the final estimated combined collision/absorption/track-length keff = .98734 with an estimated standard deviation of .00084 the estimated 68, 95, & 99 percent keff confidence intervals are .98650 to .98818, .98566 to .98901, and .98512 to .98956 the estimated collision/absorption neutron removal lifetime = 5.41E-05 seconds with an estimated standard deviation of 1.44E-07

```
1mcnp
           version 4a
                          ld=10/01/93
                                                              04/20/96 13:32:58
                                                                                                   probid =
                                                                                                               04/20/96 13:32:58
 INP=4.0EC OUTP=4.0E.CO
              FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2-
                   Criticality
    3 -
                    SPHERE
                          7.99453107100-2
                                                        IMP:N=1
                                                                  $ Uranium/Tuff/Water
    6-
7-
                          8.11121144000-2
                                                1 -2
                                                                  $ Tuff/Water Reflector
              5
                                                        IMP:N=1
    8-
                   OUTSIDE WORLD
    ğ-
              30
                   0
                                               IMP:N=0 $ Void
   10-
   11-
              C
                   SURFACES
   12-
                   S
                           0 0 0 219.08
                                               $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so
   13 -
              2
                   S
                           0 0 0 379.08
                                               $ REFLECTOR
   14-
 warning.
            this surface has been replaced by a surface of type so
   15-
   16-
   17-
              KCODE 2000
                              33 233
                           1
                           0
                              0 0
                                          0
                                                      0
                                                                                          0 1
   18-
              С
                   KSRC
                                                  - 1
                                                               n
                                                                  1 0
                                                                           0 -1 0
                                                                                       0
                                                                                                   0
   19-
                                  0
                                         - 1
                                              0
                                                      Ω
                                                               1
                                                                  0 -1
                              1
   20:
                                         -1
                                              0
                                                      0
                                                              - 1
                                                                  0 -1
              C
                          - 1
                              1
                                  0
                                      - 1
                                                  - 1
   21-
22-
23-
24-
25-
26-
27-
28-
              C
                                       0
                                          - 1
                                                   0
                                                      1
                                                               0
                                                              -1 -1 -1
                                                  - 1
                   92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5
                                                                                                 $ Fi
                    92238.50C 3.557954-3
                                           93237.50C 8.847626-6
                                                                    8016.50C 4.359266-2
                                                                                                 $ At
                     1001.50C 1.704962-2
                                                                                                 $ an
                    14000.50c 1.121440-2
                                           13027.50c 2.563079-3
                                                                                                 $ Ca
                                                                                                 $ Wi
                    26000.55c 1.380025-4 12000.50c 2.273853-4
                                                                    20000.50C 5.599054-4
                    11023.50C 3.870375-4 19000.50C 5.465492-4
                                                                                                 $ 30
   29-
30-
              MT1 LWTR.01T
                                                                                                 $ Wa
                     1001.50c 2.005838-2 14000.50c 1.319341-2 13027.50c 3.015387-3
                                                                                                 $ Ca
   31-
32-
                     8016.50C 4.265802-2
                                                                                                 $ Wi
                    26000.55C 1.623559-4
                                            12000.50C 2.675121-4
                                                                    20000.50C 6.587122-4
                                                                                                 $ 30
   33-
                    11023.50C 4.553382-4
                                           19000.50C 6.429990-4
   34-
              MT3 LWTR.01T
                                                                                                 $ Va
   35 -
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                                             04/20/96 13:32:58
                                                                                                                  probid =
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 33 cycles and run a total of 233 cycles with nominally this problem has run 33 inactive cycles with 66066 neutron histories and 200 active cycles with
                                                                                                                      2000 neutrons per cycle.
                                                                                                                     399907 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                  465973 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .99433 with an estimated standard deviation of .00093 the estimated 68, 95, & 99 percent keff confidence intervals are .99340 to .99527, .99248 to .99619, and .99187 to .99680 the estimated collision/absorption neutron removal lifetime = 5.15E-05 seconds with an estimated standard deviation of 1.29E-07

```
04/20/96 14:48:26
1mcnp
          version 4a
                         ld=10/01/93
                                                                                               probid =
                                                                                                          04/20/96 14:48:26
 INP=4.0EC OUTP=4.0E.CO
             FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2-
             С
                  Criticality
    3 -
                  SPHERE
                         7.99453107100-2
    5 -
                                                                $ Uranium/Tuff/Water
                                                     IMP:N=1
             5
                         8.11121144000-2
                                             1 -2
                                                     IMP:N=1
                                                               $ Tuff/Water Reflector
    6-
             C
    8-
             C
                  OUTSIDE WORLD
    9-
             30
                  0
                                             IMP:N=0 $ Void
   10-
   11-
             С
                          0 0 0 275.35
   12-
                  S
                                            $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
                          0 0 0 335.35
                                            $ REFLECTOR
   13-
   14-
           this surface has been replaced by a surface of type so
 warning.
   15-
             MODE N
   16-
   17-
             KCODE 2000
                          1
                             33 233
                                        0
                                                    0
                                                                        0 -1 0
   18-
             С
                  KSRC
                          0
                             0
                                0
                                           Ð
                                                - 1
                                                       0
                                                               1
                                                                  0
                                                                                   0
                                                                                     0 1
                                                                                               0
   19-
                                                               0 -1
             С
                             1
                                0
                                     1 -1
                                           0
                                                1
                                                    0
                                                       1
                                                            1
   20-
             C
                             1
                                n
                                    -1 -1
                                           0
                                                - 1
                                                    0
                                                      1
                                                           - 1
                                                               0 -1
   21-
             C
                          0
                                     0 -1
                                           1
                                                0
                                                   1 - 1
                                                            0 -1 -1
                               1
   22-
23-
24-
25-
                                                -1 -1 1
                                                           -1 -1 -1
                                    -1 1
                  92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5
                                                                                             $ Fi
                                         93237.50C 8.847626-6
                                                                 8016.50C 4.359266-2
                                                                                             $ At
                  92238.50c 3.557954-3
                   1001.50C 1.704962-2
                                                                                             $ an
   26-
27-
28-
                   14000.50C 1.121440-2
                                                                                             $ Ca
                                         13027.50c 2.563079-3
                  26000.55C 1.380025-4
11023.50C 3.870375-4
                                         12000.50C 2.273853-4
19000.50C 5.465492-4
                                                                                             $ Wi
                                                                20000.50C 5.599054-4
                                                                                             $ 30
   29-
             MT1
                 LWTR.01T
                                                                                             $ Wa
   30-
                                                                                             $ Ca
                    1001.50c 2.005838-2
                                         14000.50c 1.319341-2 13027.50c 3.015387-3
   31-
                   8016.50C 4.265802-2
                                                                                             S Wi
   32-
                                                                                             $ 30
                   26000.55C 1.623559-4
                                         12000.50C 2.675121-4
                                                                20000.50C 6.587122-4
   33-
                   11023.50C 4.553382-4 19000.50C 6.429990-4
   34-
                                                                                             $ Wa
             MT3 LWTR.01T
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                            probid =
                                                                                                                        04/20/96 14:48:26
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 33 cycles and run a total of 233 cycles with nominally
                                                                                                                 2000 neutrons per cycle.
 this problem has run 33 inactive cycles with 66122 neutron histories and 200 active cycles with
                                                                                                                398971 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                              465093 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .99869 with an estimated standard deviation of .00094 the estimated 68, 95, & 99 percent keff confidence intervals are .99775 to .99964, .99681 to 1.00057, and .99620 to 1.00119 the estimated collision/absorption neutron removal lifetime = 5.01E-05 seconds with an estimated standard deviation of 1.17E-07

```
ld=10/01/93
                                                              04/19/96 07:02:56
           version 4a
                                                                                                    probid =
                                                                                                                04/19/96 07:02:56
 INP=4.0ERS OUTP=4.0E.RSO
              FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2-
                   Reflector Savings
    3 -
                    SPHERE
    5 -
                          7.99453107100-2
                                                        IMP:N=1
                                                                   $ Uranium/Tuff/Water
    6-
7-
                          8.11121144000-2
                                                1 -2
                                                                   $ Tuff/Water Reflector
                                                        IMP:N=1
    8 -
                   OUTSIDE WORLD
    9-
              30
                   0
                                                IMP:N=0
                                                        $ Void
   10-
   11-
              C
                    SURFACES
   12-
                           0 0 0 280.0
                                              $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so
                           0 0 0 340.0
   13-
              2
                   S
                                              $ REFLECTOR
   14-
 warning.
            this surface has been replaced by a surface of type so
   15 -
   16-
   17-
              KCODE 2000
                           1
                              33 233
   18-
              C
                   KSRC
                           0
                              0
                                          0
                                                       0
                                  0
                                              n
                                                          n
                                                                n
                                                                  1
                                                                     0
                                                                            0 -1 0
                                                                                        0
                                                                                           0 1
                                                                                                    0
   19-
              C
                                  0
                                         - 1
                                              O
                                                       0
                                                          1
                                                               1
                                                                  0 -1
                              1
   20 -
21 -
                                         -1
                                              0
                                                       0
                                                               - 1
                                                                  0 -1
              C
                              1
                                  0
                                       - 1
                                                   - 1
                                                          1
                           0
                                       0
                                          - 1
                                                   0
                                                                0
                                                                  -1 -1
   22 -
23 -
24 -
25 -
26 -
                                                               -1 -1 -1
                                           1
                   92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5
                                                                                                  $ Fi
                    92238.50C 3.557954-3
                                           93237.50c 8.847626-6
                                                                    8016.50C 4.359266-2
                                                                                                  $ At
                    1001.50C 1.704962-2
                                                                                                  $ an
                    14000.50C 1.121440-2 13027.50C 2.563079-3
                                                                                                  $ Ca
   27-
                    26000.55C 1.380025-4 12000.50C 2.273853-4
                                                                    20000.50C 5.599054-4
                                                                                                  $ Wi
   28 -
29 -
                    11023.50c 3.870375-4 19000.50c 5.465492-4
                                                                                                  $ 30
              MT1 LWTR.01T
                                                                                                  $ Wa
   30-
                    1001.50C 2.005838-2 14000.50C 1.319341-2 13027.50C 3.015387-3
                                                                                                  $ Ca
                   8016.50C 4.265802-2
26000.55C 1.623559-4
   31-
                                                                                                  $ Wi
   32-
                                            12000.50c 2.675121-4
                                                                    20000.50C 6.587122-4
                                                                                                  $ 30
   33-
                    11023.50C 4.553382-4 19000.50C 6.429990-4
   34 -
              MT3 LWTR.01T
                                                                                                  $ Wa
   35 -
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                                  probid =
                                                                                                                              04/19/96 07:02:56
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 33 cycles and run a total of 233 cycles with nominally this problem has run 33 inactive cycles with 65532 neutron histories and 200 active cycles with
                                                                                                                      2000 neutrons per cycle.
                                                                                                                     399764 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                   465296 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .99892 with an estimated standard deviation of .00091 the estimated 68, 95, & 99 percent keff confidence intervals are .99801 to .99984, .99710 to 1.00074, and .99650 to 1.00134 the estimated collision/absorption neutron removal lifetime = 4.98E-05 seconds with an estimated standard deviation of 1.35E-07

```
Ld=10/01/93
                                                            04/20/96 16:09:06
1mcnp
          version 4a
                                                                                               probid =
                                                                                                          04/20/96 16:09:06
 INP=4.0EC OUTP=4.0E.CO
             FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2 -
                   Criticality
                   SPHERE
             C
                         7.99453107100-2
    5 -
                                                     IMP:N=1
                                                                $ Uranium/Tuff/Water
    6-
             5
                         8.11121144000-2
                                              1 -2
                                                     IMP:N=1
                                                                $ Tuff/Water Reflector
             C
    8-
             C
                   OUTSIDE WORLD
    ğ-
             30
                                             IMP:N=0 $ Void
   10-
   11-
             C
   12-
                          0 0 0 284.32
                                             $ FISSILE SPHERE
                   S
 warning.
           this surface has been replaced by a surface of type so
   13-
             2
                          0 0 0 344.32
                                             $ REFLECTOR
   14 -
           this surface has been replaced by a surface of type so
 warning.
   15 -
   16-
             MODE N
   17-
             KCODE 2000
                          1
                             33
                                                - 1
                          Ó
                             0
                                        0
                                                    0
                                                                        0 -1 0
   18-
             C
                   KSRC
                                0
                                     1
                                           0
                                                       0
                                                               1
                                                                   0
                                                                                    0
                                                                                      0 1
   19-
             C
                             1
                                0
                                       - 1
                                            0
                                                 1
                                                    0
                                                       1
                                                            1
                                                               0 -1
   20-
             C
                         - 1
                             1
                                0
                                     -1 -1
                                           0
                                                - 1
                                                    0
                                                       1
                                                            - 1
                                                               0 -1
   21 -
22 -
23 -
24 -
25 -
             C
                          0
                                     0 -1
                                                 0
                                                   1 - 1
                                                            0 -1 -1
                             1
                                1
                                           1
                                     -1 1
                                                -1 -1 1
                                                           -1 -1 -1
                   92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5
             М1
                                                                                             $ Fi
                   92238.50C 3.557954-3 93237.50C 8.847626-6
                                                                 8016.50C 4.359266-2
                                                                                             $ At
                    1001.50c 1.704962-2
                                                                                             $ an
   26 -
27 -
28 -
                   14000.50C 1.121440-2
                                          13027.50C 2.563079-3
                                                                                             $ Ca
                  26000.55C 1.380025-4
11023.50C 3.870375-4
                                         12000.50C 2.273853-4
19000.50C 5.465492-4
                                                                 20000.50C 5.599054-4
                                                                                             $ Wi
                                                                                             $ 30
   29-
             MT1
                  LWTR.01T
                                                                                             $ Wa
   30-
                                                                                             $ Ca
                    1001.50c 2.005838-2 14000.50c 1.319341-2 13027.50c 3.015387-3
                                                                                             S Wi
   31-
                    8016.50C 4.265802-2
   32-
                   26000.55c 1.623559-4 12000.50c 2.675121-4
                                                                 20000.50C 6.587122-4
                                                                                             $ 30
   33 -
                   11023.50c 4.553382-4 19000.50c 6.429990-4
   34 -
                                                                                             $ Wa
             MT3 LWTR.01T
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                             probid =
                                                                                                                        04/20/96 16:09:06
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 33 cycles and run a total of 233 cycles with nominally
                                                                                                                 2000 neutrons per cycle.
this problem has run 33 inactive cycles with 66019 neutron histories and 200 active cycles with
                                                                                                                399041 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                              465060 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

May 21 10:25 1996 File Name: C6-4.0E-40GWD-30W15U BBA000000-01717-0200-00016 REV 00 ATTACHMENT CII - Page 2

the final estimated combined collision/absorption/track-length keff = .99933 with an estimated standard deviation of .00093 the estimated 68, 95, & 99 percent keff confidence intervals are .99840 to 1.00026, .99748 to 1.00118, and .99688 to 1.00179 the estimated collision/absorption neutron removal lifetime = 4.99E-05 seconds with an estimated standard deviation of 1.24E-07

```
ld=10/01/93
                                                                04/20/96 11:59:37
1mcnp
           version 4a
                                                                                                      probid =
                                                                                                                  04/20/96 11:59:37
 INP=4.0EC OUTP=4.0E.CO
              FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2-
              C
                    Criticality
    3 -
              C
                    SPHERE
                           7.99453107100-2
                                                         IMP:N=1
                                                                     $ Uranium/Tuff/Water
                           8.11121144000-2
                                                 1 -2
                                                                    $ Tuff/Water Reflector
    6-
              5
                                                         IMP:N=1
                    3
    8-
                    OUTSIDE WORLD
              C
    9-
              30
                    0
                          2
                                                IMP:N=0
                                                           $ Void
   10-
   11-
              C
                    SURFACES
                            0 0 0 293.22
   12-
                    S
                                                $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so 2 S 0 0 0 353.22 $ REFLECTOR
   13-
   14 -
 warning.
            this surface has been replaced by a surface of type so
   15 -
   16-
              MODE N
              KCODE 2000
   17-
                           1
                               33 233
   18-
                    KSRC
                            0
                               0 0
                                           0
                                               0
                                                        0
                                                                    1 0
                                                                              0 -1 0
                                                                                          0
                                                                                             0 1
                                                                                                      0
              C
   19-
                               1
                                  0
                                          - 1
                                               0
                                                        0
                                                                 1
                                                                    0 -1
   20-
                                  0
                                       -1 -1
                                               0
                                                        0 1
                                                                -1 0 -1
                           - 1
                                                   - 1
              C
                               1
   21 -
22 -
23 -
24 -
25 -
                                        0 -1
                                                    0
                                                                 0 -1 -1
                            n
              C
                                  1
                                                       1 - 1
                                                                -1 -1 -1
                                                    -1 -1
                                                           1
              C
                   92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5 92238.50C 3.557954-3 93237.50C 8.847626-6 8016.50C 4.359266-2
                                                                                                    $ Fi
                                                                                                    $ At
                                                                      8016.50C 4.359266-2
                     1001.50C 1.704962-2
                                                                                                    $ an
   26-
                    14000.50C 1.121440-2
                                            13027.50c 2.563079-3
                                                                                                    $ Ca
                    26000.55C 1.380025-4
   27-
                                            12000.50c 2.273853-4
                                                                     20000.50C 5.599054-4
                                                                                                    $ Wi
   28-
                    11023.50c 3.870375-4 19000.50c 5.465492-4
                                                                                                    $ 30
   29 -
30 -
                                                                                                    $ Wa
              MT1 LWTR.01T
                                                                                                    $ Ca
                     1001.50C 2.005838-2
                                            14000.50c 1.319341-2 13027.50c 3.015387-3
   31-
                     8016.50C 4.265802-2
                                                                                                    $ Wi
   32-
                                                                                                    $ 30
                    26000.55C 1.623559-4
                                            12000.50C 2.675121-4
                                                                     20000.50C 6.587122-4
   33 -
                    11023.50C 4.553382-4
                                            19000.50C 6.429990-4
              MT3 LWTR.01T
                                                                                                    $ Wa
   34 -
   35 -
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                                     probid =
                                                                                                                                 04/20/96 11:59:37
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 33 cycles and run a total of 233 cycles with nominally this problem has run 33 inactive cycles with 66055 neutron histories and 200 active cycles with
                                                                                                                         2000 neutrons per cycle.
                                                                                                                        399655 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                     465710 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.00119 with an estimated standard deviation of .00099 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00020 to 1.00219, .99921 to 1.00317, and .99857 to 1.00382 the estimated collision/absorption neutron removal lifetime = 4.99E-05 seconds with an estimated standard deviation of 1.35E-07

