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

     1-        FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
     2-        C    Criticality
     3-        C
     4-        C    SPHERE
     5-        1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    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  this surface has been replaced by a surface of type so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-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE 2000  1  33  233
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
    24-             92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
    25-              1001.50C 1.704962-2                                                   $ an
    26-             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-             11023.50C 3.870375-4  19000.50C 5.465492-4                            $ 30
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
    31-              8016.50C 4.265802-2                                                  $ Wi
    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-        MT3  LWTR.01T                                                              $ Wa
    35-        PRINT
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        probid =   04/20/96 13:32:58


  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    66066 neutron histories and  200 active cycles with      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

```
1mcnp     version 4a    ld=10/01/93                          04/20/96 14:48:26
 ******************************************************************************                probid =   04/20/96 14:48:26
 INP=4.0EC OUTP=4.0E.CO

    1-        FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
    2-        C    Criticality
    3-        C
    4-        C    SPHERE
    5-        1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-        5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-        C
    8-        C    OUTSIDE WORLD
    9-        30   0     2                  IMP:N=0   $ Void
   10-
   11-        C    SURFACES
   12-        1    S      0 0 0 275.35      $ FISSILE SPHERE
 warning.  this surface has been replaced by a surface of type so
   13-        2    S      0 0 0 335.35      $ REFLECTOR
   14-        C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-        MODE  N
   17-        KCODE 2000  1  33  233
   18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
   20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
   22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   23-        M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
   24-             92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
   25-              1001.50C 1.704962-2                                                   $ an
   26-             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-             11023.50C 3.870375-4  19000.50C 5.465492-4                            $ 30
   29-        MT1  LWTR.01T                                                              $ Wa
   30-        M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
   31-              8016.50C 4.265802-2                                                  $ Wi
   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-        MT3  LWTR.01T                                                              $ Wa
   35-        PRINT
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        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

```
1mcnp     version 4a    ld=10/01/93                          04/19/96 07:02:56
 ******************************************************************************                probid =   04/19/96 07:02:56
 INP=4.0ERS OUTP=4.0E.RSO

     1-        FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
     2-        C    Reflector Savings
     3-        C
     4-        C    SPHERE
     5-        1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    S      0 0 0 280.0      $ FISSILE SPHERE
 warning.  this surface has been replaced by a surface of type so
    13-        2    S      0 0 0 340.0      $ REFLECTOR
    14-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE 2000  1  33  233
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
    24-             92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
    25-              1001.50C 1.704962-2                                                   $ an
    26-             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-             11023.50C 3.870375-4  19000.50C 5.465492-4                            $ 30
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
    31-              8016.50C 4.265802-2                                                  $ Wi
    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-        MT3  LWTR.01T                                                              $ Wa
    35-        PRINT
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        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     2000 neutrons per cycle.
  this problem has run  33 inactive cycles with    65532 neutron histories and  200 active cycles with      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

```
1mcnp     version 4a    ld=10/01/93                    04/20/96 16:09:06
 ***********************************************************************                probid =   04/20/96 16:09:06
 INP=4.0EC OUTP=4.0E.CO

    1-        FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
    2-        C    Criticality
    3-        C
    4-        C    SPHERE
    5-        1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-        5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-        C
    8-        C    OUTSIDE WORLD
    9-        30   0     2                  IMP:N=0   $ Void
   10-
   11-        C    SURFACES
   12-        1    S      0 0 0 284.32      $ FISSILE SPHERE
 warning.  this surface has been replaced by a surface of type so
   13-        2    S      0 0 0 344.32      $ REFLECTOR
   14-        C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-        MODE  N
   17-        KCODE 2000  1  33  233
   18-        C    KSRC   0  0  0    1  0  0    -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-        C           1  1  0    1 -1  0     1  0  1    1  0 -1
   20-        C          -1  1  0   -1 -1  0    -1  0  1   -1  0 -1
   21-        C           0  1  1    0 -1  1     0  1 -1    0 -1 -1
   22-        C           1  1  1   -1  1  1    -1 -1  1   -1 -1 -1
   23-        M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
   24-             92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
   25-              1001.50C 1.704962-2                                                   $ an
   26-             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-             11023.50C 3.870375-4  19000.50C 5.465492-4                            $ 30
   29-        MT1  LWTR.01T                                                              $ Wa
   30-        M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
   31-              8016.50C 4.265802-2                                                  $ Wi
   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-        MT3  LWTR.01T                                                              $ Wa
   35-        PRINT
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        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
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/20/96 11:59:37
 ******************************************************************************                probid =   04/20/96 11:59:37
 INP=4.0EC OUTP=4.0E.CO

     1-        FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
     2-        C    Criticality
     3-        C
     4-        C    SPHERE
     5-        1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    S      0 0 0 293.22      $ FISSILE SPHERE
 warning.  this surface has been replaced by a surface of type so
    13-        2    S      0 0 0 353.22      $ REFLECTOR
    14-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE 2000  1  33  233
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
    24-             92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
    25-              1001.50C 1.704962-2                                                   $ an
    26-             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-             11023.50C 3.870375-4  19000.50C 5.465492-4                            $ 30
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
    31-              8016.50C 4.265802-2                                                  $ Wi
    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-        MT3  LWTR.01T                                                              $ Wa
    35-        PRINT
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        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     2000 neutrons per cycle.
  this problem has run  33 inactive cycles with    66055 neutron histories and  200 active cycles with      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

