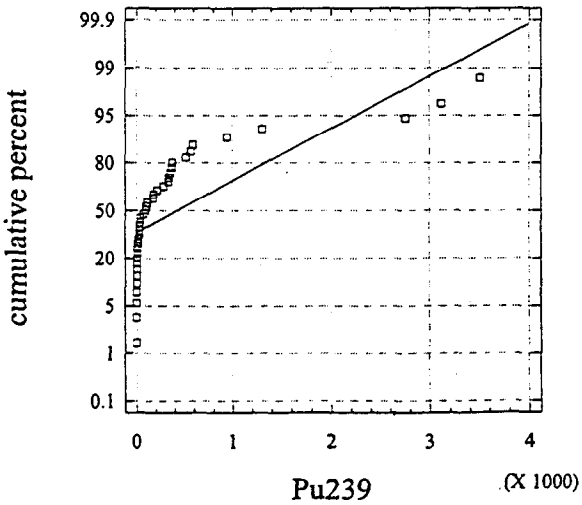
Histogram for Pu239



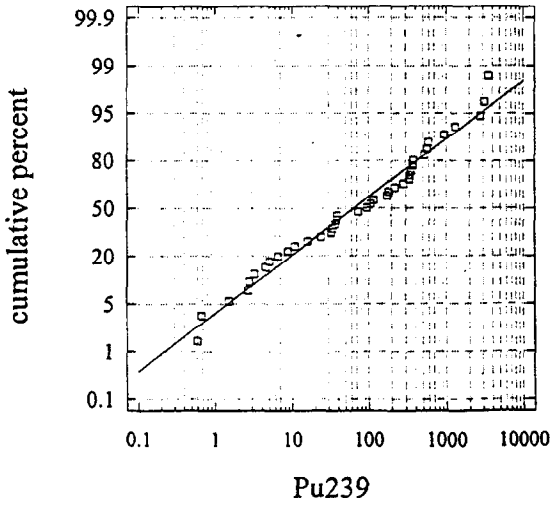
Histogram for Pu239LN



Normal Probability Plot

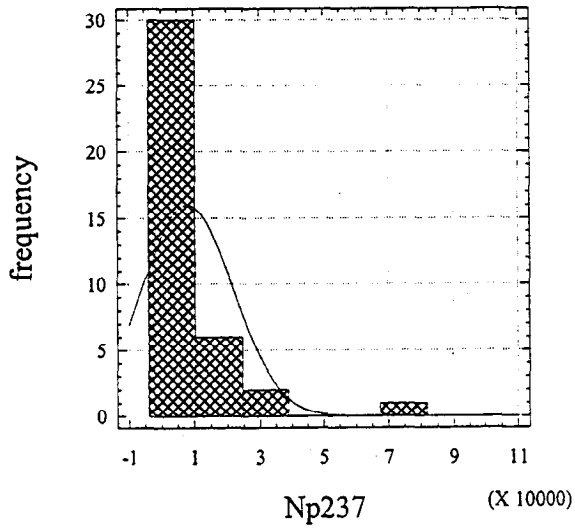


Lognormal Probability Plot

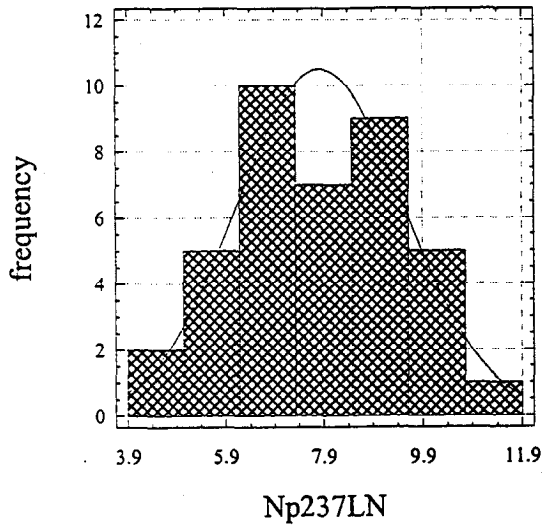


SORT = 10A

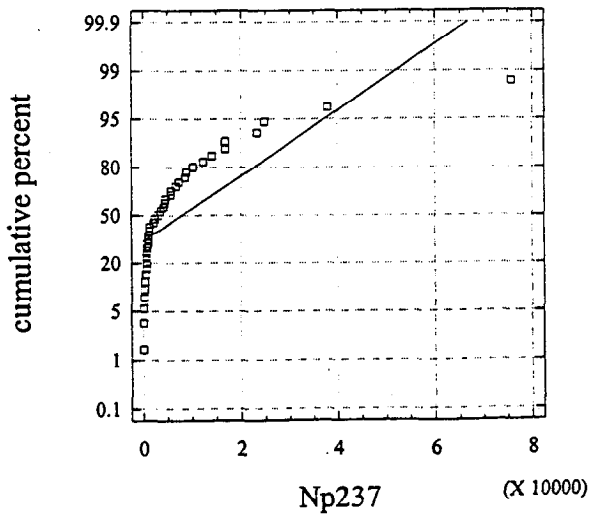
