NON- PROPRIETARY

PACTEC	CALCULATION PACKAGE	Calc. No: 41299-01 Rev. 0 Page 1 of 16

Title: Criticality Benchmarking for the TN-106

Customer: ACL Project No.: 41299

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Summary Description:

SCALE5 and USLSTATS are used to compute the upper subcritical limit for criticality calculations involving the TN-106 spent fuel package. Benchmarks consider a payload modeled as either homogeneous or heterogeneous.

The USL for the homogeneous cases is 0.9408. The range of applicability for the parameters evaluated is 2.0% ≤ Enrichment ≤ 10.0%, 133.4 ≤ H/X ≤ 925.94, and 3.25510E-02 eV ≤ EALF ≤ 0.23689 eV.

The USL for the heterogeneous cases is 0.9375 for most applications. The range of applicability for the parameters evaluated is 2.35% ≤ Enrichment ≤ 4.89%, 75.7 ≤ H/X ≤ 398.7, 9.11820E-02 eV ≤ EALF ≤ 0.31751 eV, and 1.1960 ≤ V_w/V_F ≤ 6.331. If the most reactive pellet case has a V_w/V_F > 6.331, then the following equation must be used to calculate the USL over the applicable range:

$$0.9451-1.1943E-03*(V_w/V_F).$$

This equation is valid from V_w/V_F = 6.331 to 8.22.

Codes Used:

SCALE5, USLSTATS v1.3.6

Document Revision	Affected Pages	Revision Description	Approved by: Name/Date	Names of Preparers & Verifiers
0	All	Initial Issue	See above	See above

NON-PROPRIETARY

TABLE OF CONTENTS

TABLE OF CONTENTS 2
LIST OF TABLES 2
1.0 INTRODUCTION 3
2.0 BENCHMARK SELECTION 3
2.1 DESCRIPTION OF HOMOGENEOUS CASES 4
2.2 DESCRIPTION OF HETEROGENEOUS CASES 4
3.0 BENCHMARKING METHODOLOGY 4
4.0 BENCHMARKING RESULTS 4
4.1 HOMOGENEOUS CASES 5
4.2 HETEROGENEOUS CASES 5
4.3 BORON CASES 6
5.0 CONCLUSION 6
6.0 REFERENCES 6
7.0 APPENDIX A: COMPUTER RUN RECORDS 12

LIST OF TABLES

Table 1. Critical Experiment Model and Results – Homogeneous Cases 8
Table 2. Critical Experiment Model and Results – Heterogeneous Cases 10
Table 3. Critical Experiment Model and Results – Boron Cases 11

1.0 Introduction

A criticality analysis will be performed for the TN-106 spent fuel package for contents No. 1. Contents No. 1 consists of UO_2 spent fuel pins enriched up to 10% U-235. The KENO V.a module of the SCALE5 package will be used in the criticality analysis [1]. To demonstrate this computer program is acceptable for use in this analysis, it must be benchmarked against critical systems similar to the TN-106 package and payload. The purpose of the current document is to demonstrate the acceptability of SCALE5 for criticality analyses of the TN-106. An upper subcritical limit (USL) is determined for use in subsequent criticality analyses.

The benchmarking methodology, including the benchmark cases and trending parameters utilized, is the same as the methodology used in the licensed TNF-XI package, Docket Number 71-9301 [2], with the exception of additional benchmark cases that envelop the higher allowed enrichment of the TN-106 payload. These additional benchmarks are used only for the homogenous case. For the heterogeneous case, the existing benchmark set is sufficient.

The ORNL USLSTATS code [6] is used to establish a USL for the analysis. USLSTATS provides a simple means of evaluating and combining the statistical error of the calculation and code biases. The USLSTATS calculation uses the uncertainties and data to provide a linear trend and an overall uncertainty that would be inflated due to any multicollinearity of the data. Computed multiplication factors, k_{eff}, for the package are deemed to be adequately subcritical if the computed value of k_s is less than or equal to the USL as follows:

$$k_s = k_{eff} + 2\sigma \leq USL$$

The USL includes the combined effects of code bias, uncertainty in the computational evaluation of the benchmark experiments, and an administrative margin. This methodology has accepted precedence in establishing criticality safety limits for transportation casks complying with 10 CFR 71.