```
1mcnp     version 4a    ld=10/01/93                          05/02/96 08:13:07
 ******************************************************************************                probid =   05/02/96 08:13:07
 INP=4E3015C OUTP=4E30C.O

    1-       FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2
    2-       C    k-eff Critical Radius
    3-       C
    4-       C    SPHERE
    5-       1    1     7.99453107100-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       5    3     8.11121144000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       30   0     2                  IMP:N=0   $ Void
   10-
   11-       C    SURFACES
   12-       1    S       0 0 0  310.00      $ FISSILE SPHERE
 warning.  this surface has been replaced by a surface of type so
   13-       2    S       0 0 0  370.00      $ REFLECTOR
   14-       C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-       MODE  N
   17-       KCODE  500  1  3  1003
   18-       C    KSRC   0  0  0    1  0  0    -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-       C            1  1  0    1 -1  0     1  0  1    1  0 -1
   20-       C           -1  1  0   -1 -1  0    -1  0  1   -1  0 -1
   21-       C            0  1  1    0 -1  1     0  1 -1    0 -1 -1
   22-       C            1  1  1   -1  1  1    -1 -1  1   -1 -1 -1
   23-       M1   92234.50C 1.870334-6  92235.50C 6.773585-5  92236.50C 3.026400-5       $ Fi
   24-            92238.50C 3.557954-3  93237.50C 8.847626-6   8016.50C 4.359266-2       $ At
   25-             1001.50C 1.704962-2                                                  $ an
   26-            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-            11023.50C 3.870375-4  19000.50C 5.465492-4                           $ 30
   29-       MT1  LWTR.01T                                                             $ Wa
   30-       M3    1001.50C 2.005838-2  14000.50C 1.319341-2  13027.50C 3.015387-3       $ Ca
   31-            8016.50C 4.265802-2                                                  $ Wi
   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-       MT3  LWTR.01T                                                             $ Wa
   35-       PRINT
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 4.0E 40GWD  30% Water 15% U-Np O2        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.
 this problem has run   3 inactive cycles with     1459 neutron histories and 1000 active 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

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nh)
    2-        C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.508241-2   -1   IMP:N=1
    6-        2     2  8.610406-2  1 -2  IMP:N=1
    7-        C     OUTSIDE WORLD
    8-        3     0  2   IMP:N=0
    9-
   10-        C     SURFACE SPECIFICATIONS
   11-        1     SO  115      $ INNER FUEL ZONE
   12-        2     SO  275       $ INNER FUEL ZONE
   13-
   14-        MODE  N
   15-        KCODE  4000 1. 20 75
   16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-        C       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-        c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-        m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
   22-                 12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
   23-                 19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
   24-                 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-        mt1      lwtr.01t
   27-        c         30 vol% water in calico Hills tuff
   28-        m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
   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
1     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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    79977 neutron histories and   55 active cycles with      220592 neutron histories.

 this calculation has completed the requested number of keff cycles using a total of      300569 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 =  .96843 with an estimated standard deviation of  .00108  |
```

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

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ni)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.508241-2   -1   IMP:N=1
    6-       2     2  8.610406-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  150      $ INNER FUEL ZONE
   12-       2     SO  210       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1        1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
   22-                12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
   23-                19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
   24-                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-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2        1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
   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
1     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


 ------------------------------------------------------------------------------------------------------------------------------
 |  the final estimated combined collision/absorption/track-length keff =  .98553 with an estimated standard deviation of  .00104  |
```