Histogram for Np237



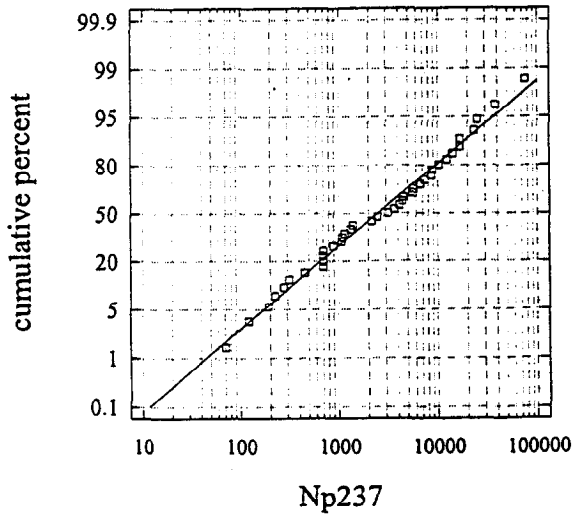
Histogram for Np237LN



Normal Probability Plot

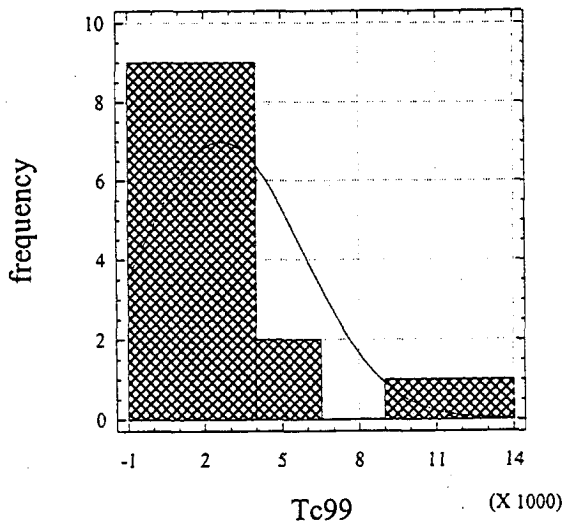


Lognormal Probability Plot

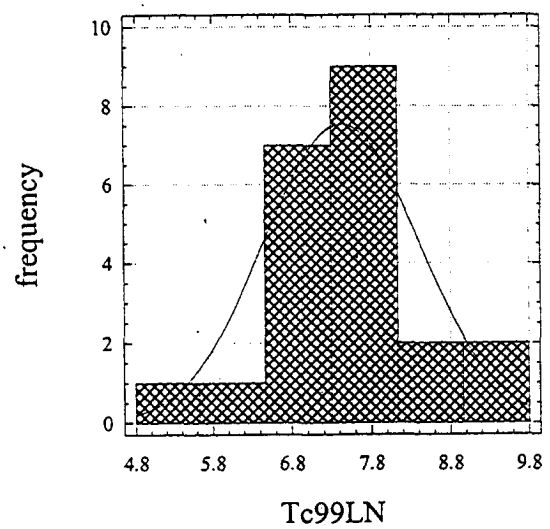


SORT = 10A

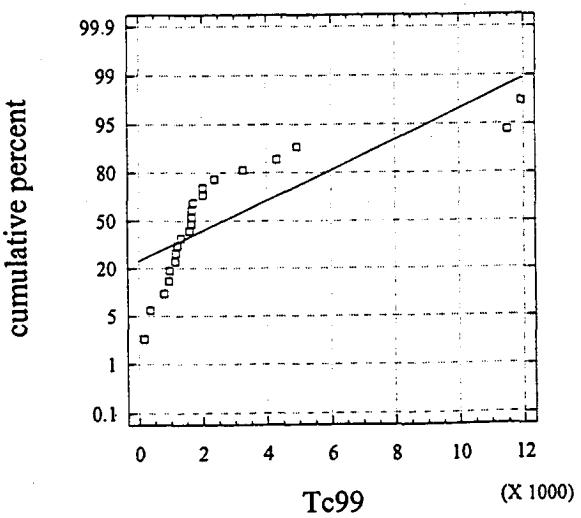
Histogram for Tc99



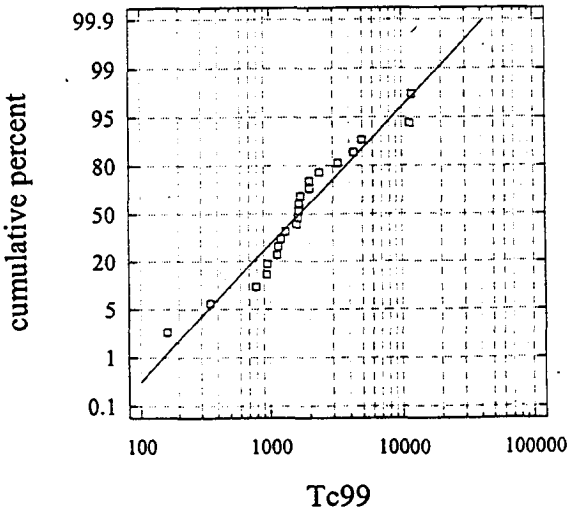