```
version 4a
                        ld=10/01/93
                                                           05/02/96 08:13:07
                                                                                              probid =
                                                                                                         05/02/96 08:13:07
 INP=4E3015C OUTP=4E30C.0
             FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
    2-
                  k-eff Critical Radius
    3-
             C
                  SPHERE
    5 -
                         7.99453107100-2
                                                    IMP:N=1
                                                              $ Uranium/Tuff/Water
             1
                        8.11121144000-2
                                             1 -2
                                                    IMP:N=1
                                                              $ Tuff/Water Reflector
    8 -
                  OUTSIDE WORLD
    9-
             30
                  0
                        2
                                            IMP:N=0 $ Void
   10-
   11-
             C
                  SURFACES
   12-
                  S
                          0 0 0 310.00
                                             $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
                         0 0 0 370.00
   13-
             2
                  S
                                             $ REFLECTOR
   14-
 warning.
           this surface has been replaced by a surface of type so
   15 -
   16-
             MODE N
   17-
             KCODE 500
                            3
   18-
             C
                  KSRC
                         0
                            0
                               0
                                       0
                                           0
                                               - 1
                                                   0
                                                            0 1 0
                                                                       0 -1 0
                                                                                  0 0 1
   19-
                            1
                                0
                                       - 1
                                           0
                                                1
                                                   0
                                                           1
                                                              0 -1
                                                      1
   20-
                                0
                                    -1 -1
                                               - 1
                                                   0
                                                      1
                                                           - 1
                                                              0 -1
   21-
                         0
                                     0 -1
                                                0
                                                  1 - 1
                                                           0 -1 -1
   22 -
23 -
24 -
25 -
26 -
                                    -1 1
                                           1
                                               -1 -1 1
                                                           -1 -1 -1
                  92234.50C 1.870334-6 92235.50C 6.773585-5 92236.50C 3.026400-5
                                                                                            $ Fi
                  92238.50C 3.557954-3
                                         93237.50C 8.847626-6 8016.50C 4.359266-2
                                                                                           $ At
                  1001.50C 1.704962-2
14000.50C 1.121440-2
                                                                                            $ an
                                         13027.50c 2.563079-3
                                                                                            $
                                                                                             Ca
   27-
28-
                  26000.55C 1.380025-4
                                         12000.50C 2.273853-4
                                                                                            $ Wi
                                                               20000.50C 5.599054-4
                  11023.50c 3.870375-4 19000.50c 5.465492-4
                                                                                            $ 30
   29-
             MT1 LWTR.01T
                                                                                           $ Wa
   30-
                   1001.50c 2.005838-2 14000.50c 1.319341-2 13027.50c 3.015387-3
                                                                                            $ Ca
   31-
                   8016.50C 4.265802-2
                                                                                            $
                                                                                             Wi
                  26000.55C 1.623559-4 12000.50C 2.675121-4
   32-
                                                               20000.50C 6.587122-4
                                                                                           $ 30
   33-
                  11023.50c 4.553382-4 19000.50c 6.429990-4
   34 -
             MT3 LWTR.01T
                                                                                           $ Wa
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD 30% Water 15% U-Np 02
                                                                                                           probid =
                                                                                                                      05/02/96 08:13:07
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
                                                                                                                500 neutrons per cycle.
                                                    1459 neutron histories and 1000 active cycles with
 this problem has run 3 inactive cycles with
                                                                                                              499832 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                             501291 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.00170 with an estimated standard deviation of .00086 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00084 to 1.00256, .99999 to 1.00341, and .99943 to 1.00397 the estimated collision/absorption neutron removal lifetime = 4.89E-05 seconds with an estimated standard deviation of 1.03E-07

```
1mcnp
           version 4a
                            ld=10/01/93
                                                                  04/30/96 20:14:20
                                                                                                           probid =
                                                                                                                       04/30/96 20:14:20
 INP=s3020nh OUTP=s3020nh0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nh)
                     Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
                      CELL SPECIFICATIONS
               C
                      INNER WATER REGION
                      1 8.508241-2 -1 IMP:N=1
2 8.610406-2 1 -2 IMP:N=1
                      OUTSIDE WORLD
                      0 2 IMP:N=0
   10-
               C
                      SURFACE SPECIFICATIONS
   11-
                      so 115
                                     $ INNER FUEL ZONE
   12-
                      so 275
                                      $ INNER FUEL ZONE
   13-
               MODE N
   14-
   15-
               KCODE 4000 1. 20 75
   16-
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   17-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                       MATERIAL SPECIFICATIONS
   19-
                          (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
               С
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   20-
               С
   21 <del>-</del>
22 -
23 -
24 -
25 -
                          1001.50c 2.891081-2 8016.50c 4.129133-2 11023.50c 3.199177-4
               m1
                         12000.50c 1.879523-4 13027.50c 2.118592-3 14000.50c 9.269606-3
                         19000.50c 4.517670-4 20000.50c 4.628070-4 26000.55c 1.140702-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
   26-
27-
28-
               mt1
                         lutr.01t
                          30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
               m2
   29-
                         12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
                         19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   30-
   31-
               mt2
                         lwtr.01t
   32-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nh)
                                                                                                                         probid = 04/30/96 20:14:20
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 79977 neutron histories and 55 active cycles with
                                                                                                                              4000 neutrons per cycle.
                                                                                                                             220592 neutron histories.
                                                                                                         300569 fission neutron source histories.
 this calculation has completed the requested number of keff cycles using a total of
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .96843 with an estimated standard deviation of .00108

May 24 13:16 1996 File Name: s3020nh.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CV - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .96735 to .96951, .96627 to .97059, and .96555 to .97131 the estimated collision/absorption neutron removal lifetime = 9.39E-05 seconds with an estimated standard deviation of 2.64E-07

```
1mcnp
          version 4a
                        ld=10/01/93
                                                           05/01/96 12:58:01
                                                                                              probid =
                                                                                                         05/01/96 12:58:01
 inp=s3020ni outp=s3020ni0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ni) C Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
    2-
                   CELL SPECIFICATIONS
                   INNER WATER REGION
                   1 8.508241-2 -1
                                         IMP:N=1
                   2 8.610406-2 1 -2 IMP:N=1
                   OUTSIDE WORLD
                   0 2 IMP:N=0
   10-
             C
                   SURFACE SPECIFICATIONS
   11-
                   so 150
                                 $ INNER FUEL ZONE
   12-
13-
             2
                   SO 210
                                  $ INNER FUEL ZONE
   14-
             MODE N
             KCODE 4000 1. 20 75
   15 -
   16-
             C
                          0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   17-
                     0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
                     MATERIAL SPECIFICATIONS
   18-
   19-
                      (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
                      3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   20-
   21 -
22 -
23 -
24 -
25 -
                                            8016.50c 4.129133-2 11023.50c 3.199177-4
                      1001.50c 2.891081-2
             m1
                      12000.50c 1.879523-4
                                            13027.50c 2.118592-3 14000.50c 9.269606-3
                      19000.50c 4.517670-4
                                            20000.50c 4.628070-4
                                                                   26000.55c 1.140702-4
                                            92235.50c 3.825286-5 92236.50c 9.153184-6
                     92234.50c 4.694450-7
                     92238.50c 1.905500-3 93237.50c 2.182926-6
   26 -
27 -
                      lwtr.01t
             mt1
                      30 vol% water in calico Hills tuff
   28-
29-
                      1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
             m2
                     12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   30-
                     19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ni)
                                                                                                            probid =
                                                                                                                       05/01/96 12:58:01
the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally
                                                                                                                4000 neutrons per cycle.
this problem has run 20 inactive cycles with 80072 neutron histories and 55 active cycles with
                                                                                                               220019 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                             300091 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 13:17 1996 File Name: s3020ni.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CVI - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .98448 to .98657, .98344 to .98762, and .98274 to .98831 the estimated collision/absorption neutron removal lifetime = 9.02E-05 seconds with an estimated standard deviation of 1.99E-07

```
1mcnp
          version 4a
                         ld=10/01/93
                                                            04/26/96 17:37:54
                                                                                                probid =
                                                                                                           04/26/96 17:37:54
 INP=s3020nb OUTP=s3020nb0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nb)
                  Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
                   CELL SPECIFICATIONS
                    INNER WATER REGION
                   1 8.508241-2 -1 IMP:N=1
2 8.610406-2 1 -2 IMP:N=1
                   OUTSIDE WORLD
                   0 2 IMP:N=0
                   SURFACE SPECIFICATIONS
   10-
   11-
                   so 160
                                 $ INNER FUEL ZONE
   12-
                    SO 220
                                  $ INNER FUEL ZONE
   13-
   14-
             MODE N
   15-
             KCODE 4000 1. 20 75
                   KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                     MATERIAL SPECIFICATIONS
             C
   19-
                       (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
             С
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   20-
             c
   21-
22-
23-
24-
25-
26-
27-
28-
             m1
                       1001.50c 2.891081-2
                                             8016.50c 4.129133-2 11023.50c 3.199177-4
                      12000.50c 1.879523-4 13027.50c 2.118592-3 14000.50c 9.269606-3
                      19000.50c 4.517670-4 20000.50c 4.628070-4 26000.55c 1.140702-4
                      92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
             mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
             m2
   29-
                      12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   30 -
                      19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nb)
                                                                                                             probid = 04/26/96 17:37:54
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80043 neutron histories and 55 active cycles with
                                                                                                                  4000 neutrons per cycle.
                                                                                                                 220187 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                               300230 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99081 with an estimated standard deviation of .00099

May 24 13:08 1996 File Name: s3020nb.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CVII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .98981 to .99181, .98882 to .99280, and .98816 to .99347 the estimated collision/absorption neutron removal lifetime = 8.94E-05 seconds with an estimated standard deviation of 2.33E-07

```
.1mcnp
           version 4a
                           ld=10/01/93
                                                                  04/26/96 18:41:03
                                                                                                                      04/26/96 18:41:03
                                                                                                         probid =
 INP=s3020nc OUTP=s3020nc0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nc)
                    Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
                     CELL SPECIFICATIONS
              C
                      INNER WATER REGION
                     1 8.508241-2 -1 IMP:N=1
2 8.610406-2 1 -2 IMP:N=1
                     OUTSIDE WORLD
                     0 2 IMP:N=0
   10-
11-
12-
13-
14-
15-
16-
17-
              C
                     SURFACE SPECIFICATIONS
                     so 175
                                     $ INNER FUEL ZONE
                     so 235
                                      $ INNER FUEL ZONE
              MODE N
              KCODE 4000 1. 20 75
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                       MATERIAL SPECIFICATIONS
   19-
                         (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
3.0% Original Enrichment/ 20 GWD/MI decayed to Uranium isotopes
   20-
              C
   21-
22-
23-
24-
25-
26-
27-
28-
29-
                         1001.50c 2.891081-2
                                                  8016.50c 4.129133-2 11023.50c 3.199177-4
              m1
                        12000.50c 1.879523-4
                                                 13027.50c 2.118592-3 14000.50c 9.269606-3
                        19000.50c 4.517670-4
                                                 20000.50c 4.628070-4 26000.55c 1.140702-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                        lwtr.01t
                         30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
              m2
                        12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   30-
                        19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   31-
                        lwtr.01t
              mt2
   32-
              PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nc)
                                                                                                                        probid =
                                                                                                                                     04/26/96 18:41:03
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80323 neutron histories and 55 active cycles with
                                                                                                                             4000 neutrons per cycle.
                                                                                                                            219186 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                         299509 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99147 with an estimated standard deviation of .00090

May 24 13:09 1996 File Name: s3020nc.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CVIII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99056 to .99237, .98966 to .99328, and .98906 to .99388 the estimated collision/absorption neutron removal lifetime = 8.92E-05 seconds with an estimated standard deviation of 2.01E-07

```
ld=10/01/93
                                                                 04/26/96 19:37:04
1mcnp
           version 4a
                                                                                                       probid =
                                                                                                                   04/26/96 19:37:04
 INP=s3020nd OUTP=s3020nd0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nd)
                    Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.508241-2 -1 IMP:N=1
2 8.610406-2 1 -2 IMP:N=1
              C
                     OUTSIDE WORLD
                     0 2 IMP:N=0
   10-
              C
                     SURFACE SPECIFICATIONS
   11-
                     so 190
                                    $ INNER FUEL ZONE
   12-
13-
                     SD 250
                                     $ INNER FUEL ZONE
   14-
              MODE N
   15-
              KCODE 4000 1. 20 75
   16-
17-
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
                       0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
              C
   18-
19-
                      MATERIAL SPECIFICATIONS
              C
              С
                         (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20-
21-
22-
23-
24-
25-
26-
28-
29-
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
                         1001.50c 2.891081-2 8016.50c 4.129133-2 11023.50c 3.199177-4
              m1
                        12000.50c 1.879523-4 13027.50c 2.118592-3 14000.50c 9.269606-3
                        19000.50c 4.517670-4 20000.50c 4.628070-4 26000.55c 1.140702-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                        lwtr.01t
                         30 vol% water in calico Hills tuff
                        1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4 12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
               m2
                        19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   30-
   31-
                        lwtr.01t
              mt2
   32-
              PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nd)
                                                                                                                      probid =
                                                                                                                                  04/26/96 19:37:04
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80408 neutron histories and 55 active cycles with
                                                                                                                          4000 neutrons per cycle.
                                                                                                                         219217 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                      299625 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99673 with an estimated standard deviation of .00086

May 24 13:11 1996 File Name: s3020nd.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CIX - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99586 to .99759, .99500 to .99845, and .99443 to .99902 the estimated collision/absorption neutron removal lifetime = 8.78E-05 seconds with an estimated standard deviation of 1.84E-07 1. 1

```
version 4a
                             ld=10/01/93
                                                                     04/26/96 20:39:40
1mcnp
                                                                                                              probid =
                                                                                                                           04/26/96 20:39:40
 INP=s3020ne OUTP=s3020ne0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020ne)
                     Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
     3-
                       CELL SPECIFICATIONS
                       INNER WATER REGION
                       1 8.508241-2 -1
                                                IMP:N=1
                       2 8.610406-2 1 -2 IMP:N=1
                       OUTSIDE WORLD
                       0 2 IMP:N=0
   10-
               C
                       SURFACE SPECIFICATIONS
   11-
                       so 205
                                      $ INNER FUEL ZONE
                       so 265
   12-
13-
                                        $ INNER FUEL ZONE
   14-
               MODE N
   15-
                KCODE 4000 1. 20 75
                       KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                         0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                        MATERIAL SPECIFICATIONS
   19-
                          (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
               С
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes 1001.50c 2.891081-2 8016.50c 4.129133-2 11023.50c 3.199177-4
   20-
               С
   21-
22-
23-
24-
25-
26-
27-
28-
29-
               m1
                         12000.50c 1.879523-4 13027.50c 2.118592-3 14000.50c 9.269606-3
                         19000.50c 4.517670-4 20000.50c 4.628070-4 26000.55c 1.140702-4
                         92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                         92238.50c 1.905500-3 93237.50c 2.182926-6
                         lwtr.01t
               mt1
                          30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
               m2
                         12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   30-
                         19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   31-
               mt2
                         lwtr.01t
               PRINT
   32-
1 initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020ne)
                                                                                                                              probid =
                                                                                                                                          04/26/96 20:39:40
 the initial fission neutron source distribution was read from the srctp file named srctp .
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80219 neutron histories and 55 active cycles with
                                                                                                                                  4000 neutrons per cycle.
                                                                                                                                 220187 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                             300406 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
             the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
             the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99792 with an estimated standard deviation of .00114

May 24 13:12 1996 File Name: s3020ne.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CX - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99677 to .99906, .99563 to 1.00021, and .99487 to 1.00097 the estimated collision/absorption neutron removal lifetime = 8.80E-05 seconds with an estimated standard deviation of 1.97E-07

```
1mcnp
           version 4a
                            Ld=10/01/93
                                                                   04/29/96 07:57:09
                                                                                                          probid =
                                                                                                                       04/29/96 07:57:09
 inp=s3020nf outp=s3020nf0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020nf) C Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
    2-
                      CELL SPECIFICATIONS
                      INNER WATER REGION
                      1 8.508241-2 -1
                                             IMP:N=1
                      2 8.610406-2 1 -2 IMP:N=1
                      OUTSIDE WORLD
    8-
9-
                      0 2 IMP:N=0
   10-
               C
                      SURFACE SPECIFICATIONS
   11-
                      so 220
                                     $ INNER FUEL ZONE
   12-
13-
                      so 280
               2
                                      $ INNER FUEL ZONE
   14-
15-
               MODE N
               KCODE 4000 1. 20 75
   16-
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   17-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                       MATERIAL SPECIFICATIONS
               C
   19-
20-
21-
22-
23-
24-
25-
26-
27-
28-
               c
                         (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               С
                                                  8016.50c 4.129133-2 11023.50c 3.199177-4
               m 1
                          1001.50c 2.891081-2
                        12000.50c 1.879523-4
                                                  13027.50c 2.118592-3 14000.50c 9.269606-3
                        19000.50c 4.517670-4
                                                 20000.50c 4.628070-4
                                                                           26000.55c 1.140702-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5
                                                                           92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
               mt1
                        lwtr.01t
                         30 vol% water in calico Hills tuff
                         1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
               m2
                        12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2 19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   29-
   30-
   31-
               mt2
                        lwtr.01t
   32-
               PRINT
       initial source from file
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nf)
                                                                                                                         probid =
                                                                                                                                      04/29/96 07:57:09
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80579 neutron histories and 55 active cycles with
                                                                                                                              4000 neutrons per cycle.
                                                                                                                             219949 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                         300528 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99735 with an estimated standard deviation of .00077

May 24 13:14 1996 File Name: s3020nf.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXI - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99657 to .99812, .99579 to .99890, and .99528 to .99942 the estimated collision/absorption neutron removal lifetime = 8.74E-05 seconds with an estimated standard deviation of 1.60E-07

```
1mcnp
           version 4a
                           ld=10/01/93
                                                                  08/19/96 09:54:48
                                                                                                         probid = 08/19/96 09:54:48
 inp=s3020ng outp=s3020ng0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 8% U02 (s3020ng)
                     Calico Hills Tuff 1.137 g/cc .47 porosity - sphere surrounded by tuff
               C
                      CELL SPECIFICATIONS
                      INNER WATER REGION
                      1 8.508241-2 -1
                                              IMP:N=1
                      2 8.610406-2 1 -2 IMP:N=1
                      OUTSIDE WORLD
    8-
                      0 2 IMP:N=0
   10-
                      SURFACE SPECIFICATIONS
   11-
                     so 235
so 290
                                     $ INNER FUEL ZONE
   12-
                                      $ INNER FUEL ZONE
   13-
14-
              MODE N
               KCODE 4000 1. 20 75
   15 -
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
17-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
               C
   18-
                       MATERIAL SPECIFICATIONS
               C
                         (47 vol% water in calico Hills tuff) x .92 8 vol% UO2
3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   19-
               C
   20 - 21 - 22 - 23 - 25 - 26 - 27 - 28 - 29 - 30 -
               C
                        1001.50c 2.891081-2 8016.50c 4.129133-2 11023.50c 3.199177-4 12000.50c 1.879523-4 13027.50c 2.118592-3 14000.50c 9.269606-3
                        19000.50c 4.517670-4 20000.50c 4.628070-4 26000.55c 1.140702-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                        lwtr.01t
                        30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
               m2
                        19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   31-
               mt2
                        lwtr.01t
   32-
               PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ng)
                                                                                                                         probid =
                                                                                                                                     08/19/96 09:54:48
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 80182 neutron histories and 55 active cycles with
                                                                                                                             4000 neutrons per cycle.
                                                                                                                            219839 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                         300021 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent
```

the final estimated combined collision/absorption/track-length keff = 1.00196 with an estimated standard deviation of .00112

Aug 27 14:16 1996 File Name: s3020ng.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00083 to 1.00308, .99971 to 1.00420, and .99897 to 1.00494 the estimated collision/absorption neutron removal lifetime = 8.67E-05 seconds with an estimated standard deviation of 1.88E-07

```
05/07/96 13:47:55
1mcnp
           version 4a
                           ld=10/01/93
                                                                                                       probid =
                                                                                                                    05/07/96 13:47:55
 inp=s3020ph outp=s3020ph0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020ph)
                    Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
    2-
    3-
                     CELL SPECIFICATIONS
                      INNER WATER REGION
                      1 8.335845-2 -1
                     2 8.423019-2 1 -2 IMP:N=1
               2
                     OUTSIDE WORLD
                     0 2 IMP:N=0
                     SURFACE SPECIFICATIONS
                                     $ INNER FUEL ZONE
                     so 140
                     so 200
                                      $ INNER FUEL ZONE
   12-
               2
   13-
   14-
               MODE N
               KCODE 4000 1. 30 130
   15-
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   16-
   17-
                        0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   18-
              C
                      MATERIAL SPECIFICATIONS
   19-
                         (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
              C
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes 1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4 12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
   20-
21-
22-
               C
              m1
   23 -
24 -
25 -
26 -
27 -
28 -
                        19000.50c 5.114344-4 20000.50c 5.239325-4 26000.55c 1.291361-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                        lwtr.01t
                         40 vol% water in calico Hills tuff
               m2
                         1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
                        12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2 19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   29-
30-
   31-
               mt2
                        lwtr.01t
   32-
              PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020ph)
                                                                                                                      probid = 05/07/96 13:47:55
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 119955 neutron histories and 100 active cycles with
                                                                                                                           4000 neutrons per cycle.
                                                                                                                          400180 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                      520135 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
 warning. the k(trk length) cycle values do not appear normally distributed at the 99 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .98191 with an estimated standard deviation of .00078