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

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nb)
     2-        C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.508241-2   -1   IMP:N=1
     6-        2     2  8.610406-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  160       $ INNER FUEL ZONE
    12-        2     SO  220        $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 20 75
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1        1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
    22-                 12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
    23-                 19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
    24-                 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-        mt1      lwtr.01t
    27-        c         30 vol% water in calico Hills tuff
    28-        m2        1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
    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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80043 neutron histories and   55 active cycles with      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  |
```

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
 ******************************************************************************                    probid =   04/26/96 18:41:03
 INP=s3020nc OUTP=s3020nc0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nc)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.508241-2   -1   IMP:N=1
    6-       2     2  8.610406-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  175       $ INNER FUEL ZONE
   12-       2     SO  235        $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
   22-                12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
   23-                19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
   24-                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-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
   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
1     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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80323 neutron histories and   55 active cycles with      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  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/26/96 19:37:04
 ******************************************************************************                    probid =   04/26/96 19:37:04
 INP=s3020nd OUTP=s3020nd0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nd)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.508241-2   -1   IMP:N=1
    6-       2     2  8.610406-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  190      $ INNER FUEL ZONE
   12-       2     SO  250       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
   22-                12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
   23-                19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
   24-                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-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80408 neutron histories and   55 active cycles with      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  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/26/96 20:39:40
 ******************************************************************************                probid =   04/26/96 20:39:40
 INP=s3020ne OUTP=s3020ne0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ne)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.508241-2   -1   IMP:N=1
    6-       2     2  8.610406-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  205       $ INNER FUEL ZONE
   12-       2     SO  265        $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
   22-                12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
   23-                19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
   24-                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-       mt1      lwtr.01t
   27-       c        30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80219 neutron histories and   55 active cycles with      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  |
```

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

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020nf)
     2-        C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.508241-2   -1   IMP:N=1
     6-        2     2  8.610406-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  220      $ INNER FUEL ZONE
    12-        2     SO  280       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 20 75
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
    22-                12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
    23-                19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
    24-                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-        mt1     lwtr.01t
    27-        c        30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
    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
1     initial source from file   srctp
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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80579 neutron histories and   55 active cycles with      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  |
```

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

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 8% UO2 (s3020ng)
     2-        C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.508241-2   -1   IMP:N=1
     6-        2     2  8.610406-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  235       $ INNER FUEL ZONE
    12-        2     SO  290       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 20 75
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (47 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 2.891081-2   8016.50c 4.129133-2  11023.50c 3.199177-4
    22-                 12000.50c 1.879523-4  13027.50c 2.118592-3  14000.50c 9.269606-3
    23-                 19000.50c 4.517670-4  20000.50c 4.628070-4  26000.55c 1.140702-4
    24-                 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-        mt1      lwtr.01t
    27-        c        30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 4.063067-2  11023.50c 3.477367-4
    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
1     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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    80182 neutron histories and   55 active cycles with      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  |
```

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

```
1mcnp     version 4a    ld=10/01/93                    05/07/96 13:47:55
 ***********************************************************************                probid =   05/07/96 13:47:55
 inp=s3020ph outp=s3020ph0

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020ph)
    2-        C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.335845-2   -1   IMP:N=1
    6-        2     2  8.423019-2  1 -2  IMP:N=1
    7-        C     OUTSIDE WORLD
    8-        3     0  2   IMP:N=0
    9-
   10-        C     SURFACE SPECIFICATIONS
   11-        1     SO  140       $ INNER FUEL ZONE
   12-        2     SO  200       $ INNER FUEL ZONE
   13-
   14-        MODE  N
   15-        KCODE  4000 1. 30 130
   16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-        C       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-        c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-        m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-        mt1     lwtr.01t
   27-        c        40 vol% water in calico Hills tuff
   28-        m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1     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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   119955 neutron histories and  100 active cycles with      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  |
```

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

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pa)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  150       $ INNER FUEL ZONE
   12-       2     SO  210       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1     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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120401 neutron histories and  100 active cycles with      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 final estimated combined collision/absorption/track-length keff =  .98670 with an estimated standard deviation of  .00075
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/06/96 17:56:04
 ******************************************************************************                probid =   05/06/96 17:56:04
 INP=s3020pb OUTP=s3020pb0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pb)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  160       $ INNER FUEL ZONE
   12-       2     SO  220       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1        1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2        1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (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
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/06/96 19:28:38
 ******************************************************************************                    probid =   05/06/96 19:28:38
 INP=s3020pc OUTP=s3020pc0