2.0 Benchmark Selection

The results for this benchmark will be used in the analysis of the TN-106 shipping container. Two types of analyses are performed. One involves a payload of optimally moderated uranium homogeneously mixed with water, and the other involves a payload pellets or scraps of uranium oxide fuel. The input files for the homogeneous benchmarks are taken from [3] and [4] and the input files for the pellet benchmarks are taken from [3] and [5]. Consistent with [5], the 44 group ENDF/B-V cross section library is utilized in all cases. The number of sampling histories is increased when necessary to reduce the statistical deviation associated with the Monte Carlo method. For the homogeneous benchmarks, cases that use the "multiregion" unit cell data are modified to "infinite homogeneous." The rod benchmark cases are modified to run the CSAS2X sequence and the fuel region is represented by a "mixture 500." This method generates cell-weighted cross sections in the XSDRNPM code to be used in the KENO calculation. These methods are selected to be consistent with the technique that will be used to analyze the contents of the package.

2.1 Description of Homogeneous Cases

Critical experiments chosen to represent a UO_2 powder and water mixture include those that feature low enriched, homogeneous, and well-moderated systems without dissolved boron. A total of 53 experiments are found to be sufficient for this benchmark and are listed in Table 1. Benchmarks 1 though 18 are from [3], while benchmarks 19 through 53 are from [4]. Experiment sets from [4] include LEU-SOL-THERM-003, -007, -016, -017, -020, and -021.

Three independent variables are used in the analysis, enrichment, hydrogen to fissile material ratio (H/X), and the energy of average lethargy of fission (EALF).

2.2 Description of Heterogeneous Cases

Experiments chosen for the pellet scenario feature low enriched simple arrays with steel and/or water reflector walls in water without soluble boron. A total of 27 cases are used for the benchmark and are listed in Table 2. Benchmark cases 2 though 5 are taken from [3], the remaining benchmarks are taken from [5]. In addition to enrichment, H/X, and EALF, the volume ratio of water to fuel is also used as an independent variable.

An additional set of pellet experiments is chosen to account for the borated material in the packages. The most appropriate representative experiments available contain borated separator plates made of either borated stainless steel, borated aluminum (Boral), or a hydro-boron hybrid polymer (Boroflex). The independent variable used for the statistical analysis is B-10 areal density. A total of 17 cases, listed in Table 3, are used in the benchmark. All boron benchmark cases are taken from [5].

3.0 Benchmarking Methodology

The USL is calculated by application of the USLSTATS code [6]. USLSTATS takes as input a trending parameter, the k_{eff} as calculated by KENO, and the 1-σ KENO uncertainty. The USL is computed as a function of each trending parameter selected. The USL Method 1 performs a confidence band analysis on the data for the trending parameter. The USLs computed with the various trending parameters are then compared to determine the lowest value of the USL.

In addition to the benchmark data, the following confidence values are used, which are the values recommended by the USLSTATS user's manual:

- P, proportion of population falling above lower tolerance level = 0.995 (note that this parameter is required input but is not utilized in the calculation of USL Method 1)
- 1-γ, confidence on fit = 0.95
- α, confidence on proportion P = 0.95 (note that this parameter is required input but is not utilized in the calculation of USL Method 1)
- Δk_m, administrative margin used to ensure subcriticality = 0.05.

4.0 Benchmarking Results

The USL results (from the USLSTATS output) are provided below.

4.1 Homogeneous Cases

Enrichment (file PO_E.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9408 (2.0000   < X <  10.000)
```

H/X (File PO_HX.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9549 + (-1.2175E-05)*X (X > 925.94)
                                     = 0.9437                       (X <= 925.944)
```

EALF (File PO_EALF.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9424 (3.25510E-2< X < 0.23689)
```

For the enrichment trending parameter, the USL1 is a constant value of 0.9408, indicating no trend with enrichment. For the H/X trending parameter, the TN-106 SAR indicates the maximum H/X for the powder cases is ~390 (may be computed from information in Table 5A-1.2 of the SAR [9]), so that the minimum USL1 value for this trending parameter is 0.9437. Note that the USL decreases for H/X values greater than 925, although cases in this range are not anticipated. For the EALF trending parameter, the USL1 is a constant value of 0.9424. Therefore, for the homogeneous cases, the limiting USL is 0.9408.

4.2 Heterogeneous Cases

Enrichment (File PE_E.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9383 (2.3500   < X <  4.8900)
```

H/X (File PE_HX.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9379 (75.700   < X <  398.70)
```

EALF (File PE_EALF.O):

```
USL Method 1 (Confidence Band with
    Administrative Margin)          USL1 = 0.9380 ( 9.11820E-2< X < 0.31751)
```

Water to Fuel Volume Ratio (file PE_VOL.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)              USL1 = 0.9451 + (-1.1943E-03)*X (X > 6.3314)
                                     = 0.9375                       (X <= 6.331)
```