May 24 12:23 1996 File Name: s3020ph.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXIII - Page 2.

the estimated 68, 95, & 99 percent keff confidence intervals are .98112 to .98269, .98035 to .98346, and .97984 to .98397 the estimated collision/absorption neutron removal lifetime = 9.27E-05 seconds with an estimated standard deviation of 1.92E-07

```
1mcnp
           version 4a
                           ld=10/01/93
                                                                 05/06/96 16:18:57
                                                               *********
                                                                                                         probid =
                                                                                                                     05/06/96 16:18:57
 INP=s3020pa OUTP=s3020pa0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pa)
    2-
                    Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
              C
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.335845-2 -1
                                              IMP:N=1
                     2 8.423019-2 1 -2 IMP:N=1
                     OUTSIDE WORLD
                     0 2 IMP:N=0
              С
                     SURFACE SPECIFICATIONS
   11-
                     so 150
                                      $ INNER FUEL ZONE
   12-
13-
14-
15-
                     SO 210
                                      $ INNER FUEL ZONE
              KCODE 4000 1. 30 130
   16-
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   17-
                       0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
  18-
19-
20-
21-
22-
23-
25-
26-
27-
28-
29-
              С
                      MATERIAL SPECIFICATIONS
                         (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
              c
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes 1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4
              C
              m1
                        12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
                        19000.50c 5.114344-4 20000.50c 5.239325-4 26000.55c 1.291361-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                        lwtr.01t
                         40 vol% water in calico Hills tuff
              m2
                         1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
                        12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2 19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   30-
   31-
                        lwtr.01t
              mt2
              PRINT
   32-
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pa)
                                                                                                                        probid =
                                                                                                                                    05/06/96 16:18:57
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120401 neutron histories and 100 active cycles with
                                                                                                                            4000 neutrons per cycle.
                                                                                                                           399469 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                                        519870 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the estimated 68, 95, & 99 percent keff confidence intervals are .98595 to .98745, .98520 to .98819, and .98471 to .98868 the estimated collision/absorption neutron removal lifetime = 9.20E-05 seconds with an estimated standard deviation of 1.64E-07

```
ld=10/01/93
1mcnp
           version 4a
                                                              05/06/96 17:56:04
                                                                                                    probid =
                                                                                                                05/06/96 17:56:04
 INP=s3020pb OUTP=s3020pb0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pb) C Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
    2 -
    3-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.335845-2 -1
                                           IMP:N=1
                     2 8.423019-2 1 -2 IMP:N=1
                     OUTSIDE WORLD
                     0 2 IMP:N=0
   10-
              C
                     SURFACE SPECIFICATIONS
   11-
12-
13-
                     SO 160
                                    $ INNER FUEL ZONE
                     SO 220
                                    $ INNER FUEL ZONE
   14-
              MODE N
   15 -
              KCODE 4000 1. 30 130
   16-
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   17-
                       0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   18-
                      MATERIAL SPECIFICATIONS
              C
   19-
                        (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20-
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              C
   21 -
22 -
23 -
24 -
25 -
                                              8016.50c 4.216620-2 11023.50c 3.621710-4
13027.50c 2.398406-3 14000.50c 1.049389-2
20000.50c 5.239325-4 26000.55c 1.291361-4
92235.50c 3.825286-5 92236.50c 9.153184-6
              m 1
                        1001.50c 2.460494-2
                       12000.50c 2.127762-4
                       19000.50c 5.114344-4
                       92234.50c 4.694450-7
                       92238.50c 1.905500-3 93237.50c 2.182926-6
   26-
27-
28-
29-
              mt1
                       lwtr.01t
                        40 vol% water in calico Hills tuff
              m2
                        1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
                       12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2
   30-
                       19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   31-
              mt2
                       lwtr.01t
   32-
              PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pb)
                                                                                                                  probid =
                                                                                                                              05/06/96 17:56:04
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally
                                                                                                                      4000 neutrons per cycle.
 this problem has run 30 inactive cycles with 119827 neutron histories and 100 active cycles with
                                                                                                                     400182 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                   520009 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .98920 with an estimated standard deviation of .00080

May 24 12:16 1996 File Name: s3020pb.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXV - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .98840 to .99000, .98760 to .99080, and .98708 to .99132 the estimated collision/absorption neutron removal lifetime = 9.11E-05 seconds with an estimated standard deviation of 1.66E-07

```
version 4a
                         ld=10/01/93
                                                            05/06/96 19:28:38
1mcnp
                                                                                               probid = 05/06/96 19:28:38
 INP=s3020pc OUTP=s3020pc0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pc)
                  Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
    Ż-
    3-
                   CELL SPECIFICATIONS
                    INNER WATER REGION
    5 -
                    1 8.335845-2
    6-
7-
                    2 8.423019-2 1 -2 IMP:N=1
                   OUTSIDE WORLD
                   0 2 IMP:N=0
   10-
             C
                   SURFACE SPECIFICATIONS
   11-
12-
13-
                   so 175
so 235
                                  $ INNER FUEL ZONE
                                  $ INNER FUEL ZONE
   14-
             MODE
   15-
             KCODE 4000 1. 30 130
   16-
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   17-
                      0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   18-
                     MATERIAL SPECIFICATIONS
   19-
                       (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20 -
21 -
22 -
23 -
25 -
26 -
27 -
28 -
29 -
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
             ^
                      1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4 12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
             m1
                      19000.50c 5.114344-4
                                            20000.50c 5.239325-4
                                                                    26000.55c 1.291361-4
                      92234.50c 4.694450-7
                                            92235.50c 3.825286-5
                                                                   92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
             mt1
                      lwtr.01t
                       40 vol% water in calico Hills tuff
             m2
                       1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
                      12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2
                      19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   31-
             mt2
                      lwtr.01t
   32 -
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pc)
                                                                                                            probid =
                                                                                                                        05/06/96 19:28:38
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally
                                                                                                                 4000 neutrons per cycle.
 this problem has run 30 inactive cycles with 120289 neutron histories and 100 active cycles with
                                                                                                                399571 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                              519860 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

.00086 the final estimated combined collision/absorption/track-length keff = .99014 with an estimated standard deviation of

May 24 12:17 1996 File Name: s3020pc.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXVI - Page 2 .

the estimated 68, 95, & 99 percent keff confidence intervals are .98928 to .99101, .98843 to .99186, and .98787 to .99242 the estimated collision/absorption neutron removal lifetime = 9.04E-05 seconds with an estimated standard deviation of 1.47E-07

.....

```
version 4a
                             ld=10/01/93
                                                                      05/06/96 21:01:42
1mcno
                                                                      *******
                                                                                                                probid =
                                                                                                                             05/06/96 21:01:42
 INP=s3020pd OUTP=s3020pd0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pd)
    2 -
                     Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
                       CELL SPECIFICATIONS
                       INNER WATER REGION
    5-
6-
7-
                       1 8.335845-2 -1
                                                 IMP:N=1
               2
                       2 8.423019-2 1 -2 IMP:N=1
                       OUTSIDE WORLD
    8-
                       0 2 IMP:N=0
   10-
                       SURFACE SPECIFICATIONS
   11-
                       so 190
                                        $ INNER FUEL ZONE
   12-
13-
14-
15-
16-
               2
                       SO 250
                                        $ INNER FUEL ZONE
               MODE N
               KCODE 4000 1. 30 130
                       KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
                         0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   17-
   18-
19-
                        MATERIAL SPECIFICATIONS
                          (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               С
   20-
21-
22-
23-
24-
25-
26-
27-
28-
29-
30-
                         1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4 12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
               m1
                         19000.50c 5.114344-4 20000.50c 5.239325-4 26000.55c 1.291361-4
                         92234.50c 4.694450-7 92235.50c 3.825286-5
                                                                               92236.50c 9.153184-6
                         92238.50c 1.905500-3 93237.50c 2.182926-6
               mt1
                         lwtr.01t
                           40 vol% water in calico Hills tuff
                         1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4 12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2 19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
               m2
   31-
               mt2
                         lwtr.01t
   32-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pd)
                                                                                                                                probid =
                                                                                                                                             05/06/96 21:01:42
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120116 neutron histories and 100 active cycles with
                                                                                                                                     4000 neutrons per cycle.
                                                                                                                                    400181 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                               520297 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
             the k( collision) cycle values appear normally distributed at the 95 percent confidence level
             the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 12:18 1996 File Name: s3020pd.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXVII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99694 to .99826, .99628 to .99892, and .99585 to .99935 the estimated collision/absorption neutron removal lifetime = 8.90E-05 seconds with an estimated standard deviation of 1.74E-07

```
version 4a
                         ld=10/01/93
                                                             05/06/96 22:33:58
1mcno
                                                                                                  probid =
                                                                                                             05/06/96 22:33:58
INP=s3020pe OUTP=s3020pe0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pe)
   2-
                   Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.335845-2 -1
                                          IMP:N=1
                    2 8.423019-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
                    0 2 IMP:N=0
  10-
11-
             С
                    SURFACE SPECIFICATIONS
                    so 205
                                   $ INNER FUEL ZONE
  12-
13-
14-
                    so 265
                                   $ INNER FUEL ZONE
             2
             MODE N
  15-
             KCODE 4000 1. 30 130
  16-
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
  17-
                      0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
  18-
19-
20-
21-
23-
24-
25-
26-
27-
28-
29-
30-
             С
                     MATERIAL SPECIFICATIONS
                       (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
             C
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
             C
                                              8016.50c 4.216620-2 11023.50c 3.621710-4
                       1001.50c 2.460494-2
             m1
                      12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
                      19000.50c 5.114344-4 20000.50c 5.239325-4
                                                                     26000.55c 1.291361-4
                      92234.50c 4.694450-7 92235.50c 3.825286-5
                                                                     92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
                      lwtr.01t
             mt1
                       40 vol% water in calico Hills tuff
             m2
                       1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
                      12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2 19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
  31-
                      lwtr.01t
             mt2
  32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% U02 (s3020pe)
                                                                                                                probid =
                                                                                                                           05/06/96 22:33:58
the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally
                                                                                                                    4000 neutrons per cycle.
this problem has run 30 inactive cycles with 120211 neutron histories and 100 active cycles with
                                                                                                                   399463 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                                 519674 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99597 with an estimated standard deviation of .00088

May 24 12:20 1996 File Name: s3020pe.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXVIII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99508 to .99685, .99421 to .99772, and .99364 to .99829 the estimated collision/absorption neutron removal lifetime = 8.93E-05 seconds with an estimated standard deviation of 1.63E-07

```
version 4a
                         ld=10/01/93
                                                           05/07/96 00:06:32
1mcnp
                                                                                              probid = 05/07/96 00:06:32
 INP=s3020pf OUTP=s3020pf0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% U02 (s3020pf)
                  Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
    2-
    3-
                   CELL SPECIFICATIONS
                    INNER WATER REGION
                   1 8.335845-2 -1 IMP:N=1
2 8.423019-2 1 -2 IMP:N=1
                   OUTSIDE WORLD
             3
                   0 2 IMP:N=0
             C
                   SURFACE SPECIFICATIONS
   11-
                   SO 220
                                  $ INNER FUEL ZONE
                   SO 280
   12-
                                  $ INNER FUEL ZONE
   13-
   14-
             MODE N
             KCODE 4000 1. 30 130
   15-
                   KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   16-
                     0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   17-
   18-
                    MATERIAL SPECIFICATIONS
   19-
                       (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20-
                      3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
             C
   21 -
22 -
23 -
24 -
                      1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4 2000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
             m1
                      12000.50c 2.127762-4
                                            20000.50c 5.239325-4
                      19000.50c 5.114344-4
                                                                   26000.55c 1.291361-4
                     92234.50c 4.694450-7 92235.50c 3.825286-5
                                                                   92236.50c 9.153184-6
   25 -
                      92238.50c 1.905500-3 93237.50c 2.182926-6
   26-
                      lwtr.01t
             mt1
   27-
28-
                      40 vol% water in calico Hills tuff
                      1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
             m2
   29-
                      12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2
   30-
                      19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% UO2 (s3020pf)
                                                                                                            probid =
                                                                                                                       05/07/96 00:06:32
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally
                                                                                                                4000 neutrons per cycle.
 this problem has run 30 inactive cycles with 120304 neutron histories and 100 active cycles with
                                                                                                               400085 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                             520389 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99911 with an estimated standard deviation of .00071

May 24 12:21 1996 File Name: s3020pf.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXIX - Page 2 .

the estimated 68, 95, & 99 percent keff confidence intervals are .99840 to .99982, .99770 to 1.00053, and .99724 to 1.00099 the estimated collision/absorption neutron removal lifetime = 8.81E-05 seconds with an estimated standard deviation of 1.36E-07

```
version 4a
                           ld=10/01/93
                                                                   05/07/96 01:37:42
                                                                                                          probid = 05/07/96 01:37:42
 INP=s3020pg OUTP=s3020pg0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% UO2 (s3020pg)
                    Calico Hills Tuff 1.5095 g/cc .40 porosity - sphere surrounded by tuff
                     CELL SPECIFICATIONS
                      INNER WATER REGION
                     1 8.335845-2 -1 IMP:N=1 2 8.423019-2 1 -2 IMP:N=1
                      OUTSIDE WORLD
                      0 2 IMP:N=0
   10-
               C
                      SURFACE SPECIFICATIONS
   11-
                      so 235
                                      $ INNER FUEL ZONE
   12-
13-
                      so 295
                                      $ INNER FUEL ZONE
   14-
              MODE N
               KCODE 4000 1. 30 130
   15-
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 5 0 0 -5 -10 0 -10
   16-
                        0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5 -16 5 5 0 10 10 17
   17-
   18-
                       MATERIAL SPECIFICATIONS
   19-
                         (40 vol% water in calico Hills tuff) x .92 8 vol% UO2
   2Ó-
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               C
   21-
                         1001.50c 2.460494-2 8016.50c 4.216620-2 11023.50c 3.621710-4
               m1
   22 -
23 -
24 -
25 -
26 -
27 -
28 -
29 -
                        12000.50c 2.127762-4 13027.50c 2.398406-3 14000.50c 1.049389-2
                        19000.50c 5.114344-4 20000.50c 5.239325-4 26000.55c 1.291361-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
               mt1
                        lwtr.01t
                         40 vol% water in calico Hills tuff
1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4
               m2
                        12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2
   30-
                        19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   31-
                        lwtr.01t
               mt2
   32-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 8% UO2 (s3020pg)
                                                                                                                          probid =
                                                                                                                                      05/07/96 01:37:42
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120294 neutron histories and 100 active cycles with
                                                                                                                              4000 neutrons per cycle.
                                                                                                                             399788 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                         520082 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 12:22 1996 File Name: s3020pg.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXX - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00275 to 1.00434, 1.00197 to 1.00512, and 1.00145 to 1.00563 the estimated collision/absorption neutron removal lifetime = 8.77E-05 seconds with an estimated standard deviation of 1.54E-07

```
ld=10/01/93
                                                             04/30/96 19:42:51
1mcnp
          version 4a
                                                             ******
                                                                                                 probid =
                                                                                                             04/30/96 19:42:51
 INP=s3020be OUTP=s3020be0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020be) C Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    2 -
    3-
                    CELL SPECIFICATIONS
             C
                    INNER WATER REGION
                    1 8.033424-2
                                           IMP:N=1
                    2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
                    0 2 IMP:N=0
    Q-
   10-
                    SURFACE SPECIFICATIONS
   11-
                    so 115
                                   $ INNER FUEL ZONE
   12-
13-
                    so 175
                                   $ INNER FUEL ZONE
   14-
             MODE
             KCODE 3000 1. 14 54
   15 -
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                     MATERIAL SPECIFICATIONS
             С
   19-
                       (30 vol% water in calico Hills tuff) x .90 10 vol% UO2
             c
  20-
21-
22-
23-
24-
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
             C
                                             8016.50c 4.328111-2 11023.50c 4.098044-4
13027.50c 2.713848-3 14000.50c 1.187407-2
20000.50c 5.928410-4 26000.55c 1.461203-4
             m1
                       1001.50c 1.805254-2
                      12000.50c 2.407609-4
                      19000.50c 5.786991-4
                      92234.50c 5.868062-7 92235.50c 4.781608-5 92236.50c 1.144148-5
  25 -
26 -
27 -
28 -
29 -
                      92238.50C 2.381875-3 93237.50C 2.728657-6
             mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
             m2
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
   30-
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020be)
                                                                                                               probid =
                                                                                                                           04/30/96 19:42:51
the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 14 cycles and run a total of 54 cycles with nominally
                                                                                                                   3000 neutrons per cycle.
this problem has run 14 inactive cycles with 42008 neutron histories and 40 active cycles with
                                                                                                                   119399 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                                161407 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .97905 with an estimated standard deviation of .00159

May 24 13:52 1996 File Name: s3020be.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXI - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .97745 to .98066, .97583 to .98227, and .97473 to .98337 the estimated collision/absorption neutron removal lifetime = 8.42E-05 seconds with an estimated standard deviation of 4.50E-07

```
1mcnp
          version 4a
                         ld=10/01/93
                                                            04/23/96 08:15:20
                                                                                                probid =
                                                                                                           04/23/96 08:15:20
 inp=s3020ba outp=s3020ba0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020ba)
                  Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                   CELL SPECIFICATIONS
                    INNER WATER REGION
                   1 8.033424-2 -1 IMP:N=1
2 8.035742-2 1 -2 IMP:N=1
                   OUTSIDE WORLD
                   0 2 IMP:N=0
   10-
             C
                   SURFACE SPECIFICATIONS
   11-
                   so 125
                                  $ INNER FUEL ZONE
                   SO 185
   12-
                                   $ INNER FUEL ZONE
   13-
             MODE N
   14-
             KCODE 3000 1. 14 54
   15 -
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   17-
   18-
                     MATERIAL SPECIFICATIONS
   19-
                       (30 vol% water in calico Hills tuff) x .90 10 vol% UO2
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   20-
             C
                       1001.50c 1.805254-2
                                              8016.50c 4.328111-2 11023.50c 4.098044-4
   21-
             m1
   22-
23-
24-
25-
                      12000.50c 2.407609-4
                                             13027.50c 2.713848-3 14000.50c 1.187407-2
                      19000.50c 5.786991-4
                                             20000.50c 5.928410-4 26000.55c 1.461203-4
                      92234.50C 5.868062-7 92235.50C 4.781608-5 92236.50C 1.144148-5
                      92238.50c 2.381875-3 93237.50c 2.728657-6
   26 -
27 -
28 -
29 -
             mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
             m2
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
   30-
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
                      lwtr.01t
             mt2
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020ba)
                                                                                                              probid =
                                                                                                                         04/23/96 08:15:20
the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 14 cycles and run a total of 54 cycles with nominally this problem has run 14 inactive cycles with 41724 neutron histories and 40 active cycles with
                                                                                                                  3000 neutrons per cycle.
                                                                                                                 120165 neutron histories.
                                                                                               161889 fission neutron source histories.
this calculation has completed the requested number of keff cycles using a total of
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99093 with an estimated standard deviation of .00177

May 24 13:47 1996 File Name: s3020ba.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXII - Page 2 .

the estimated 68, 95, & 99 percent keff confidence intervals are .98914 to .99272, .98733 to .99453, and .98611 to .99575 the estimated collision/absorption neutron removal lifetime = 8.15E-05 seconds with an estimated standard deviation of 3.25E-07