Histogram for Tc99LN



Normal Probability Plot

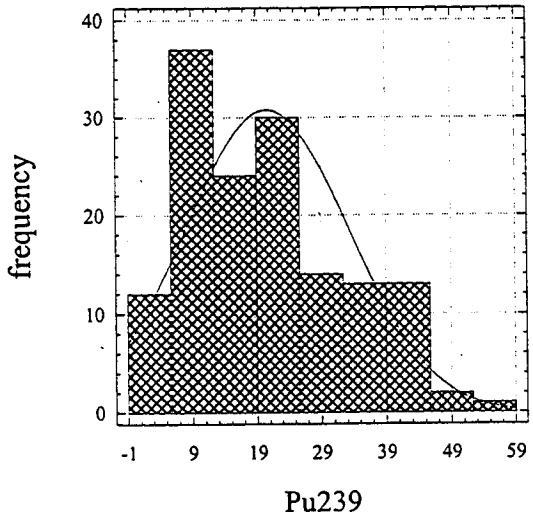


Lognormal Probability Plot

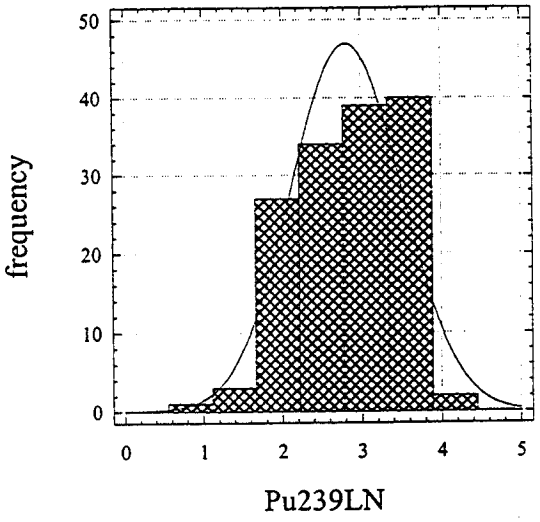


SORT = 10B

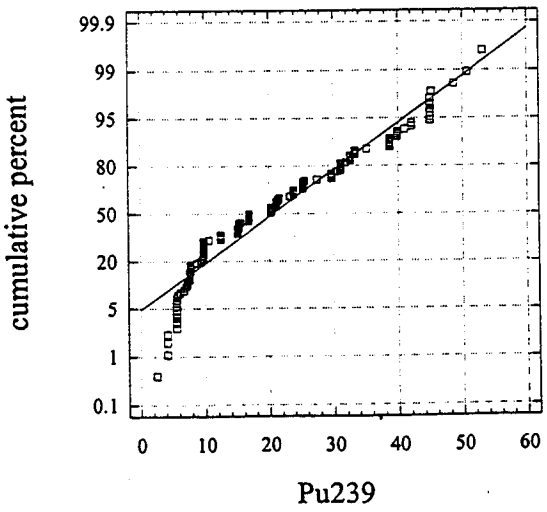
Histogram for Pu239



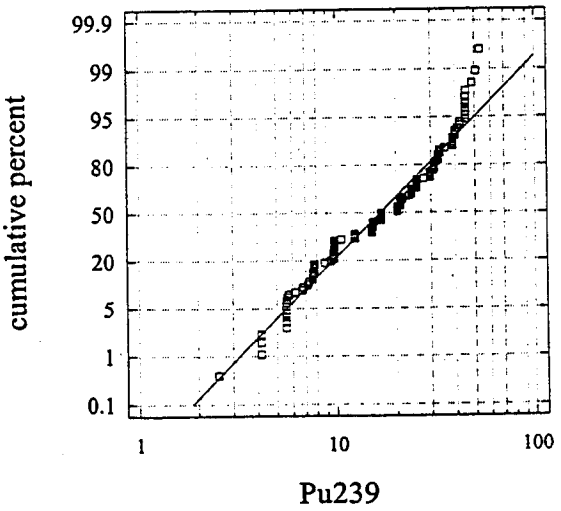
Histogram for Pu239LN



Normal Probability Plot