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pc)
    2-        C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.335845-2   -1   IMP:N=1
    6-        2     2  8.423019-2  1 -2  IMP:N=1
    7-        C     OUTSIDE WORLD
    8-        3     0  2   IMP:N=0
    9-
   10-        C     SURFACE SPECIFICATIONS
   11-        1     SO  175       $ INNER FUEL ZONE
   12-        2     SO  235       $ INNER FUEL ZONE
   13-
   14-        MODE  N
   15-        KCODE  4000 1. 30 130
   16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-        C       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-        c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-        m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                 12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                 19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                 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-        mt1      lwtr.01t
   27-        c         40 vol% water in calico Hills tuff
   28-        m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
 1     initial source from file   srctp
 1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (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

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

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

```
1mcnp     version 4a    ld=10/01/93                          05/06/96 21:01:42
 ******************************************************************************                    probid =   05/06/96 21:01:42
 INP=s3020pd OUTP=s3020pdO

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pd)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  190       $ INNER FUEL ZONE
   12-       2     SO  250       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1      initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120116 neutron histories and  100 active cycles with      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

 ------------------------------------------------------------------------------------------------------------------------------
 |  the final estimated combined collision/absorption/track-length keff =  .99760 with an estimated standard deviation of  .00066  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/06/96 22:33:58
 ******************************************************************************                    probid =   05/06/96 22:33:58
 INP=s3020pe OUTP=s3020pe0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pe)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  205       $ INNER FUEL ZONE
   12-       2     SO  265       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
 1     initial source from file   srctp
 1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (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  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/07/96 00:06:32
 ***********************************************************************                probid =   05/07/96 00:06:32
 INP=s3020pf OUTP=s3020pfO

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pf)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  220       $ INNER FUEL ZONE
   12-       2     SO  280       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1        1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2        1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 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  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/07/96 01:37:42
 ******************************************************************************                    probid =   05/07/96 01:37:42
 INP=s3020pg OUTP=s3020pgO

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 8% UO2 (s3020pg)
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.335845-2   -1   IMP:N=1
    6-       2     2  8.423019-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  235       $ INNER FUEL ZONE
   12-       2     SO  295       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 30 130
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   17-       C       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-       c        (40 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 2.460494-2   8016.50c 4.216620-2  11023.50c 3.621710-4
   22-                12000.50c 2.127762-4  13027.50c 2.398406-3  14000.50c 1.049389-2
   23-                19000.50c 5.114344-4  20000.50c 5.239325-4  26000.55c 1.291361-4
   24-                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-       mt1      lwtr.01t
   27-       c         40 vol% water in calico Hills tuff
   28-       m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120294 neutron histories and  100 active cycles with      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

 ------------------------------------------------------------------------------------------------------------------------------
 |  the final estimated combined collision/absorption/track-length keff = 1.00354 with an estimated standard deviation of  .00079  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/30/96 19:42:51
 ******************************************************************************                    probid =   04/30/96 19:42:51
 INP=s3020be OUTP=s3020be0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020be)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.033424-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  115       $ INNER FUEL ZONE
   12-       2     SO  175       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  3000 1. 14 54
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .90  10 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 1.805254-2   8016.50c 4.328111-2  11023.50c 4.098044-4
   22-                12000.50c 2.407609-4  13027.50c 2.713848-3  14000.50c 1.187407-2
   23-                19000.50c 5.786991-4  20000.50c 5.928410-4  26000.55c 1.461203-4
   24-                92234.50c 5.868062-7  92235.50c 4.781608-5  92236.50c 1.144148-5
   25-                92238.50c 2.381875-3  93237.50c 2.728657-6
   26-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (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  |
```