```
version 4a
                         ld=10/01/93
                                                             04/22/96 16:44:31
1mcnp
                                                                                                  probid =
                                                                                                              04/22/96 16:44:31
INP=s3020bb OUTP=s3020bb0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020bb)
    2-
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.033424-2 -1 IMP:N=1
2 8.035742-2 1 -2 IMP:N=1
             2
             C
                    OUTSIDE WORLD
                    0 2 IMP:N=0
   10-
             C
                    SURFACE SPECIFICATIONS
   11-
                    so 140
                                   $ INNER FUEL ZONE
                    SO 200
   12-
             2
                                   $ INNER FUEL ZONE
   13-
   14-
             MODE N
              KCODE 3000 1. 14 54
   15 -
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
             C
   18-
                     MATERIAL SPECIFICATIONS
             C
   19-
             C
                       (30 vol% water in calico Hills tuff) x .90 10 vol% UO2
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   20-
   21-
                       1001.50c 1.805254-2 8016.50c 4.328111-2 11023.50c 4.098044-4
             m1
   22-
23-
24-
25-
26-
                      12000.50c 2.407609-4 13027.50c 2.713848-3 14000.50c 1.187407-2
                      19000.50c 5.786991-4 20000.50c 5.928410-4 26000.55c 1.461203-4
                      92234.50c 5.868062-7 92235.50c 4.781608-5 92236.50c 1.144148-5
                      92238.50C 2.381875-3 93237.50C 2.728657-6
                      lwtr.01t
             mt1
  27-
28-
29-
30-
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
             m2
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3 19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020bb)
                                                                                                                probid = 04/22/96 16:44:31
the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 14 cycles and run a total of 54 cycles with nominally this problem has run 14 inactive cycles with 41846 neutron histories and 40 active cycles with
                                                                                                                    3000 neutrons per cycle.
                                                                                                                    120232 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                                 162078 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 13:48 1996 File Name: s3020bb.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXIII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99828 to 1.00119, .99681 to 1.00266, and .99581 to 1.00365 the estimated collision/absorption neutron removal lifetime = 7.92E-05 seconds with an estimated standard deviation of 3.40E-07

```
04/22/96 17:10:10
          version 4a
                         ld=10/01/93
1mcnp
                                                                                                  probid =
                                                                                                             04/22/96 17:10:10
 INP=s3020bc OUTP=s3020bc0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bc)
    2-
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    3-
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.033424-2 -1
                    2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
                    0 2 IMP:N=0
                    SURFACE SPECIFICATIONS
                    SO 155
                                   $ INNER FUEL ZONE
                    SO 215
                                   $ INNER FUEL ZONE
   12-
              2
   13-
   14-
              MODE N
   15 -
              KCODE 3000 1, 14 54
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   17-
   18-
                     MATERIAL SPECIFICATIONS
   19-
                        (30 vol% water in calico Hills tuff) x .90 10 vol% UO2
              C
   20-
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              r
                       1001.50c 1.805254-2 8016.50c 4.328111-2 11023.50c 4.098044-4 12000.50c 2.407609-4 13027.50c 2.713848-3 14000.50c 1.187407-2
   21-
22-
23-
25-
26-
27-
28-
29-
30-
                       19000.50c 5.786991-4 20000.50c 5.928410-4 26000.55c 1.461203-4
                       92234.50C 5.868062-7 92235.50C 4.781608-5 92236.50C 1.144148-5
                       92238.50C 2.381875-3 93237.50C 2.728657-6
              mt1
                       lwtr.01t
                        30 vol% water in calico Hills tuff
              m2
                        1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
                       12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
                       19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
              mt2
                       lwtr.01t
   32-
              PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bc)
                                                                                                                           04/22/96 17:10:10
                                                                                                               probid =
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 14 cycles and run a total of 54 cycles with nominally
                                                                                                                   3000 neutrons per cycle.
 this problem has run 14 inactive cycles with 42251 neutron histories and 40 active cycles with
                                                                                                                  119932 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                 162183 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = 1.00461 with an estimated standard deviation of .00139

May 24 13:50 1996 File Name: s3020bc.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXIV - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00320 to 1.00601, 1.00178 to 1.00743, and 1.00082 to 1.00839 the estimated collision/absorption neutron removal lifetime = 7.73E-05 seconds with an estimated standard deviation of 3.16E-07

```
ld=10/01/93
                                                                04/22/96 17:35:19
1mcnp
           version 4a
                                                                                                      probid =
                                                                                                                  04/22/96 17:35:19
 INP=s3020bd OUTP=s3020bd0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% U02 (s3020bd)
                    Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.033424-2
                                     - 1
              2
                     2 8.035742-2 1 -2 IMP:N=1
                     OUTSIDE WORLD
                     0 2 IMP:N=0
   10-
              C
                     SURFACE SPECIFICATIONS
   11-
                     so 170
                                     $ INNER FUEL ZONE
                     SO 230
   12-
                                     $ INNER FUEL ZONE
              2
   13-
   14-
              MODE N
   15 -
              KCODE 3000 1. 14 54
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                       0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
              C
                      MATERIAL SPECIFICATIONS
   19-
                        (30 vol% water in calico Hills tuff) x .90 10 vol% UO2
              C
   20-
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              C
   21-
22-
23-
24-
25-
26-
27-
28-
                                                8016.50c 4.328111-2 11023.50c 4.098044-4
                        1001.50c 1.805254-2
              m1
                       12000.50c 2.407609-4
                                               13027.50c 2.713848-3 14000.50c 1.187407-2
                       19000.50c 5.786991-4 20000.50c 5.928410-4 26000.55c 1.461203-4 92234.50c 5.868062-7 92235.50c 4.781608-5 92236.50c 1.144148-5
                       92238.50C 2.381875-3 93237.50C 2.728657-6
                       lwtr.01t
              mt1
                        30 vol% water in calico Hills tuff
              m2
                        1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
                       12000.50c 1.741675-4
                                               13027.50c 1.963209-3 14000.50c 8.589752-3
   29-
   30-
                       19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
              mt2
                       lwtr.01t
              PRINT
   32-
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 10% UO2 (s3020bd)
                                                                                                                     probid =
                                                                                                                                 04/22/96 17:35:19
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 14 cycles and run a total of 54 cycles with nominally this problem has run 14 inactive cycles with 41673 neutron histories and 40 active cycles with
                                                                                                                         3000 neutrons per cycle.
                                                                                                                        120050 neutron histories.
                                                                                                     161723 fission neutron source histories.
 this calculation has completed the requested number of keff cycles using a total of
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k(collision) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 13:51 1996 File Name: s3020bd.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXV - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00804 to 1.01117, 1.00646 to 1.01276, and 1.00539 to 1.01383 the estimated collision/absorption neutron removal lifetime = 7.55E-05 seconds with an estimated standard deviation of 2.25E-07

```
· 1mcnp
          version 4a
                         ld=10/01/93
                                                            05/02/96 09:23:19
                                                                                                probid = 05/02/96 09:23:19
 inp=s3020ah outp=s3020ah0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ah)
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    ₹-
              C
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.048982-2 -1
                                          IMP:N=1
                    2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
                    0 2 IMP:N=0
                    SURFACE SPECIFICATIONS
   11-
                    so 180
                                  $ INNER FUEL ZONE
   12-
                    SO 240
                                   $ INNER FUEL ZONE
   13-
   14-
              MODE N
              KCODE 4000 1. 20 75
   15 -
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
                     MATERIAL SPECIFICATIONS
   18-
   19-
                       (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
              C
   20-
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
                       1001.50c 1.845371-2 8016.50c 4.315649-2 11023.50c 4.189111-4
   21 -
22 -
23 -
24 -
25 -
26 -
27 -
28 -
                      12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
                      19000.50c 5.915591-4 20000.50c 6.060152-4 26000.55c 1.493674-4
                      92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
                      lwtr.01t
              mt1
                       30 vol% water in calico Hills tuff
              m2
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
   29-
30-
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
              mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ah)
                                                                                                             probid = 05/02/96 09:23:19
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 79950 neutron histories and 55 active cycles with
                                                                                                                 4000 neutrons per cycle.
                                                                                                                219827 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                               299777 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

1.

May 24 13:34 1996 File Name: s3020ah.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXVI - Page 2

157

the estimated 68, 95, & 99 percent keff confidence intervals are .98226 to .98429, .98125 to .98530, and .98058 to .98597 the estimated collision/absorption neutron removal lifetime = 9.03E-05 seconds with an estimated standard deviation of 2.12E-07

```
1mcnp
            version 4a ld=10/01/93
                                                                      05/01/96 16:46:48
                                                                                                                            05/01/96 16:46:48
                                                                                                               probid =
 inp=s3020ag outp=s3020ag0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ag)
                     Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                       CELL SPECIFICATIONS
               C
                       INNER WATER REGION
                       1 8.048982-2 -1 IMP:N=1
2 8.035742-2 1 -2 IMP:N=1
                       OUTSIDE WORLD
                       0 2 IMP:N=0
               C
                       SURFACE SPECIFICATIONS
   11-
                       so 220
                                        $ INNER FUEL ZONE
   12-
13-
14-
                       so 280
                                        $ INNER FUEL ZONE
               MODE N
   15-
               KCODE 4000 1. 20 75
                       KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40 0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   16-
   17-
                        MATERIAL SPECIFICATIONS
   18-
   19-
                           (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20-
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               С
   21-
22-
23-
24-
25-
26-
27-
28-
29-
30-
                          1001.50c 1.845371-2 8016.50c 4.315649-2 11023.50c 4.189111-4
               m1
                          12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
                         19000.50c 5.915591-4 20000.50c 6.060152-4 26000.55c 1.493674-4
                         92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                         92238.50c 1.905500-3 93237.50c 2.182926-6
                          lwtr.01t
               mt1
                          30 vol% water in calico Hills tuff
                         1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4 12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
                         19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
                         lwtr.01t
               mt2
   32-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ag)
                                                                                                                               probid = 05/01/96 16:46:48
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 79675 neutron histories and 55 active cycles with
                                                                                                                                    4000 neutrons per cycle.
                                                                                                                                   220026 neutron histories.
                                                                                                              299701 fission neutron source histories.
 this calculation has completed the requested number of keff cycles using a total of
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
             the k( collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99050 with an estimated standard deviation of .00111

May 24 13:41 1996 File Name: s3020ag.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXVII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .98938 to .99162, .98827 to .99273, and .98753 to .99348 the estimated collision/absorption neutron removal lifetime = 8.85E-05 seconds with an estimated standard deviation of 1.89E-07

```
ld=10/01/93
                                                            05/01/96 15:21:46
1mcnp
          version 4a
                                                                                                probid =
                                                                                                           05/01/96 15:21:46
 inp=s3020af outp=s3020af0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020af)
    2-
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.048982-2 -1
                    2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
              3
                    0 2 IMP:N=0
                    SURFACE SPECIFICATIONS
                    so 280
                                   $ INNER FUEL ZONE
                    so 340
   12-
              2
                                   $ INNER FUEL ZONE
   13-
   14-
              MODE N
              KCODE 4000 1. 20 75
   15-
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   17-
   18-
             C
                     MATERIAL SPECIFICATIONS
   19-
                       (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
              C
   20-
21-
22-
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              C
                      1001.50c 1.845371-2 8016.50c 4.315649-2 11023.50c 4.189111-4 12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
              m1
   23 -
24 -
25 -
26 -
27 -
28 -
                      19000.50c 5.915591-4 20000.50c 6.060152-4
                                                                    26000.55c 1.493674-4
                      92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
              m2
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3 19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   29-
   30-
   31-
              mt2
                      lwtr.01t
   32-
              PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020af)
                                                                                                              probid =
                                                                                                                         05/01/96 15:21:46
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally
                                                                                                                  4000 neutrons per cycle.
 this problem has run 20 inactive cycles with 80318 neutron histories and 55 active cycles with
                                                                                                                 219180 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                               299498 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cýcle values appear normally distributed at the 95 percent confidence level
            the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 13:40 1996 File Name: s3020af.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXVIII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99523 to .99740, .99415 to .99848, and .99344 to .99919 the estimated collision/absorption neutron removal lifetime = 8.72E-05 seconds with an estimated standard deviation of 1.79E-07

```
ld=10/01/93
                                                            04/30/96 18:46:26
1mcnp
          version 4a
                                                                                                probid =
                                                                                                           04/30/96 18:46:26
 INP=s3020ae OUTP=s3020ae0
             Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ae)
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.048982-2
                                    - 1
                    2 8.035742-2 1 -2 IMP:N=1
             2
                    OUTSIDE WORLD
                    0 2 IMP:N=0
   10-
                    SURFACE SPECIFICATIONS
   11-
                    so 300
                                  $ INNER FUEL ZONE
   12-
             2
                    SO 360
                                  $ INNER FUEL ZONE
   13-
14-
             MODE N
   15-
             KCODE 4000 1. 20 75
   16-
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
                     MATERIAL SPECIFICATIONS
   19-
             C
                       (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
   20-
21-
22-
23-
24-
25-
26-
27-
28-
30-
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
                       1001.50c 1.845371-2
                                              8016.50c 4.315649-2 11023.50c 4.189111-4
             m1
                      12000.50c 2.461111-4
                                             13027.50c 2.774156-3 14000.50c 1.213794-2
                      19000.50c 5.915591-4
                                             20000.50c 6.060152-4 26000.55c 1.493674-4
                                             92235.50c 3.825286-5
                      92234.50c 4.694450-7
                                                                    92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
             mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2
                                             8016.50c 3.695585-2 11023.50c 2.964542-4
             m2
                      12000.50c 1.741675-4
                                             13027.50c 1.963209-3
                                                                    14000.50c 8.589752-3
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ae)
                                                                                                              probid =
                                                                                                                         04/30/96 18:46:26
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally this problem has run 20 inactive cycles with 79806 neutron histories and 55 active cycles with
                                                                                                                  4000 neutrons per cycle.
                                                                                                                 219618 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                               299424 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 24 13:38 1996 File Name: s3020ae.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXIX - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99675 to .99882, .99571 to .99985, and .99503 to 1.00054 the estimated collision/absorption neutron removal lifetime = 8.66E-05 seconds with an estimated standard deviation of 2.14E-07

```
version 4a
                          ld=10/01/93
                                                               04/22/96 14:49:34
1mcnp
                                                               ***********
                                                                                                      probid =
                                                                                                                  04/22/96 14:49:34
 inp=s3020ad outp=s3020ad0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ad)
                    Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.048982-2 -1
                                            IMP:N=1
                     2 8.035742-2 1 -2 IMP:N=1
                     OUTSIDE WORLD
                     0 2 IMP:N=0
   10-
              C
                     SURFACE SPECIFICATIONS
                     so 335
so 395
   11-
                                     $ INNER FUEL ZONE
   12-
              2
                                     $ INNER FUEL ZONE
   13-
   14-
              MODE N
   15-
              KCODE 4000 1. 7 37
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                       0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
              C
                      MATERIAL SPECIFICATIONS
   19-
                        (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
              С
   20-
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              С
   21-
                                                8016.50c 4.315649-2 11023.50c 4.189111-4
              m1
                        1001.50c 1.845371-2
   22-
23-
24-
25-
26-
27-
28-
29-
30-
                       12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
                       19000.50c 5.915591-4 20000.50c 6.060152-4 26000.55c 1.493674-4
                       92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                       92238.50c 1.905500-3 93237.50c 2.182926-6
                       lwtr.01t
              mt1
                        30 vol% water in calico Hills tuff
                       1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4 12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
              m2
                       19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
                       lwtr.01t
              mt2
              PRINT
   32-
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ad)
                                                                                                                    probid = 04/22/96 14:49:34
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 7 cycles and run a total of 37 cycles with nominally this problem has run 7 inactive cycles with 27947 neutron histories and 30 active cycles with
                                                                                                                        4000 neutrons per cycle.
                                                                                                                       120000 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                     147947 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
            the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99945 with an estimated standard deviation of .00139

May 24 13:37 1996 File Name: s3020ad.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXX - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are .99803 to 1.00086, .99658 to 1.00231, and .99558 to 1.00331 the estimated collision/absorption neutron removal lifetime = 8.55E-05 seconds with an estimated standard deviation of 2.59E-07

```
version 4a
                           ld=10/01/93
                                                                  04/22/96 13:48:28
1mcnp
                                                                 *********
                                                                                                         probid = 04/22/96 13:48:28
 inp=s3020ac outp=s3020ac0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ac)
                    Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                      INNER WATER REGION
                      1 8.048982-2 -1
                      2 8.035742-2 1 -2 IMP:N=1
                      OUTSIDE WORLD
                      0 2 IMP:N=0
   10-
               C
                      SURFACE SPECIFICATIONS
   11-
                      so 345
                                      $ INNER FUEL ZONE
   12-
                      SO 405
                                      $ INNER FUEL ZONE
   13-
   14-
               MODE N
   15-
               KCODE 4000 1. 7 37
                      KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   17-
               C
   18-
               C
                       MATERIAL SPECIFICATIONS
   19-
               C
                         (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
   2Ó-
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               С
                        1001.50c 1.845371-2 8016.50c 4.315649-2 11023.50c 4.189111-4 12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
   21 -
22 -
23 -
24 -
25 -
26 -
28 -
29 -
30 -
               m1
                        19000.50c 5.915591-4 20000.50c 6.060152-4 26000.55c 1.493674-4
                        92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                        92238.50c 1.905500-3 93237.50c 2.182926-6
               mt1
                        lwtr.01t
                         30 vol% water in calico Hills tuff
                        1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4 12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
               m2
                        19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
               mt2
                        lwtr.01t
   32-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ac)
                                                                                                                        probid = 04/22/96 13:48:28
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 7 cycles and run a total of 37 cycles with nominally this problem has run 7 inactive cycles with 28028 neutron histories and 30 active cycles with
                                                                                                                            4000 neutrons per cycle.
                                                                                                                            120580 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                       148608 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
             the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

May 13 15:51 1996 File Name: s3020ac.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXXI - Page 2.

the estimated 68, 95, & 99 percent keff confidence intervals are .99660 to .99952, .99511 to 1.00101, and .99407 to 1.00205 the estimated collision/absorption neutron removal lifetime = 8.64E-05 seconds with an estimated standard deviation of 2.39E-07

```
1mcnp
                         ld=10/01/93
                                                            04/24/96 08:54:00
          version 4a
                                                                                                probid =
                                                                                                           04/24/96 08:54:00
 inp=s3020ab outp=s3020ab0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ab)
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
                    1 8.048982-2 -1 IMP:N=1
2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
                    0 2 IMP:N=0
    9-
   10-
             C
                    SURFACE SPECIFICATIONS
   11-
                    so 355
                                  $ INNER FUEL ZONE
                    SQ 415
             2
   12-
                                   $ INNER FUEL ZONE
   13-
   14-
             MODE N
   15-
              KCODE 4000 1, 20 75
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   16-
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
             C
                     MATERIAL SPECIFICATIONS
                       (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
   19-
             C
   20-
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21 -
22 -
23 -
24 -
25 -
                                             8016.50c 4.315649-2 11023.50c 4.189111-4
                       1001.50c 1.845371-2
             m1
                      12000.50c 2.461111-4 13027.50c 2.774156-3 14000.50c 1.213794-2
                      19000.50c 5.915591-4 20000.50c 6.060152-4 26000.55c 1.493674-4 92234.50c 4.694450-7 92235.50c 3.825286-5 92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
             mt1
                      lwtr.01t
   27-
28-
                       30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
             m2
   29-
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
   30-
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
             mt2
                      lwtr.01t
   32-
             PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020ab)
                                                                                                             probid = 04/24/96 08:54:00
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 20 cycles and run a total of 75 cycles with nominally
                                                                                                                  4000 neutrons per cycle.
 this problem has run 20 inactive cycles with 80504 neutron histories and 55 active cycles with
                                                                                                                 220090 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                               300594 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
           the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00101 to 1.00301, 1.00002 to 1.00401, and .99935 to 1.00467 the estimated collision/absorption neutron removal lifetime = 8.54E-05 seconds with an estimated standard deviation of 1.92E-07