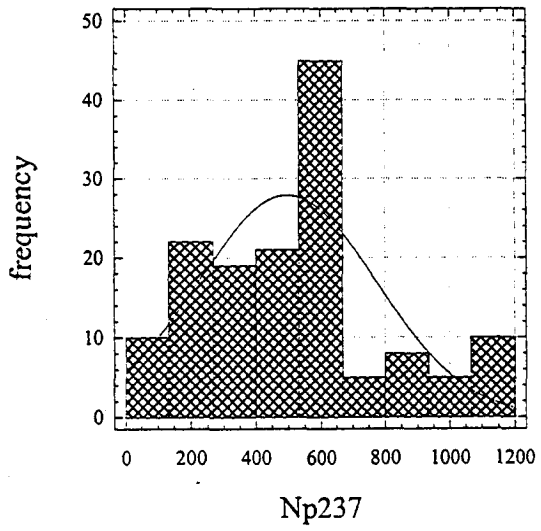


Lognormal Probability Plot

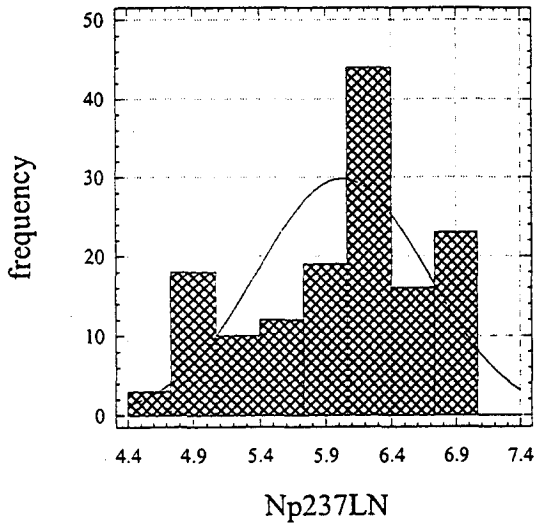


SORT = 10B

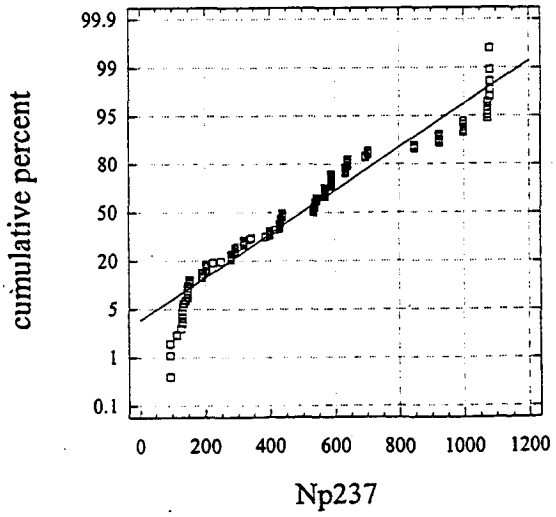
Histogram for Np237



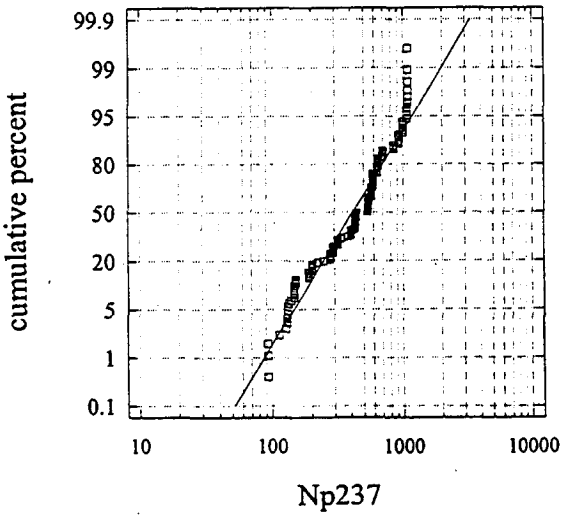
Histogram for Np237LN



Normal Probability Plot

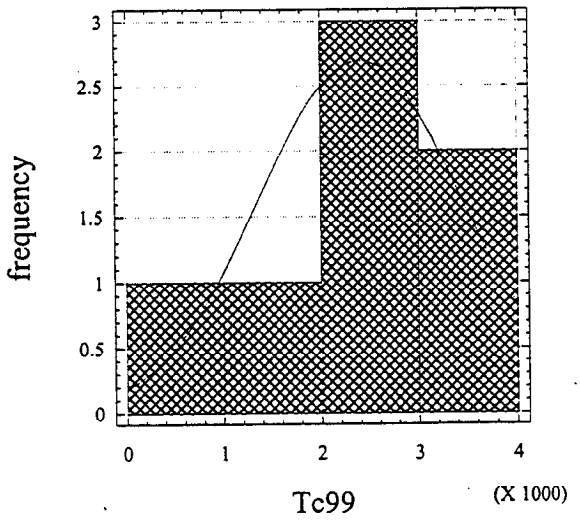