For the enrichment trending parameter, the USL1 is a constant value of 0.9383. For the H/X trending parameter, the USL1 is a constant value of 0.9379. For the EALF trending parameter, the USL1 is a constant value of 0.9380. For the water to fuel volume ratio trending parameter (V_w/V_F), the USL decreases with increasing V_w/V_F so that this parameter is the most restrictive. The TN-106 SAR [9] indicates that the most reactive pellet cases are at a V_w/V_F between 4 and 5. Therefore, a USL of 0.9375

is bounding for most V_w/V_F ratios encountered. If the most reactive case is beyond $V_w/V_F \sim 6$, the USL equation must be applied.

4.3 Boron Cases

Boron cases (file BORON.O):

```
USL Method 1 (Confidence Band with
Administrative Margin)            USL1 = 0.9429 + (-7.9426E-03)*X
```

The USL for the boron plate cases decrease with increasing boron areal density. As the boron areal density is a constant for the TN-106 models, the USL1 may be computed for the TN-106 package.

The B-10 areal density may be computed as:

B-10 areal density = B-10 volumetric density (g/cm^3) x 2(wall thickness)

The factor of two arises from computing the thickness at a line through the midpoint of the cylindrical package.

The resin density is [redacted] g/cm^3, of which [redacted]% is natural boron [9]. The weight percent of B-10 in natural boron is [redacted]%, and 75% credit is taken for the boron in the KENO models. The wall thickness of the resin is [redacted] cm [9]. Therefore, the areal density of the B-10 is:

B-10 (g/cm^2) = ([redacted])([redacted])([redacted])(0.75)(2)([redacted]) = 0.052 g/cm^2

Inserting this B-10 areal density into the USL1 equation above gives a USL1 = 0.9425. Therefore, this USL is bounded by both the powder and pellet USL values.

5.0 Conclusion

The USL for the homogeneous cases is 0.9408. The range of applicability for the parameters evaluated is 2.0% ≤ Enrichment ≤ 10.0%, 133.4 ≤ H/X ≤ 925.94, and 3.25510E-02 eV ≤ EALF ≤ 0.23689 eV.

The USL for the heterogeneous cases is 0.9375 for most applications. The range of applicability for the parameters evaluated is 2.35% ≤ Enrichment ≤ 4.89%, 75.7 ≤ H/X ≤ 398.7, 9.11820E-02 eV ≤ EALF ≤ 0.31751 eV, and 1.1960 ≤ V_w/V_F ≤ 6.331. If the most reactive pellet case has a V_w/V_F > 6.331, then the following equation must be used to calculate the USL over the applicable range:

$$0.9451-1.1943E-03*(V_w/V_F).$$

This equation is valid up to V_w/V_F = 8.22.

6.0 References

1. *KENO V.a: An Improved Monte Carlo Criticality Program*, NUREG/CR-0200, Revision 7, May 2004.
2. *Safety Analysis Report for the TNF-XI*, US NRC Docket Number 71-9301.
3. ORNL/TM-238, *Validation of KENO V.a Comparison With Critical Experiments*, 1986.
4. *International Handbook of Evaluated Criticality Safety Benchmark Experiments*, Nuclear Energy Agency, NEA/NSC/DOC(95)03, September 2003.

5. NUREG/CR-6361, *Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages*, 1997.
6. USLSTATS, "*USLSTATS: A Utility To Calculate Upper Subcritical Limits For Criticality Safety Applications,*" Version 1.3.6, Oak Ridge National Laboratory, December 15, 1998.
7. *USLSTATS version 1.3.6,* Computer Code Verification Record dated September 11, 2003. Computer platform Windows XP/Athlon Processor (computer TN-PCT-WK-07).
8. *SCALE5 and Associated Cross Section Library Computer Code Verification Record*, VV-04-001, Rev. 0, August 2004.
9. *TN-106 Criticality Evaluation, Contents: Irradiated Fissile Material for a Range of Enriched Uranium-235, Chapter 5A – Appendix 1*, 5573-Z-5A-1, Rev. 2.