```
1mcnp
          version 4a
                          ld=10/01/93
                                                             04/22/96 14:09:18
                                                                                                  probid =
                                                                                                              04/22/96 14:09:18
 inp=s3020aa outp=s3020aa0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020aa)
                   Calico Hills Tuff 1.746 g/cc .306 porosity - sphere surrounded by tuff
                    CELL SPECIFICATIONS
                    INNER WATER REGION
1 8.048982-2 -1
                                           IMP:N=1
                    2 8.035742-2 1 -2 IMP:N=1
                    OUTSIDE WORLD
    8 -
9 -
                    0 2 IMP:N=0
   10-
              C
                    SURFACE SPECIFICATIONS
   11-
                                   $ INNER FUEL ZONE
                    so 365
   12-
13-
              2
                    so 425
                                   $ INNER FUEL ZONE
   14-
              MODE N
KCODE 4000 1. 10 40
   15 -
   16-
                    KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   17-
                      0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   18-
              C
                     MATERIAL SPECIFICATIONS
   19-
                       (30 vol% water in calico Hills tuff) x .92 8 vol% UO2
              C
   20 -
21 -
22 -
23 -
25 -
26 -
27 -
28 -
                       3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
                                              8016.50c 4.315649-2 11023.50c 4.189111-4
                       1001.50c 1.845371-2
              m1
                      12000.50c 2.461111-4
                                             13027.50c 2.774156-3 14000.50c 1.213794-2
                      19000.50c 5.915591-4
                                              20000.50c 6.060152-4 26000.55c 1.493674-4
                      92234.50c 4.694450-7
                                              92235.50c 3.825286-5 92236.50c 9.153184-6
                      92238.50c 1.905500-3 93237.50c 2.182926-6
              mt1
                      lwtr.01t
                       30 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 3.695585-2 11023.50c 2.964542-4
              m2
   29-
                      12000.50c 1.741675-4 13027.50c 1.963209-3 14000.50c 8.589752-3
   30-
                      19000.50c 4.186334-4 20000.50c 4.288637-4 26000.55c 1.057041-4
   31-
              mt2
                      lwtr.01t
   32-
              PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H20/ 8% U02 (s3020aa)
                                                                                                                probid =
                                                                                                                           04/22/96 14:09:18
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 10 cycles and run a total of 40 cycles with nominally this problem has run 10 inactive cycles with 40180 neutron histories and 30 active cycles with
                                                                                                                    4000 neutrons per cycle.
                                                                                                                   119777 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                 159957 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
warning, the kitrk length) cycle values do not appear normally distributed at the 99 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = 1.00209 with an estimated standard deviation of .00141

May 24 13:23 1996 File Name: s3020aa.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXXXIII - Page 2

the estimated 68, 95, & 99 percent keff confidence intervals are 1.00066 to 1.00353, .99919 to 1.00499, and .99818 to 1.00601 the estimated collision/absorption neutron removal lifetime = 8.57E-05 seconds with an estimated standard deviation of 2.42E-07

```
ld=10/01/93
                                                           04/29/96 10:55:36
1mcnp
          version 4a
                                                                                              probid =
                                                                                                         04/29/96 10:55:36
 INP=3E47W08I OUTP=3E4708.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 47% Water 8.0% U-Np 02
    2-
                  k-inf Optimization For Positive Water Coefficient
             C
                  SPHERE
    5 -
                         8.50824092506-2
                                                    IMP:N=1 $ Uranium/Tuff/Water
             C
                        3
                              8.61040596000-2
                                                  1 -2 IMP:N=1 $ Tuff/Water Reflector
                  OUTSIDE WORLD
                  30
                       0
                                                 IMP:N=0 $ Void
   10-
             30
                  0
                                            IMP:N=0 $ Void
   11-
   12-
             C
                  SURFACES
             1*
                          0 0 0 10.00
   13-
                                            $ *Infinite FISSILE SPHERE
                               0 0 0 174.51
                                                  $ REFLECTOR
   14-
             C
   15 -
 warning.
           this surface has been replaced by a surface of type so
   16-
   17-
             MODE N
             KCODE 500 1 3
   18-
   19-
             KSRC
                    0
                       0
                                  0
                                      0
                                              0
                                                                  0 -1 0
                                                                             0
                                                                                0 1
                                                                                         0
                                                                                           0 -1
                          n
                                                         1
   20-
                                  - 1
                                              0
                                                         0 -1
                           n
                                      0
                                                 1
                                                       1
   21-
                                                      -1 0 -1
                           0
                               -1 -1
                                      0
                                          -1
                                              0
                                                1
   22-
23-
24-
25-
                                0 -1
                                           0
                                             1 - 1
                                                      0 -1 -1
                                          -1 -1 1
                                                     -1 -1 -1
                  92234.50C 4.694450-7
                                         92235.50C 3.825286-5
                                                                92236.50C 9.153184-6
                                                                                            $ Fi
                  92238.50C 1.905500-3
                                         93237.50c 2.182926-6
                                                                 8016.50C 4.129133-2
                                                                                            $ At
   26 -
27 -
28 -
29 -
                   1001.50C 2.891081-2
                                                                                            $ an
                  14000.50C 9.269607-3
                                        13027.50C 2.118592-3
12000.50C 1.879523-4
                                                                                            $ Ca
                  26000.55C 1.140702-4
                                                                20000.50C 4.628070-4
                                                                                            $ Wi
                  11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                            $ 47
   30-
                  LWTR.01T
                                                                                            $ Wa
   31-
                         1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
             C
                  M3
   32 -
33 -
                         8016.50C 4.063067-2
             C
                                             12000.50c 2.042960-4 20000.50c 5.030511-4
                        26000.55c 1.239894-4
   34-
                        11023.50c 3.477367-4 19000.50c 4.910511-4
   35 -
                  MT3 LWTR.01T
   36-
             PRINT
      initial source from ksrc card.
                                                                                                           print table 90
                                                                                                           probid = 04/29/96 10:55:36
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 47% Water 8.0% U-Np 02
 the initial fission neutron source distribution used the 23 source points that were input on the ksrc card.
                                                                                                                500 neutrons per cycle.
 the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally
                                                                                                              250071 neutron histories.
 this problem has run 3 inactive cycles with
                                                    1553 neutron histories and 500 active cycles with
 this calculation has completed the requested number of keff cycles using a total of
                                                                                             251624 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

```
the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = 1.01025 with an estimated standard deviation of .00091 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00934 to 1.01116, 1.00844 to 1.01206, and 1.00784 to 1.01265 the estimated collision/absorption neutron removal lifetime = 8.46E-05 seconds with an estimated standard deviation of 1.46E-07

```
04/27/96 15:54:54
          version 4a
                         ld=10/01/93
1mcnp
                                                                                                               04/27/96 15:54:54
                                                                                                   probid =
 INP=3E40W08I OUTP=3E4008.0
              Farfield Criticality - Sphere of Transmuted 3.0E 20GWD 40% Water 8.0% U-Np 02
    2-
                   k-inf Optimization For Positive Water Coefficient
    3-
                   SPHERE
                          7.86236115346-2
                                                       IMP:N=1 $ Uranium/Tuff/Water
                               8.61040596000-2
                        3
                                                     1 -2 IMP:N=1 $ Tuff/Water Reflector
    7-
8-
                   OUTSIDE WORLD
    9-
                   30 0
                                                    IMP:N=0 $ Void
   1Ó-
              30
                   0
                                               IMP:N=0 $ Void
   11-
   12-
13-
              C
                   SURFACES
                           0 0 0 10.00
                   S
                                              $ *Infinite FISSILE SPHERE
   14-
                                0 0 0 174.51
                                                     $ REFLECTOR
   15-
 warning.
           this surface has been replaced by a surface of type so
  16-
   17-
              MODE N
   18-
              KCODE
                    500
                          1 3
   19-
              KSRC
                     0
                        0
                            0
                                    0
                                       0
                                            - 1
                                                O
                                                         0
                                                             1
                                                                     0 -1 0
                                                                                 0
                                                                                    0 1
                                                                                                0 -1
   20-
                                                             0 -1
                            0
                                   - 1
                                        0
                                             1
                                                0
                                                         1
   21-
                            n
                                - 1
                                   - 1
                                            - 1
                                                         -1 0 -1
                                        n
                                                ก 1
   22-
23-
24-
25-
26-
27-
                     Ω
                                 0 -1
                                             n
                                                1 -1
                                                         0 -1 -1
                                                        -1 -1 -1
                                           92235.50C 3.825286-5
                   92234.50C 4.694450-7
                                                                   92236.50C 9.153184-6
                   92238.50C 1.905500-3
                                           93237.50C 2.182926-6
                                                                    8016.50C 3.913840-2
                                                                                                $ At
                    1001.50c 2.460494-2
                                                                                                $ an
                   14000.50C 9.269607-3
                                           13027.50c 2.118592-3
                                                                                                $ Ca
   28-
29-
30-
                   26000.55c 1.140702-4 12000.50c 1.879523-4 11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                   20000.50C 4.628070-4
                                                                                                $ Wi
                                                                                                $ 47
                  LWTR.01T
                                                                                                 $ Wa
                          1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
   31-
              C
                   M3
   32-
                         8016.50C 4.063067-2
              C
   33-
                         26000.55C 1.239894-4
                                                12000.50c 2.042960-4
                                                                        20000.50c 5.030511-4
   34-
                         11023.50c 3.477367-4 19000.50c 4.910511-4
   35-
                   MT3 LWTR.01T
              PRINT
   36-
                                                                                                                 print table 90
      initial source from ksrc card.
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 40% Water 8.0% U-Np 02
                                                                                                                 probid = 04/27/96 15:54:54
 the initial fission neutron source distribution used the 23 source points that were input on the ksrc card.
the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally this problem has run 3 inactive cycles with 1592 neutron histories and 500 active cycles with
                                                                                                                      500 neutrons per cycle.
                                                                                                                    250396 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                  251988 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
```

the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.02854 with an estimated standard deviation of .00090 the estimated 68, 95, & 99 percent keff confidence intervals are 1.02764 to 1.02944, 1.02675 to 1.03033, and 1.02616 to 1.03091 the estimated collision/absorption neutron removal lifetime = 8.61E-05 seconds with an estimated standard deviation of 1.50E-07

BBA00000-01717-0200-00016 REV 00 ATTACHMENT CXXXVI -

May 21 13:43 1996 File Name: P4715-3.0E-20GWD-35W08U

INP=3E35W08I OUTP=3E3508.0

```
FarField Criticality - Sphere of Transmuted 3.0E 20GWD 35% Water 8.0% U-Np 02
   2-
                 k-inf Optimization For Positive Water Coefficient
            C
                 SPHERE
   5 -
                       7.40101845946-2
                                                   IMP:N=1 $ Uranium/Tuff/Water
                            8.61040596000-2
   6-
            C
                                                 1 -2 IMP:N=1 $ Tuff/Water Reflector
   8-
                 OUTSIDE WORLD
   9-
                 30
                      0
                                                IMP:N=0 $ Void
  10-
            30
                 0
                                           IMP:N=0 $ Void
  11-
                 SURFACES
  12-
            C
  13-
            1 *
                 S
                        0 0 0 10.00
                                          $ *Infinite FISSILE SPHERE
  14-
            C
                             0 0 0 174.51
                                                $ REFLECTOR
  15-
warning.
          this surface has been replaced by a surface of type so
 16-
 17-
            MODE N
 18-
            KCODE 500 1 3 503
            KSRC
                              1 0
 19-
                   0
                      0
                         0
                                     0
                                         - 1
                                             0
                                                       1
                                                                0 -1 0
                                                                            0
                                                                               0 1
                                                                                          0 -1
  20-
                         0
                                     0
                                             Ð
                                                        0 -1
                      1
                              1 -1
                                         1
                                               1
                                                     1
  21-
                                            0 1
                                                    -1 0 -1
                             -1 -1
                                     0
                  - 1
                         n
                                         - 1
                      1
 22-
23-
24-
25-
                   a
                              n
                                - 1
                                         Ω
                                                     0 - 1 - 1
                      1
                                            1 - 1
                                         -1 -1
                                               1
                 92234.500 4.694450-7
                                        92235.50C 3.825286-5
                                                              92236.50C 9.153184-6
                                                                                          $ Fi
                 92238.50C 1.905500-3
                                        93237.50C 2.182926-6
                                                               8016.50c 3.760059-2
                                                                                          $ At
 26 -
27 -
                  1001.50c 2.152933-2
                                                                                          $ an
                 14000.50c 9.269607-3 13027.50c 2.118592-3
                                                                                          $ Ca
 28 -
29 -
                 26000.55c 1.140702-4 12000.50c 1.879523-4
                                                              20000.50C 4.628070-4
                                                                                          $ Wi
                 11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                          $ 47
 3Ó-
                LWTR.01T
                                                                                          $ Wa
 31-
            C
                 м3
                       1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
 32-
            C
                       8016.50C 4.063067-2
                      26000.55c 1.239894-4 12000.50c 2.042960-4 20000.50c 5.030511-4
 33 -
            C
                      11023.50c 3.477367-4 19000.50c 4.910511-4
 34 -
 35-
                 MT3 LWTR.01T
            PRINT
 36-
    initial source from ksrc card.
```

print table 90

1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 35% Water 8.0% U-Np 02 probid = 04/27/96 16:47:00

the initial fission neutron source distribution used the 23 source points that were input on the ksrc card. the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally 500 neutrons per cycle. this problem has run 3 inactive cycles with 1546 neutron histories and 500 active cycles with 250601 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 252147 fission neutron source histories. all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

```
the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = 1.03566 with an estimated standard deviation of .00094 the estimated 68, 95, & 99 percent keff confidence intervals are 1.03472 to 1.03661, 1.03378 to 1.03754, and 1.03317 to 1.03816 the estimated collision/absorption neutron removal lifetime = 8.63E-05 seconds with an estimated standard deviation of 1.54E-07

```
1mcnp
          version 4a
                        ld=10/01/93
                                                          04/27/96 17:32:06
                                                                                            probid =
                                                                                                       04/27/96 17:32:06
 INP=3E30W081 OUTP=3E3008.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 30% Water 8.0% U-Np 02
    2-
                  k-inf Optimization For Positive Water Coefficient
             C
                  SPHERE
                        6.93967576546-2
                                           - 1
                                                    IMP:N=1 $ Uranium/Tuff/Water
                       3
                             8.61040596000-2
                                                  1 -2 IMP:N=1 $ Tuff/Water Reflector
                  OUTSIDE WORLD
                  30
                       0
                                                 IMP:N=0 $ Void
   10-
             30
                  0
                                            IMP:N=0 $ Void
   11-
   12-
                  SURFACES
   13-
             1*
                         0 0 0 10.00
                  S
                                           $ *Infinite FISSILE SPHERE
                              0 0 0 174.51
                                                 $ REFLECTOR
   14-
             C
   15-
 warning.
           this surface has been replaced by a surface of type so
   16-
   17-
             KCODE 500 1 3
   18-
   19-
             KSRC
                    Ò
                       0
                          0
                                             0
                                                                 0 -1 0
                                  0
                                     0
                                          - 1
                                                n
                                                        1
                                                                            0 0 1
                                                                                       0 0 - 1
   20-
                          0
                               1 -1
                                     O
                                          1
                                             n
                                                      1
                                                        0 -1
   21-
                              -1 -1
                                          - 1
                                             0
                                                     -1 0 -1
   22-
23-
                    n
                               0 -1
                                          0
                                            1 - 1
                                                      0 -1 -1
                                                    -1 -1 -1
   24 -
25 -
                  92234.50C 4.694450-7
                                        92235.50C 3.825286-5
                                                              92236.50C 9.153184-6
                                                                                          $ Fi
                  92238.50C 1.905500-3
                                        93237.50c 2.182926-6
                                                               8016.50C 3.606278-2
                                                                                          $ At
   26-
27-
28-
                   1001.50c 1.845371-2
                                                                                          $ an
                  14000.50C 9.269607-3
                                        13027.50c 2.118592-3
                                                                                          $ Ca
                  26000.55C 1.140702-4
                                        12000.50C 1.879523-4
                                                              20000.50C 4.628070-4
                                                                                          $ Wi
   29-
                  11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                          $ 47
   30-
                  LWTR.01T
                                                                                          $ Wa
   31-
             C
                        1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
   32-
                        8016.50C 4.063067-2
   33-
                       26000.55c 1.239894-4 12000.50c 2.042960-4 20000.50c 5.030511-4
   34 -
                       11023.50c 3.477367-4 19000.50c 4.910511-4
   35-
             C
                  MT3 LWTR.01T
   36-
             PRINT
      initial source from ksrc card.
                                                                                                         print table 90
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 30% Water 8.0% U-Np 02
                                                                                                         probid = 04/27/96 17:32:06
 the initial fission neutron source distribution used the 23 source points that were input on the ksrc card.
 the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally
                                                                                                               500 neutrons per cycle.
 this problem has run 3 inactive cycles with
                                                   1490 neutron histories and 500 active cycles with
                                                                                                            249800 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                           251290 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
```

the k(collision) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the final estimated combined collision/absorption/track-length keff = 1.04272 with an estimated standard deviation of .00097 the estimated 68, 95, & 99 percent keff confidence intervals are 1.04175 to 1.04368, 1.04079 to 1.04464, and 1.04016 to 1.04527 the estimated collision/absorption neutron removal lifetime = 8.67E-05 seconds with an estimated standard deviation of 1.53E-07

```
1mcnp
          version 4a
                        ld=10/01/93
                                                          04/27/96 18:14:23
                                                                                             probid =
                                                                                                        04/27/96 18:14:23
 INP=3E25W08I OUTP=3E2508.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 25% Water 8.0% U-Np 02
    2-
                  k-inf Optimization For Positive Water Coefficient
    3-
             C
                  SPHERE
                        6.47833307146-2
                                                    IMP:N=1 $ Uranium/Tuff/Water
                             8.61040596000-2
             C
                                                  1 -2 IMP:N=1 $ Tuff/Water Reflector
             C
    8-
             C
                  OUTSIDE WORLD
                                                 IMP:N=0 $ Void
             C
                  30
                       0
   10-
             30
                                            IMP:N=0 $ Void
   11-
   12-
             C
   13-
                         0 0 0 10.00
                                           $ *Infinite FISSILE SPHERE
   14-
             r.
                              0 0 0 174.51
                                                 $ REFLECTOR
   15-
 warning.
           this surface has been replaced by a surface of type so
   16-
   17-
             MODE N
   18-
             KCODE
                   500 1 3
   19-
             KSRC
                    0
                       0 0
                               1 0
                                     0
                                          - 1
                                              0
                                                      0
                                                        1
                                                            0
                                                                 0 -1 0
                                                                            0 0 1
                                                                                       n
                                                                                          0 -1
  20-
21-
22-
23-
24-
25-
26-
27-
                               1 -1
                                     0
                                           1
                                              0
                                                      1 0 -1
                               -1 -1
                                     0
                                          - 1
                                              0
                                                     -1 0 -1
                    0
                               0 -1
                                           0
                                             1 -1
                                                      0 -1 -1
                                          -1 -1
                                                     -1 -1 -1
                  92234.50C 4.694450-7
                                         92235.50c 3.825286-5
                                                               92236.50C 9.153184-6
                                                                                           $ Fi
                  92238.50C 1.905500-3
                                         93237.50C 2.182926-6
                                                                8016.50C 3.452497-2
                                                                                           $ At
                   1001.50c 1.537809-2
                                                                                           $ an
                  14000.50C 9.269607-3
                                         13027.50c 2.118592-3
                                                                                           $ Ca
   28-
                  26000.55c 1.140702-4 12000.50c 1.879523-4
                                                               20000.50C 4.628070-4
                                                                                           $ Wi
   29-
                  11023.50C 3.199178-4 19000.50C 4.517670-4
                                                                                           $ 47
   30 -
31 -
                 LWTR.01T
                                                                                           $ Wa
                        1001.50C 3.142479-2
                  м3
                                              14000.50C 1.007566-2 13027.50C 2.302817-3
   32-
                        8016.50C 4.063067-2
             C
   33.
                       26000.55C 1.239894-4
                                             12000.50C 2.042960-4 20000.50C 5.030511-4
   34-
                       11023.50c 3.477367-4 19000.50c 4.910511-4
   35-
                  MT3 LWTR.01T
             PRINT
   36-
      initial source from ksrc card.
                                                                                                          print table 90
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 25% Water 8.0% U-Np 02
                                                                                                          probid = 04/27/96 18:14:23
 the initial fission neutron source distribution used the 23 source points that were input on the ksrc card.
the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally
                                                                                                               500 neutrons per cycle.
                                                    1500 neutron histories and 500 active cycles with
this problem has run 3 inactive cycles with
                                                                                                             250102 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                            251602 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.04320 with an estimated standard deviation of .00102 the estimated 68, 95, & 99 percent keff confidence intervals are 1.04217 to 1.04422, 1.04116 to 1.04523, and 1.04050 to 1.04589 the estimated collision/absorption neutron removal lifetime = 8.66E-05 seconds with an estimated standard deviation of 1.64E-07

the final estimated combined collision/absorption/track-length keff = 1.03318 with an estimated standard deviation of .00108 the estimated 68, 95, & 99 percent keff confidence intervals are 1.03210 to 1.03426, 1.03103 to 1.03533, and 1.03033 to 1.03603 the estimated collision/absorption neutron removal lifetime = 8.49E-05 seconds with an estimated standard deviation of 1.64E-07