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

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020ba)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.033424-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  125       $ INNER FUEL ZONE
   12-       2     SO  185       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  3000 1. 14 54
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .90  10 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 1.805254-2   8016.50c 4.328111-2  11023.50c 4.098044-4
   22-                12000.50c 2.407609-4  13027.50c 2.713848-3  14000.50c 1.187407-2
   23-                19000.50c 5.786991-4  20000.50c 5.928410-4  26000.55c 1.461203-4
   24-                92234.50c 5.868062-7  92235.50c 4.781608-5  92236.50c 1.144148-5
   25-                92238.50c 2.381875-3  93237.50c 2.728657-6
   26-       mt1      lwtr.01t
   27-       c        30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (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     3000 neutrons per cycle.
 this problem has run  14 inactive cycles with    41724 neutron histories and   40 active cycles with      120165 neutron histories.

 this calculation has completed the requested number of keff cycles using a total of      161889 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 =  .99093 with an estimated standard deviation of  .00177  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/22/96 16:44:31
 ******************************************************************************                    probid =   04/22/96 16:44:31
 INP=s3020bb OUTP=s3020bb0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bb)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.033424-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  140       $ INNER FUEL ZONE
   12-       2     SO  200       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  3000 1. 14 54
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .90  10 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 1.805254-2   8016.50c 4.328111-2  11023.50c 4.098044-4
   22-                12000.50c 2.407609-4  13027.50c 2.713848-3  14000.50c 1.187407-2
   23-                19000.50c 5.786991-4  20000.50c 5.928410-4  26000.55c 1.461203-4
   24-                92234.50C 5.868062-7  92235.50C 4.781608-5  92236.50C 1.144148-5
   25-                92238.50C 2.381875-3  93237.50C 2.728657-6
   26-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (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     3000 neutrons per cycle.
 this problem has run  14 inactive cycles with    41846 neutron histories and   40 active cycles with      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


 ------------------------------------------------------------------------------------------------------------------------------
 |
 | the final estimated combined collision/absorption/track-length keff =  .99973 with an estimated standard deviation of  .00144
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/22/96 17:10:10
 ******************************************************************************                    probid =   04/22/96 17:10:10
 INP=s3020bc OUTP=s3020bc0

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bc)
    2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.033424-2   -1   IMP:N=1
    6-        2     2  8.035742-2  1 -2  IMP:N=1
    7-        C     OUTSIDE WORLD
    8-        3     0  2   IMP:N=0
    9-
   10-        C     SURFACE SPECIFICATIONS
   11-        1     SO  155       $ INNER FUEL ZONE
   12-        2     SO  215       $ INNER FUEL ZONE
   13-
   14-        MODE  N
   15-        KCODE  3000 1. 14 54
   16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-        C       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-        c        (30 vol% water in calico Hills tuff) x .90  10 vol% UO2
   20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-        m1       1001.50c 1.805254-2   8016.50c 4.328111-2  11023.50c 4.098044-4
   22-                12000.50c 2.407609-4  13027.50c 2.713848-3  14000.50c 1.187407-2
   23-                19000.50c 5.786991-4  20000.50c 5.928410-4  26000.55c 1.461203-4
   24-                92234.50C 5.868062-7  92235.50C 4.781608-5  92236.50C 1.144148-5
   25-                92238.50C 2.381875-3  93237.50C 2.728657-6
   26-        mt1     lwtr.01t
   27-        c        30 vol% water in calico Hills tuff
   28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bc)          probid =   04/22/96 17:10:10


 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
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/22/96 17:35:19
 ******************************************************************************                probid =   04/22/96 17:35:19
 INP=s3020bd OUTP=s3020bd0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 10% UO2 (s3020bd)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.033424-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  170       $ INNER FUEL ZONE
   12-       2     SO  230       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  3000 1. 14 54
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .90  10 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 1.805254-2   8016.50c 4.328111-2  11023.50c 4.098044-4
   22-                12000.50c 2.407609-4  13027.50c 2.713848-3  14000.50c 1.187407-2
   23-                19000.50c 5.786991-4  20000.50c 5.928410-4  26000.55c 1.461203-4
   24-                92234.50C 5.868062-7  92235.50C 4.781608-5  92236.50C 1.144148-5
   25-                92238.50C 2.381875-3  93237.50C 2.728657-6
   26-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1      initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 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     3000 neutrons per cycle.
 this problem has run  14 inactive cycles with    41673 neutron histories and   40 active cycles with      120050 neutron histories.