Table 1. Critical Experiment Model and Results – Homogeneous Cases

No.	Filename	Enrichment (wt.%)	H/X	EALF (eV)	k_{eff}	σ
1	Caa35	4.89	526.2	4.8794E-02	1.00412	0.00079
2	Caa36	4.89	526.2	4.7761E-02	1.00800	0.00085
3	Caa37	4.89	734	4.1696E-02	1.00078	0.00074
4	Caa38	4.89	1094.2	3.6048E-02	0.99814	0.00076
5	Caa39	4.89	991	3.7381E-02	0.99916	0.00081
6	Cas11	2	195.2	1.9815E-01	1.00384	0.00074
7	Cas13	2	293.9	1.1675E-01	1.00142	0.00075
8	Cas15	2	406.3	8.4179E-02	1.00067	0.00075
9	Cas16	2	495.9	7.1076E-02	0.99946	0.00069
10	Cas17	2	613.6	6.0872E-02	0.99888	0.00071
11	Cas19	2	971.7	4.7150E-02	0.99268	0.00073
12	Cas21	3	133.4	2.3635E-01	1.01230	0.00100
13	Cas22	3	133.4	2.3689E-01	1.01256	0.00091
14	Cas23	3	133.4	2.3603E-01	1.01346	0.00086
15	Cas24	3	133.4	2.3505E-01	1.01338	0.00077
16	Cas25	3	133.4	2.3573E-01	1.01450	0.00110
17	Cas29	3	276.9	9.2786E-02	1.01205	0.00091
18	Cas34	4.98	488	5.4124E-02	1.00272	0.00080
19	leu003_1	10	770.3	3.9040E-02	0.99820	0.00068
20	leu003_2	10	877.6	3.7303E-02	0.99661	0.00074
21	leu003_3	10	897.0	3.6950E-02	1.00075	0.00081
22	leu003_4	10	913.2	3.6846E-02	0.99457	0.00073
23	leu003_5	10	1173.4	3.4188E-02	0.99818	0.00067
24	leu003_6	10	1213.1	3.3868E-02	0.99848	0.00063
25	leu003_7	10	1239.8	3.3706E-02	0.99731	0.00076
26	leu003_8	10	1411.6	3.2690E-02	0.99965	0.00060
27	leu003_9	10	1437.5	3.2551E-02	0.99637	0.00069
28	leu007_1	9.97	709.2	4.0377E-02	0.99530	0.00100
29	leu007_2	9.97	770.0	3.9090E-02	0.99868	0.00078
30	leu007_3	9.97	842.2	3.7820E-02	0.99782	0.00084

No.	Filename	Enrichment (wt.%)	H/X	EALF (eV)	k_{eff}	σ
31	leu007_4	9.97	896.0	3.7031E-02	1.00010	0.00079
32	leu007_5	9.97	942.2	3.6430E-02	0.99809	0.00073
33	leu016_R105	9.97	468.7	4.9321E-02	1.00716	0.00026
34	leu016_R113	9.97	514.2	4.6889E-02	1.00793	0.00047
35	leu016_R125	9.97	608.4	4.3166E-02	1.00673	0.00051
36	leu016_R129	9.97	650.2	4.1914E-02	1.01158	0.00052
37	leu016_R131	9.97	699.1	4.0680E-02	1.00455	0.00046
38	leu016_R140	9.97	738.9	3.9836E-02	1.00342	0.00052
39	leu016_R196	9.97	771.8	3.9180E-02	1.00439	0.00057
40	leu017_R104	9.97	468.7	4.9413E-02	1.01056	0.00094
41	leu017_R122	9.97	510.8	4.7146E-02	1.00565	0.00084
42	leu017_R123	9.97	610.9	4.3187E-02	1.00080	0.00091
43	leu017_R126	9.97	650.1	4.1977E-02	1.00417	0.00085
44	leu017_R130	9.97	699.2	4.0739E-02	1.00312	0.00091
45	leu017_R147	9.97	729.0	4.0079E-02	1.00244	0.00082
46	leu020_1	9.97	971.0	3.5985E-02	0.99948	0.00073
47	leu020_2	9.97	1053.9	3.5122E-02	0.99915	0.00065
48	leu020_3	9.97	1168.0	3.4171E-02	0.99737	0.00060
49	leu020_4	9.97	1239.3	3.3651E-02	0.99814	0.00054
50	leu021_1	9.97	971.0	3.6142E-02	0.99875	0.00097
51	leu021_2	9.97	1052.7	3.5279E-02	0.99864	0.00051
52	leu021_3	9.97	1168.0	3.4301E-02	0.99681	0.00058
53	leu021_4	9.97	1238.9	3.3764E-02	0.99926	0.00069