Lognormal Probability Plot

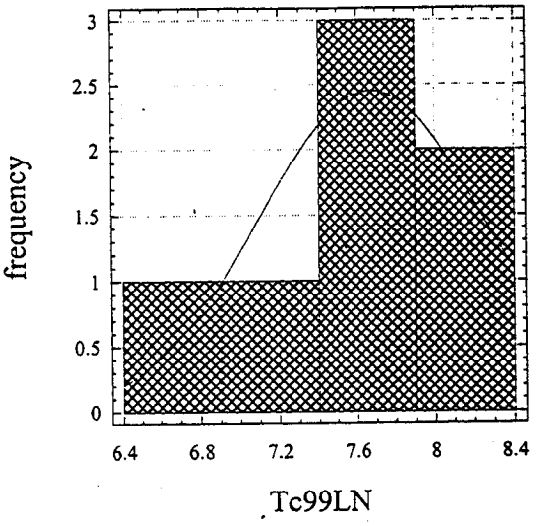


SORT = 10B

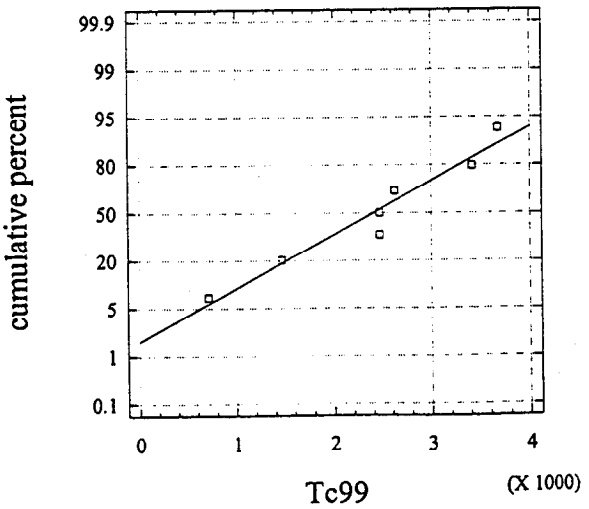
Histogram for Tc99



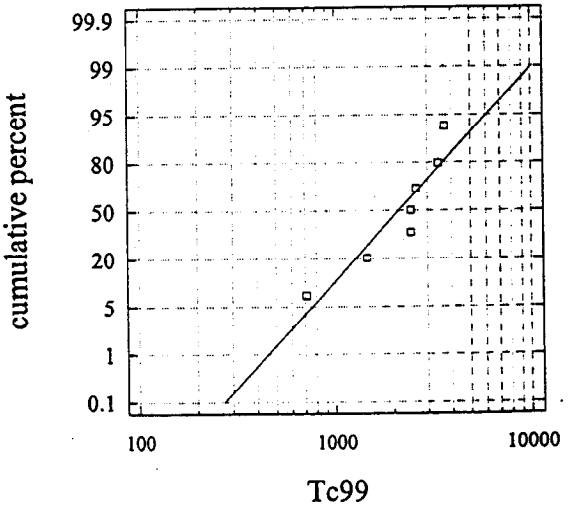
Histogram for Tc99LN



Normal Probability Plot

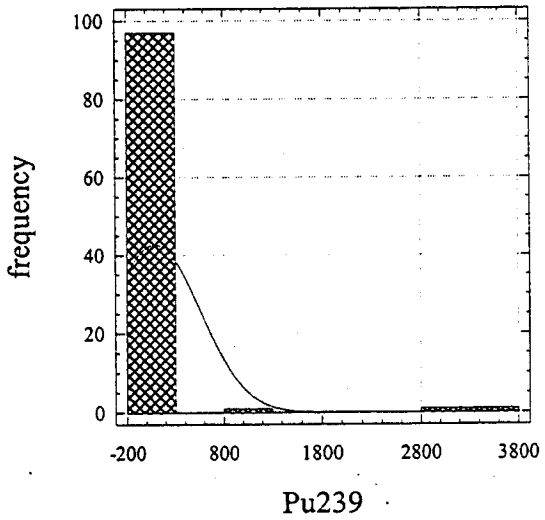


Lognormal Probability Plot