đ

```
1mcnp
           version 4a
                          ld=10/01/93
                                                               04/27/96 18:54:26
                                                                                                     probid =
                                                                                                                 04/27/96 18:54:26
 INP=3E20W08I OUTP=3E2008.0
              Farfield Criticality - Sphere of Transmuted 3.0E 20GWD 20% Water 8.0% U-Np 02
                   k-inf Optimization For Positive Water Coefficient
    3-
              C
                   SPHERE
                          6.01699037746-2
                                               - 1
                                                        IMP:N=1 $ Uranium/Tuff/Water
                                8.61040596000-2
                                                      1 -2 IMP:N=1 $ Tuff/Water Reflector
    8-
                   OUTSIDE WORLD
    9-
                   30
                         0
                                                     IMP:N=0 $ Void
   10-
              30
                                               IMP:N=0 $ Void
   11-
   12-
   13-
              1*
                           0 0 0 10.00
                                               $ *Infinite FISSILE SPHERE
                                 0 0 0 174.51
   14-
                                                      $ REFLECTOR
   15 -
 warning.
            this surface has been replaced by a surface of type so
   16-
   17-
              MODE N
   18-
              KCODE 500 1 3
   19-
                      0 0
                                     0
                                                 0
              KSRC
                            0
                                  1
                                        0
                                                             1
                                                                       0 -1 0
                                                                                   0
                                                                                      0 1
                                                                                                  0 -1
   20-
                            0
                                  1 -1
                                         0
                                                 O
                                                          1
                                                              0 -1
   21-
                            n
                                 -1 -1
                                        0
                                             -1
                                                 0
                                                          -1 0 -1
                         1
   22-
23-
24-
25-
                                  0 -1
                                              0
                                                 1 -1
                                                          0 -1 -1
                                        1
                                    1
                                                         -1 -1 -1
                                             -1 -1
                                            92235.50c 3.825286-5
                    92234.50C 4.694450-7
                                                                     92236.50C 9.153184-6
                                                                                                   $ Fi
                    92238.50c 1.905500-3
                                            93237.50C 2.182926-6
                                                                     8016.50C 3.298716-2
                                                                                                   $ At
   26-
27-
28-
29-
30-
                     1001.50c 1.230247-2
                                                                                                   $ an
                    14000.50C 9.269607-3
                                                                                                   $ Ca
                                            13027.50C 2.118592-3
                    26000.55c 1.140702-4 12000.50c 1.879523-4 20000.50c 4.628070-4
                                                                                                   $ Wi
                    11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                                   $ 47
                   LWTR.01T
                                                                                                   $ Wa
   31-
                    м3
                          1001.50C 3.142479-2 14000.50C 1.007566-2 13027.50C 2.302817-3
   32-
                          8016.50C 4.063067-2
                          26000.55c 1.239894-4 12000.50c 2.042960-4 20000.50c 5.030511-4
   33 -
              C
   34 -
                          11023.50c 3.477367-4 19000.50c 4.910511-4
              C
   35 -
                   MT3 LWTR.01T
   36-
              PRINT
       initial source from ksrc card.
                                                                                                                    print table 90
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 20% Water 8.0% U-Np 02
                                                                                                                    probid = 04/27/96 18:54:26
the initial fission neutron source distribution used the 23 source points that were input on the ksrc card. the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally this problem has run 3 inactive cycles with 1413 neutron histories and 500 active cycles with 25
                                                                                                                         500 neutrons per cycle.
                                                                                                                       250887 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                    252300 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
```

the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

```
1mcnp
          version 4a
                         ld=10/01/93
                                                             04/27/96 19:32:52
                                                                                                 probid =
                                                                                                             04/27/96 19:32:52
 INP=3E15W08I OUTP=3E1508.0
              FarField Criticality - Sphere of Transmuted 3.0E 20GWD 15% Water 8.0% U-Np 02
                   k-inf Optimization For Positive Water Coefficient
    3 -
                   SPHERE
    5 -
                         5.55564768346-2
                                                       IMP:N=1 $ Uranium/Tuff/Water
    6-
             C
                               8.61040596000-2
                                                    1 -2 IMP:N=1 $ Tuff/Water Reflector
             C
    8-
             C
                   OUTSIDE WORLD
    9-
                   30
                        0
                                                   IMP:N=0 $ Void
   10-
                   Ō
             30
                                              IMP:N=0 $ Void
   11-
   12-
             C
                   SURFACES
                                             $ *Infinite FISSILE SPHERE
   13-
              1*
                          0 0 0 10.00
                   S
   14-
             C
                                0 0 0 174.51
                                                    $ REFLECTOR
   15 -
 warning.
           this surface has been replaced by a surface of type so
   16-
   17-
              MODE N
   18-
              KCODE 500 1 3
   19-
              KSRC
                     0 0 0
                                 1
                                    0
                                       0
                                                0
                                                                    0 -1
                                                                                   0 1
                                                                                               0 -1
                                                                           0
                                                                                            0
   20 -
21 -
                                                0
                           0
                                                        1 0 -1
                                   - 1
                                       0
                                            1
                                                   1
                    -1
                           0
                                -1 -1
                                       n
                                            - 1
                                                0
                                                        -1 0 -1
                                                  - 1
   22 -
23 -
24 -
25 -
                     0
                                 0
                                   - 1
                                             0
                                               1 -1
                                                        0 -1 -1
                                            - 1
                                               - 1
                                                        -1 -1 -1
                                          92235.50C 3.825286-5
                   92234.50C 4.694450-7
                                                                  92236.50c 9.153184-6
                                                                                               $ Fi
                   92238.50C 1.905500-3
                                          93237.50c 2.182926-6
                                                                   8016.50c 3.144935-2
                                                                                               $ At
   26-
27-
28-
29-
30-
                    1001.50C 9.226854-3
                                                                                               $ an
                   14000.50C 9.269607-3
                                          13027.50c 2.118592-3
                                                                                               $ Ca
                   26000.55C 1.140702-4 12000.50C 1.879523-4
                                                                  20000.50c 4.628070-4
                                                                                               $ Wi
                   11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                               $ 47
                  LWTR.01T
                                                                                               $ Wa
   31-
             C
                   М3
                         1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
   32-
33-
                         8016.50C 4.063067-2
             C
                         26000.55C 1.239894-4
                                                12000.50C 2.042960-4
                                                                       20000.50C 5.030511-4
   34 -
                        11023.50c 3.477367-4 19000.50c 4.910511-4
   35 -
                   MT3 LWTR.01T
   36-
             PRINT
      initial source from ksrc card.
                                                                                                               print table 90
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 15% Water 8.0% U-Np 02
                                                                                                               probid = 04/27/96 19:32:52
 the initial fission neutron source distribution used the 23 source points that were input on the ksrc card.
the criticality problem was scheduled to skip 3 cycles and run a total of 503 cycles with nominally this problem has run 3 inactive cycles with 1464 neutron histories and 500 active cycles with
                                                                                                                     500 neutrons per cycle.
                                                                                                                   251063 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                252527 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent
```

the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.00676 with an estimated standard deviation of .00109 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00567 to 1.00786, 1.00459 to 1.00894, and 1.00388 to 1.00964 the estimated collision/absorption neutron removal lifetime = 8.21E-05 seconds with an estimated standard deviation of 1.53E-07

```
1mcnp
          version 4a
                         ld=10/01/93
                                                           04/27/96 12:38:38
                                                                                              probid =
                                                                                                         04/27/96 12:38:38
 INP=3E47W08C OUTP=3C4708.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 47% Water 8.0% U-Np 02
    2-
                  k-eff Optimization For Positive Water Volume Coefficient
    3 -
                   SPHERE
                         8.50824092506-2
                                                     IMP:N=1
                                                               $ Uranium/Tuff/Water
             5
                         8.61040596000-2
                                             1 -2
                  3
                                                     IMP:N=1
                                                               $ Tuff/Water Reflector
    8-
                  OUTSIDE WORLD
    9-
             30
                  0
                         2
                                             IMP:N=0
                                                     $ Void
   10-
   11-
             C
                  SURFACES
   12-
                  S
                          0 0 0 150.00
                                             $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
   13-
             2
                  S
                          0 0 0 210.00
                                             $ REFLECTOR
   14-
 warning.
           this surface has been replaced by a surface of type so
   15-
   16-
             MODE N
   17-
             KCODE 500
                             3
                             0 0
                                        0
   18-
             С
                  KSRC
                          0
                                           0
                                                - 1
                                                    0
                                                      n
                                                            n
                                                              1 0
                                                                       0 -1 0
                                                                                   0
                                                                                      0 1
                                                                                              0
   19-
                                                               0 -1
                                O
                                       - 1
                                           0
                                                    0
                                                            1
                             1
   20-
21-
22-
23-
24-
25-
26-
27-
28-
                                       -1
                                                    0
                                                           - 1
                                                               0 -1
             C
                         - 1
                             1
                                0
                                    -1
                                           0
                                                - 1
                                                      1
                                                              -1 -1
                          0
                                     0
                                       - 1
                                           1
                                                0
                                                            0
                                                           -1 -1 -1
                  92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                                                                                            $ Fi
                  92238.50c 1.905500-3 93237.50c 2.182926-6
                                                                8016.50C 4.129133-2
                                                                                            $ At
                   1001.50C 2.891081-2
                                                                                            $ an
                   14000.50c 9.269607-3 13027.50c 2.118592-3
                                                                                            $ Ca
                   26000.55c 1.140702-4 12000.50c 1.879523-4
                                                                20000.50C 4.628070-4
                                                                                            $ Wi
$ 47
                   11023.50c 3.199178-4 19000.50c 4.517670-4
   29 -
30 -
             MT1 LWTR.01T
                                                                                            $ Wa
                   1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
                                                                                            $ Ca
   31 -
32 -
                   8016.50C 4.063067-2
                                                                                            $ Wi
                   26000.55C 1.239894-4
                                         12000.50C 2.042960-4
                                                                20000.50C 5.030511-4
                                                                                            $ 47
   33 -
                   11023.50c 3.477367-4 19000.50c 4.910511-4
   34 -
             MT3 LWTR.01T
                                                                                            $ Wa
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 47% Water 8.0% U-Np 02
                                                                                                                      04/27/96 12:38:38
                                                                                                            probid =
 the initial fission neutron source distribution was read from the srctp file named srctp
                                                                                                                 500 neutrons per cycle.
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
 this problem has run 3 inactive cycles with
                                                     1498 neutron histories and 1000 active cycles with
                                                                                                               500461 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                             501959 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .98706 with an estimated standard deviation of .00067 the estimated 68, 95, & 99 percent keff confidence intervals are .98638 to .98773, .98571 to .98840, and .98528 to .98884 the estimated collision/absorption neutron removal lifetime = 9.01E-05 seconds with an estimated standard deviation of 1.39E-07

0

```
1mcnp
           version 4a
                         ' l'a=fu/U1/95
                                                            704727796 14:15:57
                                                                                                 probid =
                                                                                                            04/27/96 14:15:37
 INP=3E40W08C OUTP=3C4008.0
              FarField Criticality - Sphere of Transmuted 3.0E 20GWD 40% Water 8.0% U-Np 02
    2-
                   k-eff Optimization For Positive Water Volume Coefficient
    <u>3</u>-
              C
                   SPHERE
                          7.86236115346-2
                                                                 $ Uranium/Tuff/Water
                                                      IMP:N=1
                         8.61040596000-2
                                              1 -2
              5
                   3
                                                      IMP:N=1
                                                                $ Tuff/Water Reflector
              C
    8-
                   OUTSIDE WORLD
    9-
              30
                   0
                         2
                                              IMP:N=0 $ Void
   10-
   11-
   12-
                   S
                          0 0 0 150.00
                                              $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so
   13-
                   S
                          0 0 0 210.00
                                              $ REFLECTOR
   14-
 warning.
           this surface has been replaced by a surface of type so
   15-
              MODE N
   16-
              KCODE 500
   17-
                          1
                             3
   18-
                   KSRC
                          0
                             0
                                0
                                         0
                                            0
                                                    0
                                                                         0 -1 0
                                                                                     0
                                                                                       0
                                                                                           1
                                                     0 1
   19-
                             1
                                 0
                                      1
                                        - 1
                                            0
                                                 1
                                                             1
                                                                0 -1
                                        - 1
   20-
                                0
                                            0
                                                 - 1
                                                     0 1
                                                             -1 0 -1
                         - 1
                             1
                                     - 1
   21-
                          0
                                      0
                                        - 1
                                                 0 1 - 1
                                1
                                            1
                                                             0 -1 -1
   22-
23-
24-
25-
26-
27-
28-
30-
31-
                                                 -1 -1 1
                                                             -1 -1 -1
                                         1
                   92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
              M1
                   92238.50C 1.905500-3
                                          93237.50c 2.182926-6
                                                                  8016.50C 3.913840-2
                                                                                              $ At
                    1001.50C 2.460494-2
                                                                                              $ an
                   14000.50C 9.269607-3 13027.50C 2.118592-3
                                                                                              $ Ca
                   26000.55C 1.140702-4 12000.50C 1.879523-4
                                                                  20000.50C 4.628070-4
                                                                                              $ Wi
                   11023.50C 3.199178-4
                                         19000.50C 4.517670-4
                                                                                              $ 47
                   LWTR.01T
                                                                                              $ Wa
                    1001.50C 3.142479-2
                                          14000.50c 1.007566-2 13027.50c 2.302817-3
                                                                                              $ Ca
                    8016.50C 4.063067-2
                                                                                              S Wi
   32-
                   26000.55C 1.239894-4 12000.50C 2.042960-4 20000.50C 5.030511-4
                                                                                              $ 47
   33-
                   11023.50c 3.477367-4 19000.50c 4.910511-4
   34-
              MT3 LWTR.01T
                                                                                              $ Wa
   35-
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 40% Water 8.0% U-Np 02
                                                                                                              probid =
                                                                                                                          04/27/96 14:15:37
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
                                                                                                                    500 neutrons per cycle.
 this problem has run 3 inactive cycles with
                                                      1533 neutron histories and 1000 active cycles with
                                                                                                                  500377 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                               501910 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
            the k( collision) cycle values appear normally distributed at the 95 percent confidence level
           the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .99684 with an estimated standard deviation of .00069 the estimated 68, 95, & 99 percent keff confidence intervals are .99615 to .99753, .99547 to .99821, and .99502 to .99866 the estimated collision/absorption neutron removal lifetime = 9.29E-05 seconds with an estimated standard deviation of 1.53E-07

```
1mcnp
           version 4a
                         ld=10/01/93
                                                             05/02/96 13:25:45
                                                                                                 probid =
                                                                                                             05/02/96 13:25:45
 INP=3E35W08C OUTP=3E3508.0
              FarField Criticality - Sphere of Transmuted 3.0E 20GWD 35% Water 8.0% U-Np 02
    2-
                   k-eff Optimization For Positive Water Coefficient
    3 -
              C
                   SPHERE
                          7.40101845946-2
                                                                 $ Uranium/Tuff/Water
                                                       IMP:N=1
                          8.61040596000-2
                                               1 -2
                   3
                                                       IMP:N=1
                                                                 $ Tuff/Water Reflector
    8-
                   OUTSIDE WORLD
                                              IMP:N=0 $ Void
    Q-
              30
                   0
                         2
   10-
   11-
   12-
                           0 0 0 150.00
                   S
                                               $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so
              2
                          0 0 0 210.00
                                               $ REFLECTOR
   13-
                   S
   14-
           this surface has been replaced by a surface of type so
 warning.
   15 -
   16-
              MODE N
   17-
              KCODE 500
                              3
                   KSRC
                              Ō
                                         O
   18-
              C
                          0
                                 O
                                             Ω
                                                 - 1
                                                     0
                                                         n
                                                                1 0
                                                                          0 -1 0
                                                                                     0
                                                                                        0 1
   19-
                                                     0
                                                              1
                                                                 0 -1
                              1
                                 0
                                      1 - 1
                                             0
                                                  1
                                                        1
   20-
              C
                                 0
                                     - 1
                                        - 1
                                             0
                                                 - 1
                                                     0 1
                                                             -1 0 -1
   21-
              C
                          0
                                      0 -1
                                                  0
                                                     1 - 1
                                                              0 -1 -1
   22-
23-
24-
25-
26-
                                          1
                                                 -1 -1 1
                                                             -1 -1 -1
                                            - 1
                   92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                                                                                               $ Fi
                   92238.50c 1.905500-3
                                          93237.50c 2.182926-6
                                                                   8016.50C 3.760059-2
                                                                                               $ At
                    1001.50c 2.152933-2
                                                                                               $ an
                   14000.50C 9.269607-3
                                           13027.50c 2.118592-3
                                                                                                 Ca
   27-
28-
                                           12000.50C 1.879523-4
                   26000.55C 1.140702-4
                                                                  20000.50C 4.628070-4
                                                                                               $ Wi
                   11023.50C 3.199178-4
                                          19000.50C 4.517670-4
                                                                                               $ 47
   29 -
30 -
                                                                                               $ Wa
              MT1 LWTR.01T
                    1001.50c 3.142479-2
                                          14000.50c 1.007566-2 13027.50c 2.302817-3
                                                                                               $ Ca
   31-
                    8016.50C 4.063067-2
                                                                                               $ Wi
   32-
                   26000.55C 1.239894-4
                                          12000.50C 2.042960-4
                                                                  20000.50C 5.030511-4
                                                                                               $ 47
   33 -
                   11023.50c 3.477367-4 19000.50c 4.910511-4
   34-
              MT3 LWTR.01T
                                                                                               $ Wa
   35 -
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 35% Water 8.0% U-Np 02
                                                                                                               probid =
                                                                                                                           05/02/96 13:25:45
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally this problem has run 3 inactive cycles with 1433 neutron histories and 1000 active cycles with
                                                                                                                     500 neutrons per cycle.
                                                                                                                   500368 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                501801 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k( collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

7 ...

the final estimated combined collision/absorption/track-length keff = 1.00242 with an estimated standard deviation of .00075 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00167 to 1.00317, 1.00093 to 1.00391, and 1.00044 to 1.00439 the estimated collision/absorption neutron removal lifetime = 9.45E-05 seconds with an estimated standard deviation of 1.58E-07