Table 2. Critical Experiment Model and Results – Heterogeneous Cases

No.	Filename	Water to Fuel Volume Ratio	Enrichment (wt%)	H/X	EALF (eV)	k_{eff}	σ
1	bw1484sl	1.841	2.46	216.10	1.3149E-01	0.99646	0.00078
2	caa02	2.710	4.89	76.10	3.1751E-01	0.99615	0.00092
3	caa03	2.710	4.89	75.70	1.3613E-01	1.00275	0.00096
4	caa04	8.220	4.89	230.00	1.2405E-01	0.99098	0.00095
5	caa05	8.220	4.89	230.00	1.1344E-01	0.99417	0.00080
6	epru65	1.196	2.35	163.60	2.4873E-01	0.99654	0.00081
7	epru75	2.408	2.35	329.4	1.0885E-01	0.99962	0.00077
8	p2438slg	2.918	2.35	398.7	9.1767E-02	1.00292	0.00079
9	p2827slg	2.918	2.35	398.7	9.1182E-02	1.00240	0.00075
10	p3314slg	1.600	4.31	105.4	2.1683E-01	1.00279	0.00093
11	p3602n11	1.600	2.35	218.6	1.7364E-01	1.00959	0.00079
12	p3602n12	1.600	2.35	218.6	1.6776E-01	1.00768	0.00079
13	p3602n13	1.600	2.35	218.6	1.6074E-01	1.00626	0.00082
14	p3602n14	1.600	2.35	218.6	1.5557E-01	1.00307	0.00075
15	p3602n21	2.918	2.35	398.7	9.1722E-02	1.00540	0.00077
16	p3602n22	2.918	2.35	398.7	9.4660E-02	1.00780	0.00073
17	p3602n31	1.600	4.31	105.4	3.0051E-01	1.01119	0.00088
18	p3602n32	1.600	4.31	105.4	2.8738E-01	1.01108	0.00082
19	p3602n33	1.600	4.31	105.4	2.7680E-01	1.00990	0.00100
20	p3602n34	1.600	4.31	105.4	2.7117E-01	1.00768	0.00086
21	p3602n35	1.600	4.31	105.4	2.6651E-01	1.00656	0.00081
22	p3602n36	1.600	4.31	105.4	2.5898E-01	1.00401	0.00088
23	p3602n41	3.883	4.31	256.1	1.1676E-01	1.01708	0.00080
24	p3602n42	3.883	4.31	256.1	1.0952E-01	1.01449	0.00077
25	p3602n43	3.883	4.31	256.1	1.0645E-01	1.01168	0.00077
26	p3926sl1	1.600	2.35	218.6	1.5349E-01	0.99973	0.00086
27	p3926sl2	1.600	4.31	105.4	2.6011E-01	1.00088	0.00086

Table 3. Critical Experiment Model and Results – Boron Cases

No.	Filename	B-10 (g/cm^2)	k_{eff}	σ
1	p2438ba	0.067000	0.99682	0.00072
2	p2615ba	0.067000	0.99933	0.00079
3	p3314ba	0.067000	0.99940	0.00089
4	p3314bc	0.026300	0.99929	0.00074
5	p3314bf1	0.023600	1.00286	0.00082
6	p3314bf2	0.047200	1.00122	0.00087
7	p3314bs1	0.004600	0.99587	0.00079
8	p3314bs2	0.006900	0.99523	0.00073
9	p3314bs3	0.004600	0.99629	0.00093
10	p3314bs4	0.006900	1.00066	0.00083
11	p3602bb	0.040800	1.00491	0.00096
12	p3602bs1	0.004556	1.00197	0.00084
13	p3602bs2	0.004113	1.00307	0.00077
14	pat80l1	0.046100	1.00062	0.00089
15	pat80l2	0.046100	0.99450	0.00080
16	pat80ss1	0.046100	1.00041	0.00091
17	pat80ss2	0.046100	0.99413	0.00082

7.0 Appendix A: Computer Run Records

PACTEC	COMPUTER RUN RECORD
Computer Run Number	See Input File Names
Analysis Software	SCALE5
Hardware Description	Windows XP/Athlon Processor QA verification for SCALE5 has been performed for this hardware platform [Reference 8]. Models were executed on computer TN-PCT-WK-07.
Disk Storage Description	1 CD