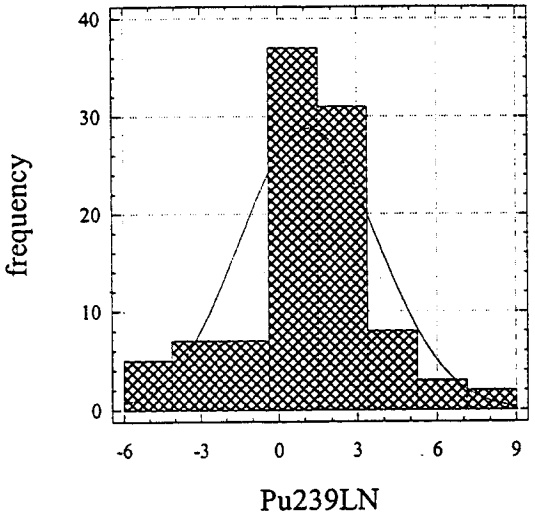


SORT = 11

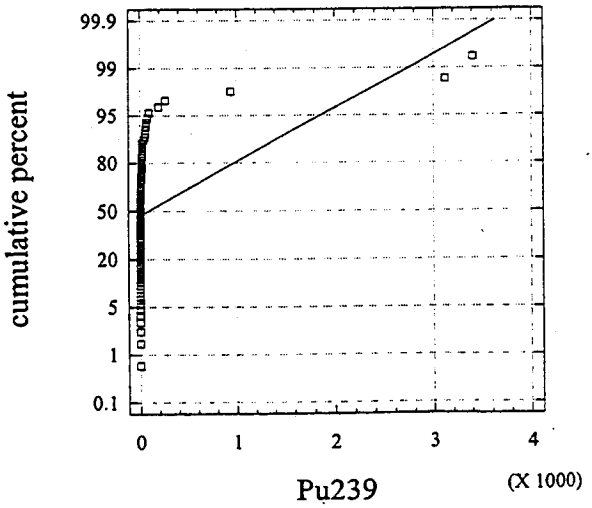
Histogram for Pu239



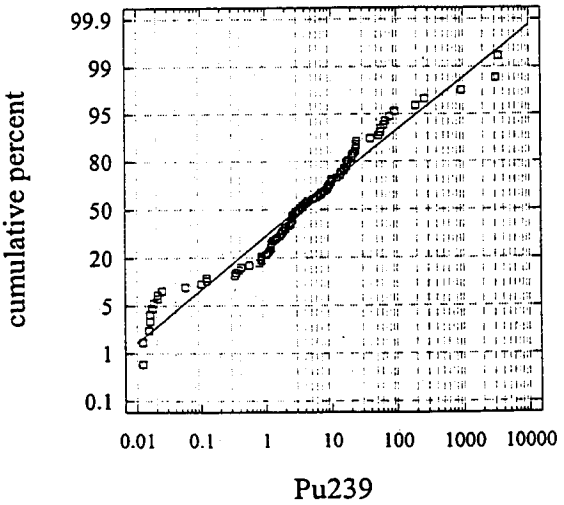
Histogram for Pu239LN



Normal Probability Plot

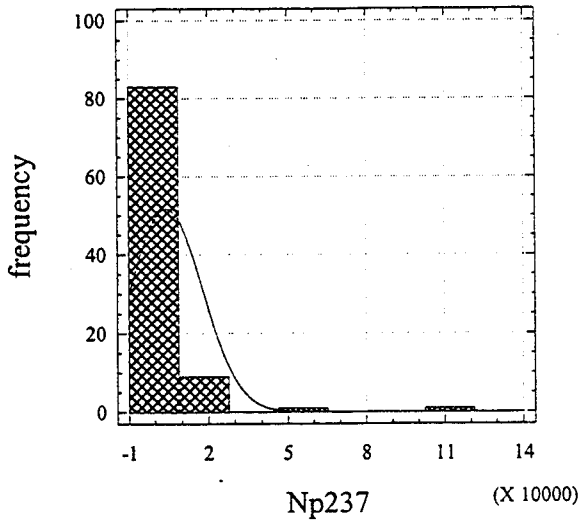


Lognormal Probability Plot

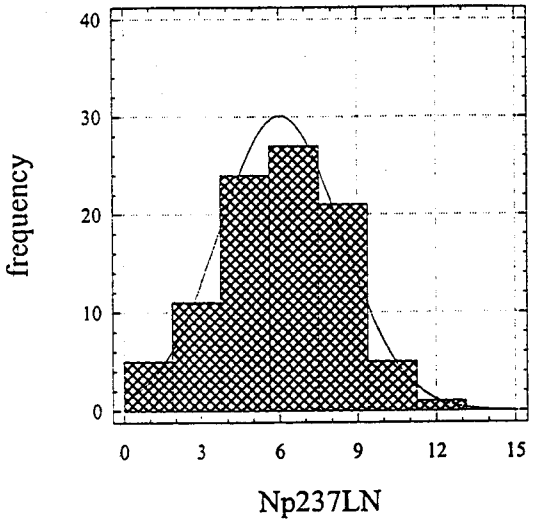


SORT = 11