```
version 4a
                        ld=10/01/93
                                                           05/02/96 14:50:47
1mcno
                                                                                              probid =
                                                                                                         05/02/96 14:50:47
 INP=3E30W08C OUTP=3E3008.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 30% Water 8.0% U-Np 02
    2-
                  k-eff Optimization For Positive Water Coefficient
             C
                  SPHERE
                         6.93967576546-2
                                                     IMP:N=1
                                                               $ Uranium/Tuff/Water
             5
                         8.61040596000-2
                                             1 -2
                                                     IMP:N=1
                                                               $ Tuff/Water Reflector
             C
    8-
             C
                  OUTSIDE WORLD
    9-
             30
                  0
                        2
                                            IMP:N=0 $ Void
   10-
   11-
             C
   12-
                          0 0 0 150.00
                  S
                                             $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
   13-
                         0 0 0 210.00
                                             $ REFLECTOR
   14-
 warning.
           this surface has been replaced by a surface of type so
   15 -
             MODE N
   16-
             KCODE 500
   17-
                            3
                                1003
   18-
             C
                  KSRC
                         0
                            Ò
                                0
                                        0
                                           0
                                                - 1
                                                   0
                                                       0
                                                              1
                                                                  0
                                                                       0 -1 0
                                                                                  0
                                                                                     0
                                                                                        1
                                                                                              0
   19-
                            1
                                       - 1
                                           0
                                                1
                                                   0
                                                            1
                                                               0 -1
             C
                                0
   20-
             C
                                0
                                    -1 -1
                                           0
                                                - 1
                                                   0
                                                           -1 0 -1
                            1
                                                       1
   21-
             C
                         0
                                1
                                     0 -1
                                           1
                                                Ω
                                                   1 - 1
                                                            0 -1 -1
   22 -
23 -
24 -
                                                -1 -1 1
                                                           -1 -1 -1
                                        1
                  92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                                                                                            $ Fi
                                         93237.50C 2.182926-6
                  92238.50C 1.905500-3
                                                                 8016.50C 3.606278-2
                                                                                            $ At
   25-
                   1001.50C 1.845371-2
                                                                                            $ an
   26-
27-
28-
                  14000.50C 9.269607-3
                                         13027.50c 2.118592-3
                                                                                            $ Ca
                  26000.55C 1.140702-4
11023.50C 3.199178-4
                                         12000.50c 1.879523-4
                                                                20000.50C 4.628070-4
                                                                                            $ Wi
                                         19000.50C 4.517670-4
                                                                                            $ 47
   29-
             MT1 LWTR.01T
                                                                                            $ Wa
                                                                                            $ Ca
   30-
                   1001.50c 3.142479-2
                                         14000.50c 1.007566-2 13027.50c 2.302817-3
   31-
                   8016.50C 4.063067-2
                                                                                            $ Wi
   32-
                  26000.55c 1.239894-4
                                         12000.50c 2.042960-4
                                                                20000.50C 5.030511-4
                                                                                            $ 47
   33-
                  11023.50c 3.477367-4 19000.50c 4.910511-4
   34-
             MT3 LWTR.01T
                                                                                            $ Va
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 30% Water 8.0% U-Np 02
                                                                                                           probid =
                                                                                                                       05/02/96 14:50:47
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
                                                                                                                 500 neutrons per cycle.
this problem has run 3 inactive cycles with
                                                    1441 neutron histories and 1000 active cycles with
                                                                                                               499950 neutron histories.
this calculation has completed the requested number of keff cycles using a total of
                                                                                             501391 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.
the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.00163 with an estimated standard deviation of .00079 the estimated 68, 95, & 99 percent keff confidence intervals are 1.00084 to 1.00242, 1.00006 to 1.00320, and .99955 to 1.00371 the estimated collision/absorption neutron removal lifetime = 9.66E-05 seconds with an estimated standard deviation of 1.63E-07

```
05/02/96 16:50:03
1mcnp
          version 4a
                         ld=10/01/93
                                                            ******
                                                                                               probid =
                                                                                                          05/02/96 16:50:03
 INP=3E25W08C OUTP=3E2508.0
             FarField Criticality - Sphere of Transmuted 3.0E 20GWD 25% Water 8.0% U-Np 02
    2-
3-
                  k-eff Optimization For Positive Water Coefficient
             C
                  SPHERE
    5-
                         6.47833307146-2
                                                               $ Uranium/Tuff/Water
             1
    6-
7-
             5
                         8.61040596000-2
                                              1 -2
                                                     IMP:N=1
                                                               $ Tuff/Water Reflector
             C
    8-
                   OUTSIDE WORLD
    ğ-
             30
                  0
                                             IMP:N=0 $ Void
   10-
   11-
             C
                  SURFACES
   12-
                  S
                          0 0 0 150.00
                                              $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
   13 -
                  S
                          0 0 0 210.00
                                              $ REFLECTOR
   14-
 warning.
           this surface has been replaced by a surface of type so
   15-
   16-
             MODE N
             KCODE 500
   17-
                  KSRC
                             Õ
   18-
             C
                         0
                                0
                                     1
                                        0
                                           0
                                                - 1
                                                    0
                                                            0
                                                               1
                                                                  0
                                                                        0 -1 0
                                                                                   0 0 1
   19-
                             1
                                n
                                       - 1
                                           0
                                                1
                                                    0
                                                            1
                                                               0 -1
   20-
             C
                         - 1
                             1
                                0
                                    -1 -1
                                           0
                                                - 1
                                                    0
                                                      1
                                                           - 1
                                                               0 -1
   21 -
22 -
23 -
24 -
25 -
26 -
27 -
28 -
                                     0 -1
                                                 0 1 - 1
                               1
                                           1
                                                            0 -1 -1
                                    -1 1
                                                -1 -1 1
                                                           -1 -1 -1
                  92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                                                                                             $ Fi
                  92238.50C 1.905500-3 93237.50C 2.182926-6
                                                                                             $ At
                                                                 8016.50C 3.452497-2
                   1001.50c 1.537809-2
                                                                                             $ an
                  14000.50C 9.269607-3
                                          13027.50c 2.118592-3
                                                                                             $ Ca
                  26000.55C 1.140702-4
11023.50C 3.199178-4
                                                                                             $ Wi
$ 47
                                         12000.50C 1.879523-4
                                                                20000.50C 4.628070-4
                                         19000.50C 4.517670-4
   29 -
30 -
             MT1
                                                                                             $ Wa
                  LWTR.01T
                                                                                             $ Ca
                   1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
   31 -
32 -
                   8016.50C 4.063067-2
                                                                                             S Wi
                  26000.55c 1.239894-4 12000.50c 2.042960-4
                                                                20000.50c 5.030511-4
                                                                                             $ 47
   33 -
                  11023.50C 3.477367-4 19000.50C 4.910511-4
   34-
             MT3 LWTR.01T
                                                                                             $ Va
   35 -
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 25% Water 8.0% U-Np 02
                                                                                                            probid =
                                                                                                                       05/02/96 16:50:03
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
                                                                                                                 500 neutrons per cycle.
                                                     1488 neutron histories and 1000 active cycles with
 this problem has run 3 inactive cycles with
                                                                                                               500779 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                              502267 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .99189 with an estimated standard deviation of .00081 the estimated 68, 95, & 99 percent keff confidence intervals are .99108 to .99270, .99027 to .99351, and .98974 to .99404 the estimated collision/absorption neutron removal lifetime = 9.80E-05 seconds with an estimated standard deviation of 1.72E-07

```
1mcnp
          version 4a
                         ld=10/01/93
                                                           05/02/96 18:10:20
                                                                                              = bidora
                                                                                                         05/02/96 18:10:20
 INP=3E20W08C OUTP=3E2008.0
              FarField Criticality - Sphere of Transmuted 3.0E 20GWD 20% Water 8.0% U-Np 02
    2-
                  k-eff Optimization For Positive Water Coefficient
    3-
             C
                  SPHERE
    5-
                         6.01699037746-2
                                                     IMP:N=1
                                                               $ Uranium/Tuff/Water
    6-
7-
                         8.61040596000-2
                                             1 -2
                                                     IMP:N=1 $ Tuff/Water Reflector
             5
    8-
                  OUTSIDE WORLD
    9-
             30
                  0
                         2
                                             IMP:N=0 $ Void
   10-
   11-
             C
                  SURFACES
   12-
                          0 0 0 150.00
                                             $ FISSILE SPHERE
 warning.
           this surface has been replaced by a surface of type so
                                             $ REFLECTOR
   13-
             2
                  S
                         0 0 0 210.00
   14-
 warning.
           this surface has been replaced by a surface of type so
   15-
   16-
   17-
             KCODE 500 1
                             3
   18-
                            0
                                        0
                                                   n
                                                                                      0 1
             C
                  KSRC
                         0
                               0
                                           n
                                                - 1
                                                            n
                                                               1 0
                                                                        0 -1 0
                                                                                   0
                                                                                              0
   19-
             C
                                0
                                       - 1
                                           0
                                                1
                                                   Ω
                                                            1
                                                               0 -1
   20-
21-
22-
23-
24-
25-
26-
28-
29-
30-
                                       - 1
                                           0
                                                    0
                                                               0 -1
             C
                         - 1
                                0
                                    -1
                                                           - 1
                          0
                                     0
                                       - 1
                                                0
                                                            0
                                                              -1 -1
                  92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                  92238.50C 1.905500-3 93237.50C 2.182926-6
                                                                 8016.50C 3.298716-2
                                                                                            $ At
                   1001.50C 1.230247-2
                                                                                            $ an
                   14000.50C 9.269607-3 13027.50C 2.118592-3
                                                                                            $ Ca
                  26000.55C 1.140702-4 12000.50C 1.879523-4
                                                                20000.50C 4.628070-4
                                                                                            $ Wi
                  11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                            $ 47
             MT1 LWTR.01T
                                                                                            $ Wa
                   1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
                                                                                            $ Ca
                  8016.50C 4.063067-2
26000.55C 1.239894-4
   31-
32-
                                                                                            $ Wi
                                         12000.50C 2.042960-4
                                                                20000.50C 5.030511-4
                                                                                            $ 47
   33 -
                  11023.50c 3.477367-4 19000.50c 4.910511-4
   34-
             MT3 LWTR.01T
                                                                                            $ Wa
   35
             PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 20% Water 8.0% U-Np 02
                                                                                                                       05/02/96 18:10:20
                                                                                                            probid =
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally
                                                                                                                 500 neutrons per cycle.
 this problem has run 3 inactive cycles with
                                                    1418 neutron histories and 1000 active cycles with
                                                                                                               499908 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                             501326 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
           the k( collision) cycle values appear normally distributed at the 95 percent confidence level
```

the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .97117 with an estimated standard deviation of .00082 the estimated 68, 95, & 99 percent keff confidence intervals are .97036 to .97199, .96955 to .97280, and .96902 to .97333 the estimated collision/absorption neutron removal lifetime = 9.98E-05 seconds with an estimated standard deviation of 1.87E-07

```
1mcnp
          version 4a
                         ld=10/01/93
                                                             05/02/96 19:26:16
                                                                                                              05/02/96 19:26:16
                                                                                                  probid =
 INP=3E15W08C OUTP=3E1508.0
              FarField Criticality - Sphere of Transmuted 3.0E 20GWD 15% Water 8.0% U-Np 02
    2-
                   k-eff Optimization For Positive Water Coefficient
    <u> 3</u> -
              C
    4 -
5 -
              C
                   SPHERE
                          5.55564768346-2
                                                                 $ Uranium/Tuff/Water
                                                       IMP:N=1
    6-
              5
                         8.61040596000-2
                                               1 -2
                                                       IMP:N=1
                                                                 $ Tuff/Water Reflector
    7-
    8 -
                   OUTSIDE WORLD
    9-
              30
                   0
                         2
                                              IMP:N=0 $ Void
   10-
   11-
                   SURFACES
   12-
                   S
                          0 0 0 150.00
                                               $ FISSILE SPHERE
 warning.
            this surface has been replaced by a surface of type so
   13-
                          0 0 0 210.00
                                               $ REFLECTOR
              2
                   S
   14 -
 warning.
            this surface has been replaced by a surface of type so
   15 -
              MODE N
   16-
              KCODE 500
   17-
                             3
                   KSRC
                             Ō
   18 -
                          0
                                Ω
                                         0
                                             O
                                                  -1 0
                                                              O
                                                                 1 0
                                                                          0 -1 0
                                                                                      O
                                                                                         0 1
                                                                                                  n
              C
   19-
                              1
                                      1 -1
                                                      0
                                                                 0 -1
                                 0
                                             0
                                                  1
                                                         1
                                                              1
   20-
                             1
                                 0
                                     -1 -1
                                             0
                                                  - 1
                                                      0
                                                             -1 0 -1
   21-
                          0
                             1
                                 1
                                      0 -1
                                                  0
                                                     1 - 1
                                                              0 -1 -1
   22 -
23 -
24 -
25 -
26 -
                                         1
                                                 -1 -1 1
                                                             -1 -1 -1
                   92234.50C 4.694450-7 92235.50C 3.825286-5 92236.50C 9.153184-6
                                                                                                $ Fi
                   92238.50C 1.905500-3
                                          93237.50c 2.182926-6
                                                                  8016.50c 3.144935-2
                                                                                                $ At
                    1001.50C 9.226854-3
                                                                                                $ an
                   14000.50C 9.269607-3
                                           13027.50c 2.118592-3
                                                                                                $ Ca
   27 -
28 -
                                                                   20000.50C 4.628070-4
                   26000.55C 1.140702-4
                                           12000.50c 1.879523-4
                                                                                                $ Wi
                   11023.50c 3.199178-4 19000.50c 4.517670-4
                                                                                                $ 47
   29 -
30 -
              MT1 LWTR.01T
                                                                                                $ Wa
                    1001.50c 3.142479-2 14000.50c 1.007566-2 13027.50c 2.302817-3
                                                                                                $ Ca
   31-
                    8016.50C 4.063067-2
                                                                                                $ Wi
   32-
                   26000.55C 1.239894-4 12000.50C 2.042960-4
                                                                   20000.50C 5.030511-4
                                                                                                $ 47
   33-
                   11023.50c 3.477367-4 19000.50c 4.910511-4
   34 -
              MT3 LWTR.01T
                                                                                                $ Wa
   35 -
              PRINT
      initial source from file srctp
1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD 15% Water 8.0% U-Np 02
                                                                                                                            05/02/96 19:26:16
                                                                                                                probid =
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 3 cycles and run a total of 1003 cycles with nominally this problem has run 3 inactive cycles with 1435 neutron histories and 1000 active cycles with
                                                                                                                     500 neutrons per cycle.
                                                                                                                   500781 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                 502216 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level.

the final estimated combined collision/absorption/track-length keff = .93067 with an estimated standard deviation of .00088 the estimated 68, 95, & 99 percent keff confidence intervals are .92979 to .93156, .92892 to .93243, and .92835 to .93300 the estimated collision/absorption neutron removal lifetime = 1.01E-04 seconds with an estimated standard deviation of 1.93E-07

```
ld=10/01/93
                                                                        05/16/96 11:06:44
1mcnp
            version 4a
                                                                                                                   probid =
                                                                                                                                05/16/96 11:06:44
 inp=s3020mz outp=s3020mz0
                Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mz) C Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
     2-
3-
                        CELL SPECIFICATIONS
                C
                        INNER WATER REGION
     5-
6-
7-
8-
                           8.374149-2 -1
                                                  IMP:N=1
                        2 8.509901-2 1 -2 IMP:N=1
                        3 8.610406-2 2 -3 IMP:N=1
                        OUTSIDE WORLD
    9-
                        0 3 IMP:N=0
    10-
   11-
12-
13-
                        SURFACE SPECIFICATIONS
                                         $ INNER FUEL ZONE
                        so 40.
                        so 80.
                                          $ INNER FUEL ZONE
    14-
                3
                        so 140.
                                           $ INNER FUEL ZONE
    15-
    16-
                MODE N
    17-
                KCODE 4000 1. 30 130
    18-
                        KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
    19-
                          0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   MATERIAL SPECIFICATIONS
                C
                           (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
1001.50c 2.561121-2 8016.50c 4.215845-2 11023.50c 2.834054-4
                С
                C
                                                      8016.50c 4.215845-2 11023.50c 2.834054-4
13027.50c 1.876796-3 14000.50c 8.211662-3
                m1
                          12000.50c 1.665012-4
                                                     20000.50c 4.099866-4 26000.55c 1.010513-4 92235.50c 8.845975-5 92236.50c 2.116674-5
                          19000.50c 4.002067-4
                          92234.50c 1.085591-6
                          92238.50c 4.406469-3 93237.50c 5.048015-6
                           lwtr.01t
                mt1
                            (47 vol% water in calico Hills tuff) x .9213 7.87 vol% UO2
                           3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
1001.50c 2.895166-2 8016.50c 4.128059-2 11023.50c 3.203698-4
12000.50c 1.882179-4 13027.50c 2.121585-3 14000.50c 9.282705-3
                С
                m2
                           12000.50c 1.882179-4
                           19000.50c 4.524054-4
                                                      20000.50c 4.634610-4
                                                                                  26000.55c 1.142314-4
                          92234.50c 4.618165-7 92235.50c 3.763125-5 92236.50c 9.004445-6
                          92238.50c 1.874536-3 93237.50c 2.147453-6
                mt2
                           lwtr.01t
                            47 vol% water in calico Hills tuff
                m3
                            1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
    39-
                          12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
    40-
                          19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
    41-
                           lwtr.01t
                mt3
    42-
                PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 18.5% U02 (s3020mz)
                                                                                                                                   = bidora
                                                                                                                                                 05/16/96 11:06:44
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120411 neutron histories and 100 active cycles with
                                                                                                                                        4000 neutrons per cycle.
                                                                                                                                       399532 neutron histories.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

519943 fission neutron source histories.

this calculation has completed the requested number of keff cycles using a total of

all cells with fissionable material were sampled and had fission neutron source points.

Jun 07 10:31 1996 File Name: s3020mz.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CXLVIII - Page 2

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .98472 with an estimated standard deviation of .00090 the estimated 68, 95, & 99 percent keff confidence intervals are .98382 to .98562, .98293 to .98651, and .98235 to .98709 the estimated collision/absorption neutron removal lifetime = 8.37E-05 seconds with an estimated standard deviation of 2.37E-07

```
05/16/96 07:29:34
           version 4a
                            ld=10/01/93
1mcnp
                                                                                                                      05/16/96 07:29:34
                                                                                                         probid =
 inp=s3020my outp=s3020my0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020my)
                     Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
    2-
    3 -
                      CELL SPECIFICATIONS
                      INNER WATER REGION
                      1 8.374149-2
                                              IMP:N=1
                      2 8.509901-2 1 -2 IMP:N=1
                      3 8.610406-2 2 -3 IMP:N=1
                      OUTSIDE WORLD
                      0 3 IMP:N=0
   10-
   11-
                      SURFACE SPECIFICATIONS
   12-
                      so 50.
                                      $ INNER FUEL ZONE
   13-
                          100.
                      SO
                                       $ INNER FUEL ZONE
   14-
               3
                          160.
                                       $ INNER FUEL ZONE
                      SO
   15-
   16-
               MODE N
   17-
               KCODE 4000 1. 30 130
   18-
                      K$RC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   19-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   20-
               C
                       MATERIAL SPECIFICATIONS
   21-
223-
24-
25-
26-
27-
29-
31-
33-
34-
                          (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
               С
                         3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes 1001.50c 2.561121-2 8016.50c 4.215845-2 11023.50c 2.834054-4
               С
               m1
                        12000.50c 1.665012-4
                                                  13027.50c 1.876796-3
                                                                           14000.50c 8.211662-3
                                                 20000.50c 4.099866-4 26000.55c 1.010513-4 92235.50c 8.845975-5 92236.50c 2.116674-5
                        19000.50c 4.002067-4
                        92234.50c 1.085591-6
                        92238.50c 4.406469-3 93237.50c 5.048015-6
               mt1
                        lwtr.01t
                         (47 vol% water in calico Hills tuff) x .9213 7.87 vol% UO2 3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               C
                                                 8016.50c 4.128059-2 11023.50c 3.203698-4
13027.50c 2.121585-3 14000.50c 9.282705-3
               m2
                         1001.50c 2.895166-2
                        12000.50c 1.882179-4
                        19000.50c 4.524054-4
                                                  20000.50c 4.634610-4
                                                                           26000.55c 1.142314-4
                        92234.50c 4.618165-7
                                                  92235.50c 3.763125-5
                                                                           92236.50c 9.004445-6
   35 -
                        92238.50c 1.874536-3 93237.50c 2.147453-6
   36-
37-
               mt2
                        lwtr.01t
                         47 vol% water in calico Hills tuff
   38-
               m3
                         1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
                        12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   39-
                        19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   40-
   41-
                        lwtr.01t
               mt3
               PRINT
   42-
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020my)
                                                                                                                         probid =
                                                                                                                                     05/16/96 07:29:34
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120414 neutron histories and 100 active cycles with
                                                                                                                             4000 neutrons per cycle.
                                                                                                                            400502 neutron histories.
```

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

520916 fission neutron source histories.

this calculation has completed the requested number of keff cycles using a total of

all cells with fissionable material were sampled and had fission neutron source points.

Jun 07 10:30 1996 File Name: s3020my.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CIL - Page 2