Benchmark Files

```
01/26/2004  02:49 PM            1,111 BW1484SL.IN
09/16/2004  12:46 PM          499,791 BW1484SL.out
01/26/2004  02:49 PM              706 CAA02.IN
09/16/2004  12:48 PM          455,700 CAA02.out
01/26/2004  02:49 PM              747 CAA03.IN
09/16/2004  12:49 PM          456,294 CAA03.out
01/26/2004  02:49 PM              681 CAA04.IN
09/16/2004  12:51 PM          455,533 CAA04.out
01/26/2004  02:49 PM              701 CAA05.IN
09/16/2004  12:53 PM          456,186 CAA05.out
01/26/2004  02:49 PM              466 CAA35.IN
09/16/2004  12:54 PM          389,137 CAA35.out
01/26/2004  02:49 PM              463 CAA36.IN
09/16/2004  12:56 PM          380,986 CAA36.out
01/26/2004  02:49 PM              468 CAA37.IN
09/16/2004  12:58 PM          388,853 CAA37.out
01/26/2004  02:49 PM              490 CAA38.IN
09/16/2004  01:01 PM          382,212 CAA38.out
01/26/2004  02:49 PM              465 CAA39.IN
09/16/2004  01:04 PM          389,512 CAA39.out
01/26/2004  02:49 PM              868 CAS11.IN
09/16/2004  01:05 PM          382,377 CAS11.out
01/26/2004  02:49 PM              893 CAS13.IN
09/16/2004  01:07 PM          382,753 CAS13.out
01/26/2004  02:49 PM              868 CAS15.IN
09/16/2004  01:08 PM          382,677 CAS15.out
01/26/2004  02:49 PM              869 CAS16.IN
09/16/2004  01:10 PM          383,257 CAS16.out
01/26/2004  02:49 PM              885 CAS17.IN
09/16/2004  01:12 PM          383,089 CAS17.out
01/26/2004  02:49 PM              889 CAS19.IN
09/16/2004  01:14 PM          384,581 CAS19.out
01/26/2004  02:49 PM              902 CAS21.IN
09/16/2004  01:16 PM          382,052 CAS21.out
01/26/2004  02:49 PM              888 CAS22.IN
09/16/2004  01:18 PM          382,788 CAS22.out
```

01/26/2004	02:49 PM	886	CAS23.IN
09/16/2004	01:19 PM	383,180	CAS23.out
01/26/2004	02:49 PM	910	CAS24.IN
09/16/2004	01:21 PM	383,032	CAS24.out
01/26/2004	02:49 PM	886	CAS25.IN
09/16/2004	01:22 PM	383,106	CAS25.out
01/26/2004	02:49 PM	880	CAS29.IN
09/16/2004	01:23 PM	382,445	CAS29.out
01/26/2004	02:49 PM	1,016	CAS34.IN
09/16/2004	01:26 PM	387,259	CAS34.out
01/26/2004	02:49 PM	3,059	EPRU65.IN
09/16/2004	01:29 PM	527,444	EPRU65.out
01/26/2004	02:49 PM	2,227	EPRU75.IN
09/16/2004	01:31 PM	514,683	EPRU75.out
09/23/2004	02:12 PM	580	leu003_1.in
09/23/2004	02:16 PM	253,538	leu003_1.out
09/23/2004	02:12 PM	580	leu003_2.in
09/23/2004	02:19 PM	253,607	leu003_2.out
09/23/2004	02:12 PM	542	leu003_3.in
09/23/2004	02:21 PM	252,280	leu003_3.out
09/23/2004	02:12 PM	579	leu003_4.in
09/23/2004	02:23 PM	253,148	leu003_4.out
09/23/2004	02:12 PM	580	leu003_5.in
09/23/2004	02:26 PM	253,491	leu003_5.out
09/23/2004	02:12 PM	542	leu003_6.in
09/23/2004	02:29 PM	252,565	leu003_6.out
09/23/2004	02:13 PM	579	leu003_7.in
09/23/2004	02:32 PM	252,952	leu003_7.out
09/23/2004	02:13 PM	580	leu003_8.in
09/23/2004	02:36 PM	253,120	leu003_8.out
09/23/2004	02:13 PM	542	leu003_9.in
09/23/2004	02:39 PM	252,279	leu003_9.out
09/23/2004	02:30 PM	1,241	leu007_1.in
09/23/2004	02:42 PM	325,545	leu007_1.out
09/23/2004	02:30 PM	1,239	leu007_2.in
09/23/2004	02:44 PM	325,419	leu007_2.out
09/23/2004	02:30 PM	1,239	leu007_3.in
09/23/2004	02:46 PM	325,627	leu007_3.out
09/23/2004	02:31 PM	1,239	leu007_4.in
09/23/2004	02:48 PM	325,673	leu007_4.out
09/23/2004	02:31 PM	1,240	leu007_5.in
09/23/2004	02:51 PM	325,489	leu007_5.out
09/23/2004	02:48 PM	992	leu016_R105.in
09/23/2004	03:17 PM	827,254	leu016_R105.out
09/23/2004	03:05 PM	991	leu016_R113.in
09/23/2004	03:24 PM	307,283	leu016_R113.out
09/23/2004	03:06 PM	991	leu016_R125.in
09/23/2004	03:31 PM	306,927	leu016_R125.out
09/23/2004	03:19 PM	991	leu016_R129.in
09/23/2004	03:38 PM	306,852	leu016_R129.out
09/23/2004	03:19 PM	991	leu016_R131.in
09/23/2004	03:45 PM	306,652	leu016_R131.out
09/23/2004	03:19 PM	991	leu016_R140.in
09/23/2004	03:52 PM	307,461	leu016_R140.out
09/23/2004	03:19 PM	992	leu016_R196.in
09/23/2004	03:59 PM	306,900	leu016_R196.out
09/23/2004	02:49 PM	1,721	leu017_R104.in
09/23/2004	04:01 PM	485,778	leu017_R104.out
09/23/2004	02:49 PM	1,721	leu017_R122.in
09/23/2004	04:02 PM	485,756	leu017_R122.out