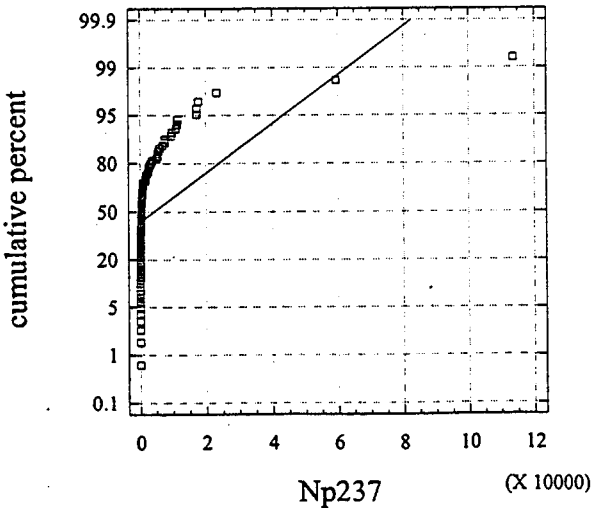
Histogram for Np237



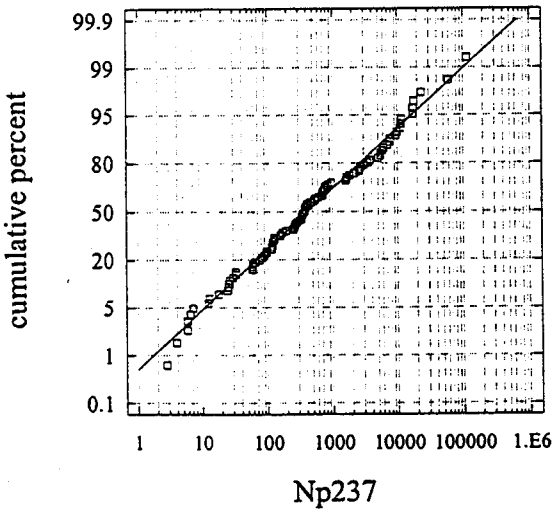
Histogram for Np237LN



Normal Probability Plot

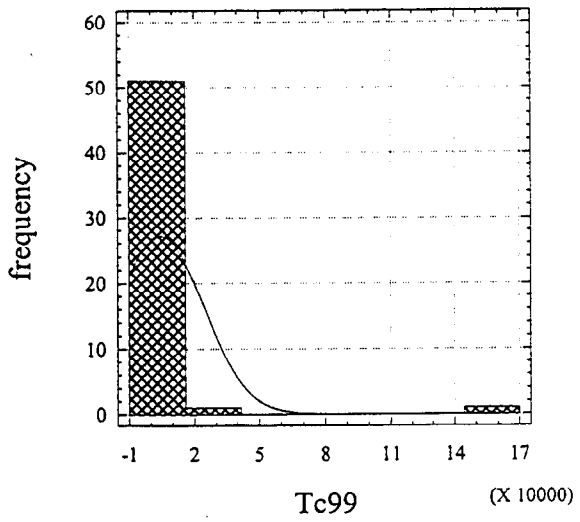


Lognormal Probability Plot

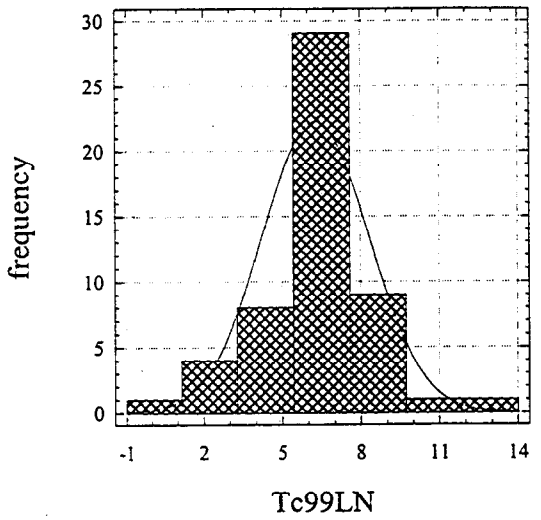


SORT = 11

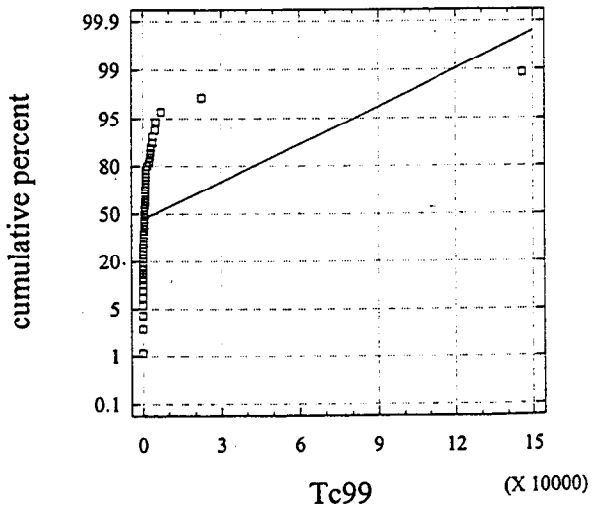
Histogram for Tc99