```
the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff  $\pm$  1.01402 with an estimated standard deviation of .00089 the estimated 68, 95, & 99 percent keff confidence intervals are 1.01313 to 1.01491, 1.01225 to 1.01580, and 1.01167 to 1.01638 the estimated collision/absorption neutron removal lifetime  $\pm$  7.57E-05 seconds with an estimated standard deviation of 1.83E-07

```
version 4a
                          ld=10/01/93
                                                               05/15/96 16:51:53
1mcnp
                                                                                                    probid = 05/15/96 16:51:53
 inp=s3020mx outp=s3020mx0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mx)
                   Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
              C
                     1 8.374149-2
                                            IMP:N=1
                                     - 1
                    2 8.509901-2 1 -2 IMP:N=1
3 8.610406-2 2 -3 IMP:N=1
    6-
7-
              C
                     OUTSIDE WORLD
                     0 3 IMP:N=0
   10-
   11-
12-
13-
14-
15-
16-
17-
18-
              C
                     SURFACE SPECIFICATIONS
                     so 57.4
                                     $ INNER FUEL ZONE
                     so 114.8
                                      $ INNER FUEL ZONE
              3
                     so 174.8
                                      $ INNER FUEL ZONE
              MODE N
              KCODE 4000 1. 30 130
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
                       0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   20-
                      MATERIAL SPECIFICATIONS
              C
                        (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
   21-
22-
23-
24-
25-
26-
27-
28-
29-
              С
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              m 1
                        1001.50c 2.561121-2
                                                8016.50c 4.215845-2 11023.50c 2.834054-4
                       12000.50c 1.665012-4
                                              13027.50c 1.876796-3 14000.50c 8.211662-3
                       19000.50c 4.002067-4
                                               20000.50c 4.099866-4
                                                                       26000.55c 1.010513-4
                       92234.50c 1.085591-6
                                               92235.50c 8.845975-5
                                                                       92236.50c 2.116674-5
                       92238.50c 4.406469-3 93237.50c 5.048015-6
                       lwtr.01t
              mt1
                        (47 vol% water in calico Hills tuff) x .9213 7.87 vol% UO2 3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              C
   30-
              С
   31 -
32 -
33 -
34 -
35 -
36 -
37 -
38 -
              m2
                        1001.50c 2.895166-2
                                                8016.50c 4.128059-2 11023.50c 3.203698-4
                                               13027.50c 2.121585-3 14000.50c 9.282705-3
                       12000.50c 1.882179-4
                       19000.50c 4.524054-4
                                               20000.50c 4.634610-4 26000.55c 1.142314-4
                                               92235.50c 3.763125-5 92236.50c 9.004445-6
                       92234.50c 4.618165-7
                       92238.50c 1.874536-3 93237.50c 2.147453-6
              mt2
                       lwtr.01t
                        47 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
              m3
   39-
                       12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   40-
                       19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   41-
                       lwtr.01t
              mt3
   42-
              PRINT
      initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mx)
                                                                                                                   = bidora
                                                                                                                              05/15/96 16:51:53
 the initial fission neutron source distribution was read from the srctp file named srctp
                                                                                                                       4000 neutrons per cycle.
```

the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally 4000 neutrons per cycle. this problem has run 30 inactive cycles with 120424 neutron histories and 100 active cycles with 400380 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 520804 fission neutron source histories. all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

Jun 07 10:28 1996 File Name: s3020mx.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CL - Page 2

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = 1.03012 with an estimated standard deviation of .00096 the estimated 68, 95, & 99 percent keff confidence intervals are 1.02916 to 1.03108, 1.02820 to 1.03204, and 1.02758 to 1.03267 the estimated collision/absorption neutron removal lifetime = 7.10E-05 seconds with an estimated standard deviation of 1.62E-07

```
05/16/96 12:46:13
1mcnp
            version 4a
                             ld=10/01/93
                                                                                                              probid =
                                                                                                                           05/16/96 12:46:13
 inp=s3020ms outp=s3020ms0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mr) C Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
     2-
     <u>3</u>-
                      CELL SPECIFICATIONS
                       INNER WATER REGION
                       1 8.374149-2
                                                IMP:N=1
    6-
7-
8-
                       2 8.577020-2 1 -2 IMP:N=1
                       3 8.610406-2 2 -3 IMP:N=1
                       OUTSIDE WORLD
     ğ-
                      0 3 IMP:N=0
   10-
   11-
               C
                       SURFACE SPECIFICATIONS
   12-
13-
                       so 53.0
                                         $ INNER FUEL ZONE
                       so 106.0
                                          $ INNER FUEL ZONE
   14-
               3
                       so 166.0
                                          $ INNER FUEL ZONE
   15-
   16-
                MODE N
   17-
                KCODE 4000 1. 30 130
                       KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   18-
   19-
                         0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   20-
                        MATERIAL SPECIFICATIONS
               С
   21-
22-
23-
24-
25-
26-
27-
28-
29-
30-
                          (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
               C
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
1001.50c 2.561121-2 8016.50c 4.215845-2 11023.50c 2.834054-4
12000.50c 1.665012-4 13027.50c 1.876796-3 14000.50c 8.211662-3
               C
                         12000.50c 1.665012-4
                                                    20000.50c 4.099866-4 26000.55c 1.010513-4
                         19000.50c 4.002067-4
                                                    92235.50c 8.845975-5 92236.50c 2.116674-5
                         92234.50c 1.085591-6
                         92238.50c 4.406469-3 93237.50c 5.048015-6
               mt1
                         lwtr.01t
                          (47 vol% water in calico Hills tuff) x .973857 2.6143 vol% UO2
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               С
   31-
32-
33-
34-
                                                   8016.50c 4.084656-2 11023.50c 3.386458-4
13027.50c 2.242615-3 14000.50c 9.812251-3
                          1001.50c 3.060325-2
               m2
                         12000.50c 1.989551-4
                                                   20000.50c 4.898998-4 26000.55c 1.207479-4 92235.50c 1.250056-5 92236.50c 2.991146-6
                         19000.50c 4.782136-4
                         92234.50c 1.534087-7
   35 -
                         92238.50c 6.226936-4 93237.50c 7.133528-7
   36-
                         lwtr.01t
               mt2
   37-
38-
                          47 vol% water in calico Hills tuff
                          1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
               m3
                         12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   39-
                         19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   40-
   41-
                         lwtr.01t
               mt3
               PRINT
   42-
       initial source from file
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mr)
                                                                                                                              probid = 05/16/96 12:46:13
 the initial fission neutron source distribution was read from the srctp file named srctp
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 119975 neutron histories and 100 active cycles with
                                                                                                                                  4000 neutrons per cycle.
                                                                                                                                  399641 neutron histories.
```

this calculation has completed the requested number of keff cycles using a total of 519616 fission neutron source histories. all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

Jun 07 09:12 1996 File Name: s3020ms.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CLI - Page 2

the k( collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .97622 with an estimated standard deviation of .00087 the estimated 68, 95, & 99 percent keff confidence intervals are .97535 to .97710, .97449 to .97796, and .97392 to .97853 the estimated collision/absorption neutron removal lifetime = 7.81E-05 seconds with an estimated standard deviation of 1.98E-07

```
1mcnp
            version 4a
                            ld=10/01/93
                                                                   05/16/96 11:07:55
                                                                                                            probid =
                                                                                                                        05/16/96 11:07:55
 inp=s3020mr outp=s3020mr0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 18.5% U02 (s3020mr)
    2-
                     Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
    3-
                      CELL SPECIFICATIONS
                      INNER WATER REGION
                         8.374149-2
                                               IMP:N=1
                          8.577020-2 1 -2 IMP:N=1
                        8.610406-2 2 -3 IMP:N=1
                      OUTSIDE WORLD
    8-
                      0 3 IMP:N=0
   10-
   11-
                      SURFACE SPECIFICATIONS
   12-
13-
                      so 55.0
                                        $ INNER FUEL ZONE
                      so 110.0
                                         $ INNER FUEL ZONE
   14-
15-
                      so 170.0
                                         $ INNER FUEL ZONE
   16-
               MODE N
   17-
               KCODE 4000 1. 30 130
   18-
                             0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   19-
                        0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
                       MATERIAL SPECIFICATIONS
   20 -
21 -
22 -
23 -
24 -
25 -
26 -
27 -
28 -
                          (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
               C
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
                                                   8016.50c 4.215845-2 11023.50c 2.834054-4
                          1001.50c 2.561121-2
               m1
                                                  13027.50c 1.876796-3 14000.50c 8.211662-3
                         12000.50c 1.665012-4
                        19000.50c 4.002067-4
92234.50c 1.085591-6
                                                  20000.50c 4.099866-4
92235.50c 8.845975-5
                                                                            26000.55c 1.010513-4
                                                                            92236.50c 2.116674-5
                        92238.50c 4.406469-3 93237.50c 5.048015-6
                        lwtr.01t
               mt1
   29-
                          (47 vol% water in calico Hills tuff) x .973857 2.6143 vol% UO2
               С
                          3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   30-
               C
   31-
                                                    8016.50c 4.084656-2 11023.50c 3.386458-4
                          1001.50c 3.060325-2
               m2
   32-
                        12000.50c 1.989551-4
                                                  13027.50c 2.242615-3 14000.50c 9.812251-3
                        19000.50c 4.782136-4
92234.50c 1.534087-7
                                                  20000.50c 4.898998-4
   33 -
                                                                            26000.55c 1.207479-4
   34 -
35 -
36 -
                        92234.50c 1.534087-7 92235.50c 1.250056-5 92236.50c 2.991146-6 92238.50c 6.226936-4 93237.50c 7.133528-7
               mt2
                         lwtr.01t
   37-
                          47 vol% water in calico Hills tuff
1001.50c 3.142479-2 8016.50c 4.00
   38-
               m3
                                                   8016.50c 4.063067-2 11023.50c 3.477367-4
   39-
                        12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   40-
                        19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   41-
               mt3
                         lwtr.01t
   42-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 18.5% U02 (s3020mr)
                                                                                                                                        05/16/96 11:07:55
                                                                                                                           probid =
the initial fission neutron source distribution was read from the srctp file named srctp.
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally this problem has run 30 inactive cycles with 120047 neutron histories and 100 active cycles with
                                                                                                                                4000 neutrons per cycle.
                                                                                                                               400573 neutron histories.
```

this calculation has completed the requested number of keff cycles using a total of 520620 fission neutron source histories. all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

Jun 07 09:07 1996 File Name: s3020mr.sum BBA000000-01717-0200-00016 REV 00 ATTACHMENT CLII - Page 2

```
the k( collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level
```

the final estimated combined collision/absorption/track-length keff = .98701 with an estimated standard deviation of .00091 the estimated 68, 95, & 99 percent keff confidence intervals are .98610 to .98792, .98520 to .98883, and .98461 to .98942 the estimated collision/absorption neutron removal lifetime = 7.62E-05 seconds with an estimated standard deviation of 2.09E-07

```
1mcnp
           version 4a
                          ld=10/01/93
                                                              05/16/96 08:18:27
                                                                                                   probid =
                                                                                                               05/16/96 08:18:27
 inp=s3020mq outp=s3020mq0
              Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mg)
                    Calico Hills Tuff 1.137 g/cc .47 porosity - shells surrounded by tuff
    2-
                     CELL SPECIFICATIONS
                     INNER WATER REGION
                     1 8.374149-2 -1
                                           IMP:N=1
                     2 8.577020-2 1 -2 IMP:N=1
                     3 8.610406-2 2 -3 IMP:N=1
                     OUTSIDE WORLD
                     0 3 IMP:N=0
   10-
   11-
                     SURFACE SPECIFICATIONS
   12-
                     SO 57.4
                                     $ INNER FUEL ZONE
   13-
                     so 114.8
                                      $ INNER FUEL ZONE
              2
   14-
                     so 174.8
                                      $ INNER FUEL ZONE
   15-
   16-
   17-
              KCODE 4000 1. 30 130
   18-
                     KSRC 0 0 1 0 0 10 0 0 -20 0 0 29 0 20 15 0 0 -55 -10 0 -40
   19-
                       0 -50 -20 -30 0 -13 0 -10 60 0 0 -25 -30 -15 -56 5 5 0 10 30 17
   20-
21-
22-
              C
                      MATERIAL SPECIFICATIONS
                        (47 vol% water in calico Hills tuff) x .815 18.5 vol% UO2
3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
1001.50c 2.561121-2 8016.50c 4.215845-2 11023.50c 2.834054-4
              С
              C
   23-
24-
25-
26-
27-
28-
29-
30-
              m1
                                              13027.50c 1.876796-3
                       12000.50c 1.665012-4
                                                                      14000.50c 8.211662-3
                                              20000.50c 4.099866-4 26000.55c 1.010513-4 92235.50c 8.845975-5 92236.50c 2.116674-5
                       19000.50c 4.002067-4
                       92234.50c 1.085591-6
                       92238.50c 4.406469-3 93237.50c 5.048015-6
              mt1
                       lwtr.01t
                        (47 vol% water in calico Hills tuff) x .973857 2.6143 vol% UO2
              C
                        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
              C
   31-
              m2
                        1001.50c 3.060325-2
                                               8016.50c 4.084656-2 11023.50c 3.386458-4
   32-
                       12000.50c 1.989551-4
                                              13027.50c 2.242615-3
                                                                      14000.50c 9.812251-3
   33-
34-
35-
                       19000.50c 4.782136-4
                                              20000.50c 4.898998-4
                                                                      26000.55c 1.207479-4
                       92234.50c 1.534087-7 92235.50c 1.250056-5 92236.50c 2.991146-6
                       92238.50c 6.226936-4 93237.50c 7.133528-7
   36-
                       lwtr.01t
              mt2
   37-
                        47 vol% water in calico Hills tuff
   38-
              m3
                        1001.50c 3.142479-2 8016.50c 4.063067-2 11023.50c 3.477367-4
   39-
                       12000.50c 2.042960-4 13027.50c 2.302817-3 14000.50c 1.007566-2
   40-
                       19000.50c 4.910511-4 20000.50c 5.030511-4 26000.55c 1.239894-4
   41-
                       lwtr.01t
              mt3
   42-
              PRINT
      initial source from file
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H20/ 18.5% U02 (s3020mg)
                                                                                                                 probid =
                                                                                                                             05/16/96 08:18:27
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally
                                                                                                                     4000 neutrons per cycle.
 this problem has run 30 inactive cycles with 120338 neutron histories and 100 active cycles with
                                                                                                                    398819 neutron histories.
```

this calculation has completed the requested number of keff cycles using a total of 519157 fission neutron source histories. all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 99 percent confidence level, but not at 95 percent the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .99386 with an estimated standard deviation of .00092 the estimated 68, 95, & 99 percent keff confidence intervals are .99293 to .99478, .99202 to .99570, and .99142 to .99630 the estimated collision/absorption neutron removal lifetime = 7.41E-05 seconds with an estimated standard deviation of 1.83E-07

```
ld=10/01/93
1mcnp
           version 4a
                                                                  05/28/96 12:45:58
                                                                                                                      05/28/96 12:45:58
                                                                                                         probid =
 inp=c3020nb outp=c3020nb0
               Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 4.6% UO2 (c3020nb)
                    Calico Hills Tuff 1.5095 g/cc .40 porosity - inf cylinder reflected by tuff
    2-
                      CELL SPECIFICATIONS
                      INNER WATER REGION
                         8.372894-2 -1 3 -4 IMP:N=1
8.423019-2 1 -2 3 -4 IMP:N=1
                      1
    7-
8-
9-
                             2 8.610406-2
                                                -2 4 -5 IMP:N=1
                      OUTSIDE WORLD
                     0 2:-3:4 IMP:N=0
   10-
   11-
               C
                     SURFACE SPECIFICATIONS
   12-
                     cz 61
                                    $ INNER FUEL ZONE
   13-
               2
                     cz 121
                                     $ reflector
   14-
               3*
                     pz 0
                                     $ center
               4*
   15 -
                     pz 385
                                     $ end
   16-
                      pz 445
                                     $ reflector
   17-
   18-
               MODE N
   19-
               KCODE 4000 1. 25 125
   20-
                    KSRC 0 0 1 0 0 10 0 0 20 0 0 29 0 20 15 0 0 55 -10 0 40
   21-
22-
23-/
24-
25-
26-
27-
28-
                        0 -5 20 -30 0 13 0 -10 26 5 50 125 -3 15 56 5 5 80 10 30 17
                        0 0 100 0 0 200 0 0 20 0 0 290 0 20 150 0 0 355 -10 0 240
               C
               C
                        0 -5 220 -30 0 313 0 -10 260 5 -30 325 -3 15 356 5 5 380 10 30 317
                       MATERIAL SPECIFICATIONS
               С
                         (40 vol% water in calico Hills tuff) x .954 4.6 vol% UO2
3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
               C
                                                  8016.50c 4.191775-2 11023.50c 3.75556-4
                         1001.50c 2.551426-2
               m1
                        12000.50c 2.206397-4 13027.50c 2.487043-3 14000.50c 1.088171-2
   29-
30-
                        19000.50c 5.303352-4 20000.50c 5.432952-4 26000.55c 1.339085-4
                        92234.50c 2.699309-7 92235.50c 2.199540-5 92236.50c 5.263081-6
   31-
                        92238.50c 1.095663-3 93237.50c 1.255182-6
   32-
               mt1
                        lwtr.01t
   33 -
34 -
35 -
                         40 vol% water in calico Hills tuff
                        1001.50c 2.674450-2 8016.50c 4.158162-2 11023.50c 3.936641-4 12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2
               m2
                        12000.50c 2.312785-4 13027.50c 2.606963-3 14000.50c 1.140641-2 19000.50c 5.559069-4 20000.50c 5.694918-4 26000.55c 1.403653-4
   36-
   37-
                        lwtr.01t
               mt2
   38-
               PRINT
       initial source from file srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H20/ 4.6% U02 (c3020nb)
                                                                                                                        probid =
                                                                                                                                     05/28/96 12:45:58
 the initial fission neutron source distribution was read from the srctp file named srctp
 the criticality problem was scheduled to skip 25 cycles and run a total of 125 cycles with nominally this problem has run 25 inactive cycles with 99796 neutron histories and 100 active cycles with
                                                                                                                             4000 neutrons per cycle.
                                                                                                                            399700 neutron histories.
 this calculation has completed the requested number of keff cycles using a total of
                                                                                                        499496 fission neutron source histories.
 all cells with fissionable material were sampled and had fission neutron source points.
 the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:
```

the k(collision) cycle values appear normally distributed at the 95 percent confidence level the k(absorption) cycle values appear normally distributed at the 95 percent confidence level the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .79262 with an estimated standard deviation of .00077 the estimated 68, 95, & 99 percent keff confidence intervals are .79185 to .79338, .79109 to .79414, and .79059 to .79464 the estimated collision/absorption neutron removal lifetime = 1.45E-04 seconds with an estimated standard deviation of 2.63E-07