09/23/2004	02:49 PM	1,721	leu017_R123.in
09/23/2004	04:04 PM	485,181	leu017_R123.out
09/23/2004	02:49 PM	1,722	leu017_R126.in
09/23/2004	04:06 PM	485,791	leu017_R126.out
09/23/2004	02:50 PM	1,722	leu017_R130.in
09/23/2004	04:08 PM	485,695	leu017_R130.out
09/23/2004	02:50 PM	1,723	leu017_R147.in
09/23/2004	04:10 PM	485,505	leu017_R147.out
09/23/2004	04:03 PM	1,313	leu020_1.in
09/23/2004	04:15 PM	334,482	leu020_1.out
09/23/2004	04:03 PM	1,313	leu020_2.in
09/23/2004	04:19 PM	334,286	leu020_2.out
09/23/2004	04:03 PM	1,313	leu020_3.in
09/23/2004	04:24 PM	334,535	leu020_3.out
09/23/2004	04:03 PM	1,313	leu020_4.in
09/23/2004	04:29 PM	334,412	leu020_4.out
09/23/2004	04:04 PM	2,384	leu021_1.in
09/23/2004	04:33 PM	334,284	leu021_1.out
09/23/2004	04:04 PM	2,384	leu021_2.in
09/23/2004	04:37 PM	333,898	leu021_2.out
09/23/2004	04:04 PM	2,384	leu021_3.in
09/23/2004	04:40 PM	334,592	leu021_3.out
09/23/2004	04:04 PM	2,384	leu021_4.in
09/23/2004	04:45 PM	334,331	leu021_4.out
01/26/2004	02:49 PM	1,443	P2438BA.IN
09/16/2004	01:34 PM	396,128	P2438BA.out
01/26/2004	02:49 PM	793	P2438SLG.IN
09/16/2004	01:37 PM	472,918	P2438SLG.out
01/26/2004	02:49 PM	2,970	P2615BA.IN
09/16/2004	01:40 PM	403,139	P2615BA.out
01/26/2004	02:49 PM	817	P2827SLG.IN
09/16/2004	01:42 PM	473,847	P2827SLG.out
01/26/2004	02:49 PM	3,021	P3314BA.IN
09/16/2004	01:45 PM	438,582	P3314BA.out
01/26/2004	02:49 PM	2,324	P3314BC.IN
09/16/2004	01:47 PM	416,503	P3314BC.out
01/26/2004	02:49 PM	2,141	P3314BF1.IN
09/16/2004	01:49 PM	414,358	P3314BF1.out
01/26/2004	02:49 PM	2,553	P3314BF2.IN
09/16/2004	01:52 PM	418,972	P3314BF2.out
01/26/2004	02:49 PM	2,381	P3314BS1.IN
09/16/2004	01:54 PM	409,313	P3314BS1.out
01/26/2004	02:49 PM	2,391	P3314BS2.IN
09/16/2004	01:57 PM	409,282	P3314BS2.out
01/26/2004	02:49 PM	2,803	P3314BS3.IN
09/16/2004	01:59 PM	416,823	P3314BS3.out
01/26/2004	02:49 PM	2,803	P3314BS4.IN
09/16/2004	02:02 PM	418,050	P3314BS4.out
01/26/2004	02:49 PM	1,650	P3314slg.in
09/16/2004	02:05 PM	509,207	P3314slg.out
01/26/2004	02:49 PM	1,667	P3602BB.IN
09/16/2004	02:07 PM	414,653	P3602BB.out
01/26/2004	02:49 PM	1,649	P3602BS1.IN
09/16/2004	02:09 PM	417,722	P3602BS1.out
01/26/2004	02:49 PM	1,804	P3602BS2.IN
09/16/2004	02:11 PM	426,778	P3602BS2.out
01/26/2004	02:49 PM	1,244	P3602N11.IN
09/16/2004	02:13 PM	492,958	P3602N11.out
01/26/2004	02:49 PM	1,205	P3602N12.IN
09/16/2004	02:15 PM	492,667	P3602N12.out