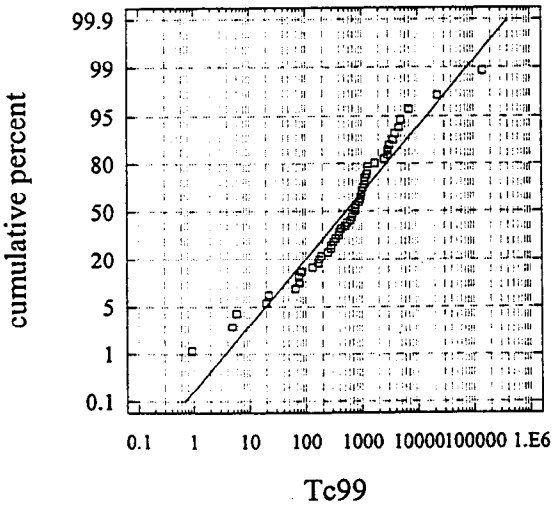
Histogram for Tc99LN



Normal Probability Plot

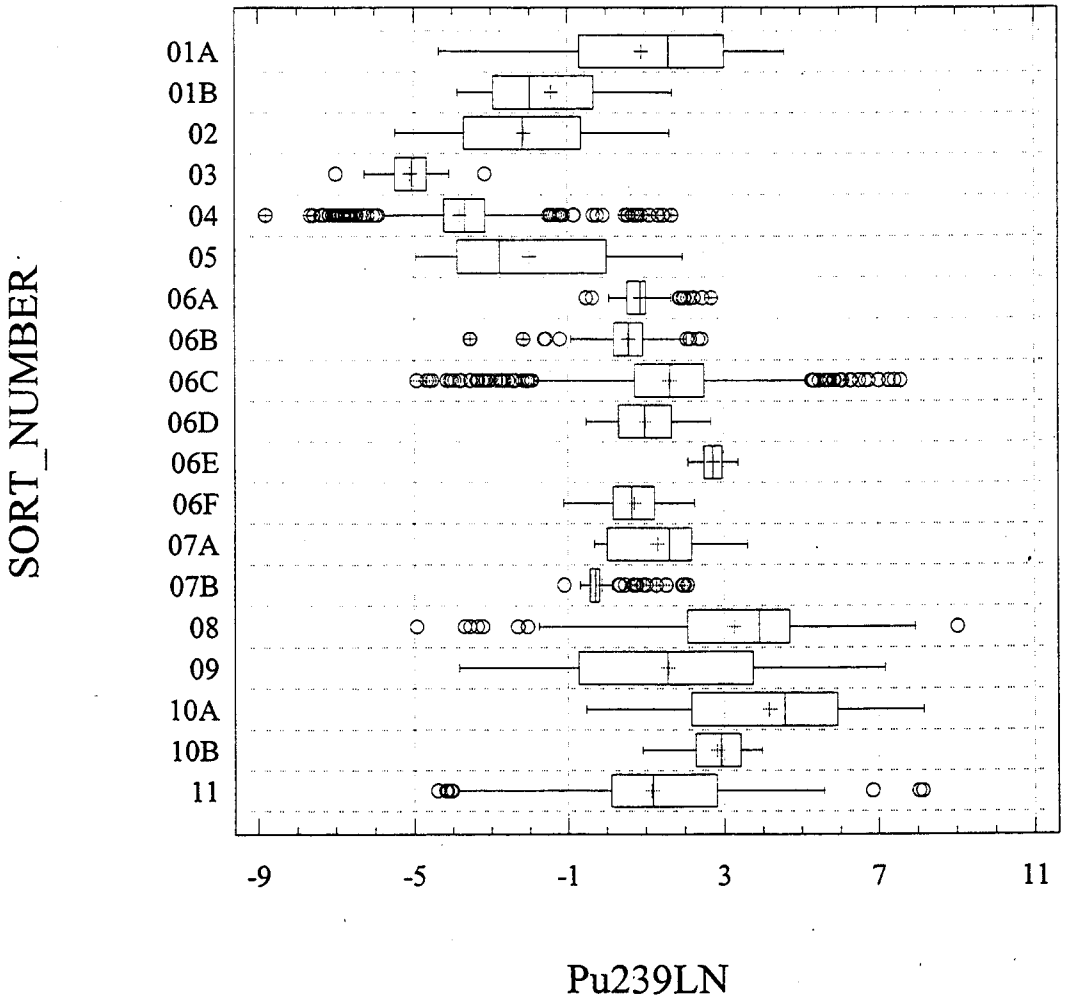


Lognormal Probability Plot



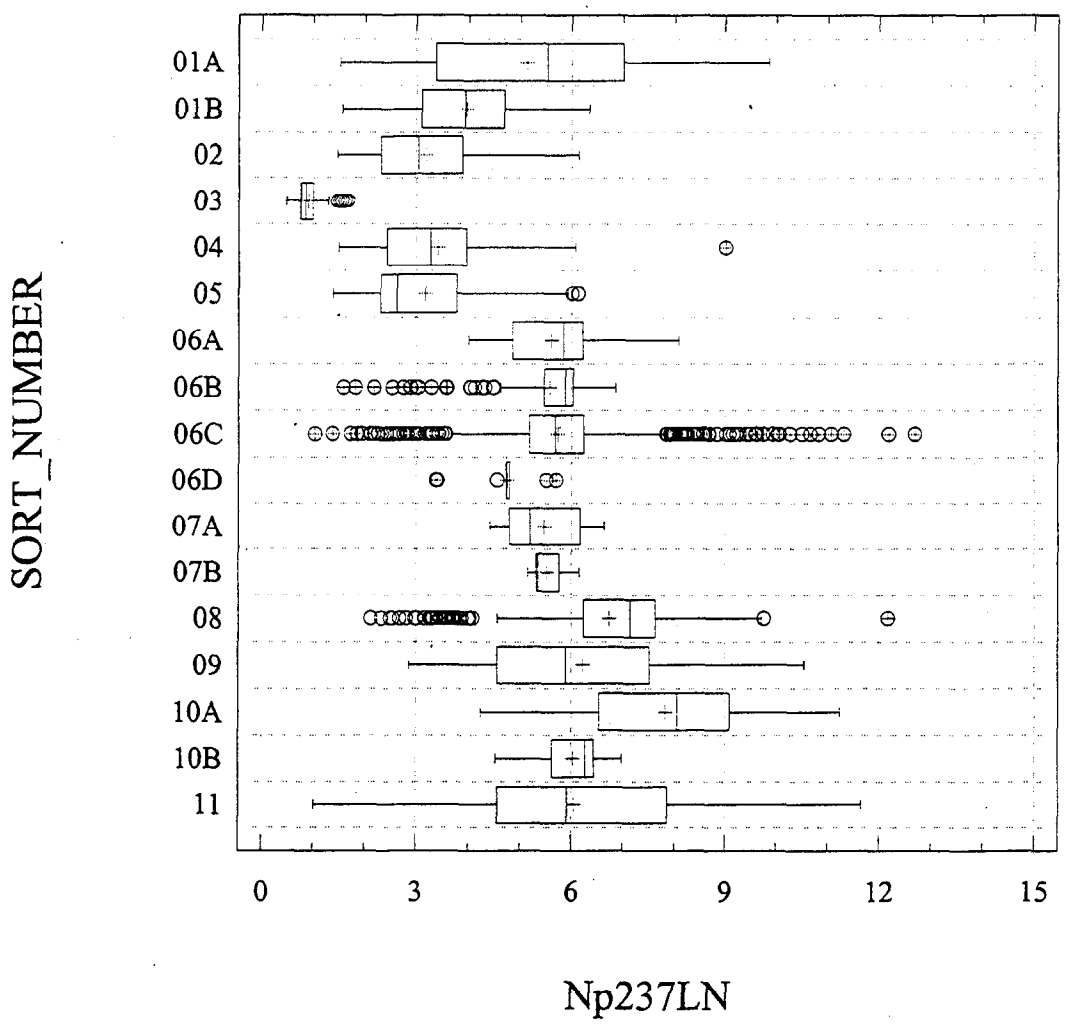
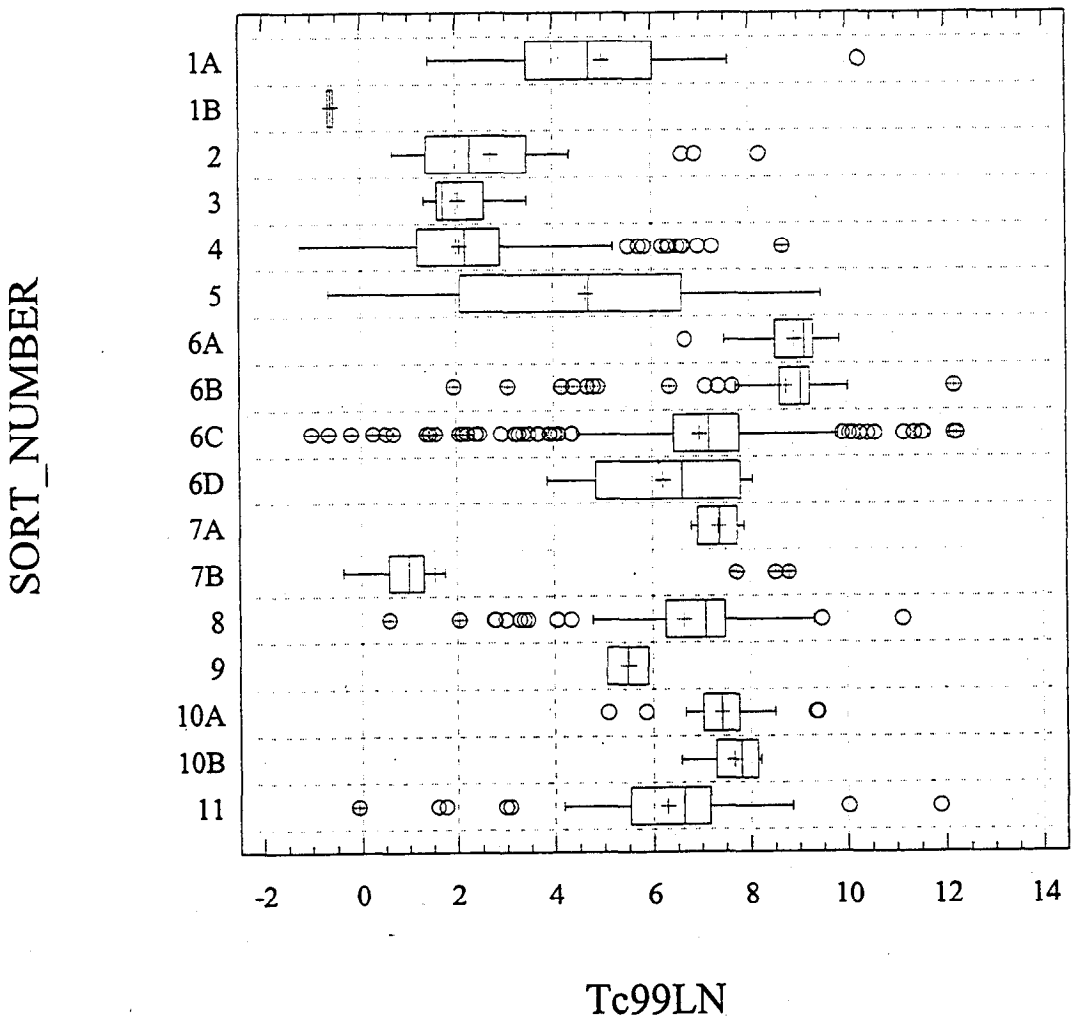
SORT = 9

Box-and-Whisker Plot



SORT = 9

Box-and-Whisker Plot



Box-and-Whisker Plot