01/26/2004	02:49 PM	1,218	P3602N13.IN
09/16/2004	02:17 PM	492,837	P3602N13.out
01/26/2004	02:49 PM	1,219	P3602N14.IN
09/16/2004	02:20 PM	493,500	P3602N14.out
01/26/2004	02:49 PM	1,140	P3602N21.IN
09/16/2004	02:22 PM	490,451	P3602N21.out
01/26/2004	02:49 PM	1,139	P3602N22.IN
09/16/2004	02:24 PM	490,361	P3602N22.out
01/26/2004	02:49 PM	1,553	P3602N31.IN
09/16/2004	02:27 PM	521,614	P3602N31.out
01/26/2004	02:49 PM	1,594	P3602N32.IN
09/16/2004	02:29 PM	522,515	P3602N32.out
01/26/2004	02:49 PM	1,542	P3602N33.IN
09/16/2004	02:31 PM	521,011	P3602N33.out
01/26/2004	02:49 PM	1,596	P3602N34.IN
09/16/2004	02:33 PM	522,668	P3602N34.out
01/26/2004	02:49 PM	1,595	P3602N35.IN
09/16/2004	02:36 PM	522,004	P3602N35.out
01/26/2004	02:49 PM	1,595	P3602N36.IN
09/16/2004	02:39 PM	522,071	P3602N36.out
01/26/2004	02:49 PM	1,582	P3602N41.IN
09/16/2004	02:43 PM	521,295	P3602N41.out
01/26/2004	02:49 PM	1,587	P3602N42.IN
09/16/2004	02:46 PM	521,795	P3602N42.out
01/26/2004	02:49 PM	1,588	P3602N43.IN
09/16/2004	02:49 PM	520,965	P3602N43.out
01/26/2004	02:49 PM	892	P3926SL1.IN
09/16/2004	02:53 PM	475,071	P3926SL1.out
01/26/2004	02:49 PM	1,297	P3926SL2.IN
09/16/2004	02:56 PM	504,418	P3926SL2.out
09/16/2004	03:11 PM	3,274	PAT80L1.IN
09/16/2004	03:14 PM	440,531	PAT80L1.out
09/16/2004	03:11 PM	3,275	PAT80L2.IN
09/16/2004	03:15 PM	439,923	PAT80L2.out
09/16/2004	03:11 PM	3,279	PAT80SS1.IN
09/16/2004	03:17 PM	444,634	PAT80SS1.out
09/16/2004	03:11 PM	3,278	PAT80SS2.IN
09/16/2004	03:19 PM	444,606	PAT80SS2.out

PACTEC	COMPUTER RUN RECORD
Computer Run Number	See Input File Names
Analysis Software	USLSTATS Version 1.3.6
Hardware Description	Windows XP/Athlon Processor QA verification USLSTATS Version 1.3.6 has been performed for this hardware platform [Reference 7]. Models were executed on computer TN-PCT-WK-07.
Disk Storage Description	1 CD

USLSTATS Files

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09/17/2004  04:21 PM              458 boron.i
09/17/2004  04:21 PM            4,327 BORON.O
09/17/2004  04:07 PM              660 pe_e.i
09/17/2004  04:10 PM            4,841 PE_E.O
09/17/2004  04:09 PM              813 pe_ealf.i
09/17/2004  04:11 PM            4,841 PE_EALF.O
09/17/2004  04:08 PM              673 pe_hx.i
09/17/2004  04:10 PM            4,841 PE_HX.O
09/17/2004  04:10 PM              663 pe_vol.i
09/17/2004  04:11 PM            5,029 PE_VOL.O
09/23/2004  04:49 PM            1,178 po_e.i
09/23/2004  04:49 PM            6,326 PO_E.O
09/23/2004  04:52 PM            1,541 po_ealf.i
09/23/2004  04:52 PM            6,326 PO_EALF.O
09/23/2004  04:51 PM            1,283 po_hx.i
09/23/2004  04:51 PM            6,514 PO_HX.O
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