 this calculation has completed the requested number of keff cycles using a total of      161723 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 = 1.00961 with an estimated standard deviation of  .00155  |
```

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

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ah)
     2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.048982-2   -1   IMP:N=1
     6-        2     2  8.035742-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  180       $ INNER FUEL ZONE
    12-        2     SO  240       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 20 75
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
    22-                 12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
    23-                 19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
    24-                 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-        mt1      lwtr.01t
    27-        c        30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
    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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    79950 neutron histories and   55 active cycles with      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

 ------------------------------------------------------------------------------------------------------------------------------
 |  the final estimated combined collision/absorption/track-length keff =  .98327 with an estimated standard deviation of  .00101  |
```

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
 ******************************************************************************                probid =   05/01/96 16:46:48
 inp=s3020ag outp=s3020ag0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ag)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.048982-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  220       $ INNER FUEL ZONE
   12-       2     SO  280       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
   22-                12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
   23-                19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
   24-                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-       mt1      lwtr.01t
   27-       c        30 vol% water in calico Hills tuff
   28-       m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    79675 neutron histories and   55 active cycles with      220026 neutron histories.

 this calculation has completed the requested number of keff cycles using a total of      299701 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 =  .99050 with an estimated standard deviation of  .00111  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/01/96 15:21:46
 ***********************************************************************                probid =   05/01/96 15:21:46
 inp=s3020af outp=s3020af0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020af)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.048982-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  280       $ INNER FUEL ZONE
   12-       2     SO  340       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 20 75
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1        1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
   22-                12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
   23-                19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
   24-                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-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2        1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1      initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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) 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 =  .99632 with an estimated standard deviation of  .00108
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/30/96 18:46:26
 ******************************************************************************                    probid =   04/30/96 18:46:26
 INP=s3020ae OUTP=s3020ae0

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ae)
    2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.048982-2   -1   IMP:N=1
    6-        2     2  8.035742-2  1 -2  IMP:N=1
    7-        C     OUTSIDE WORLD
    8-        3     0  2   IMP:N=0
    9-
   10-        C     SURFACE SPECIFICATIONS
   11-        1     SO  300       $ INNER FUEL ZONE
   12-        2     SO  360       $ INNER FUEL ZONE
   13-
   14-        MODE  N
   15-        KCODE  4000 1. 20 75
   16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-        C       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-        c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-        m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
   22-                 12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
   23-                 19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
   24-                 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-        mt1      lwtr.01t
   27-        c         30 vol% water in calico Hills tuff
   28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  20 inactive cycles with    79806 neutron histories and   55 active cycles with      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

 ------------------------------------------------------------------------------------------------------------------------
 |  the final estimated combined collision/absorption/track-length keff =  .99778 with an estimated standard deviation of  .00103  |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/22/96 14:49:34
 ******************************************************************************                    probid =   04/22/96 14:49:34
 inp=s3020ad outp=s3020ad0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ad)
    2-       C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.048982-2   -1   IMP:N=1
    6-       2     2  8.035742-2  1 -2  IMP:N=1
    7-       C     OUTSIDE WORLD
    8-       3     0  2   IMP:N=0
    9-
   10-       C     SURFACE SPECIFICATIONS
   11-       1     SO  335       $ INNER FUEL ZONE
   12-       2     SO  395       $ INNER FUEL ZONE
   13-
   14-       MODE  N
   15-       KCODE  4000 1. 7 37
   16-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   17-       C       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-       c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
   20-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   21-       m1        1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
   22-                12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
   23-                19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
   24-                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-       mt1      lwtr.01t
   27-       c         30 vol% water in calico Hills tuff
   28-       m2        1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
   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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run   7 inactive cycles with    27947 neutron histories and   30 active cycles with      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
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                    04/22/96 13:48:28
 ***********************************************************************                probid =   04/22/96 13:48:28
 inp=s3020ac outp=s3020ac0

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ac)
     2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.048982-2   -1   IMP:N=1
     6-        2     2  8.035742-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  345       $ INNER FUEL ZONE
    12-        2     SO  405       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 7 37
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
    22-                 12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
    23-                 19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
    24-                 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-        mt1      lwtr.01t
    27-        c         30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
    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
1     initial source from file   srctp

1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run   7 inactive cycles with    28028 neutron histories and   30 active cycles with      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

 ------------------------------------------------------------------------------------------------------------------------------
 |
 | the final estimated combined collision/absorption/track-length keff =  .99806 with an estimated standard deviation of  .00144  |
```

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     version 4a    ld=10/01/93                          04/24/96 08:54:00
 ******************************************************************************                probid =   04/24/96 08:54:00
 inp=s3020ab outp=s3020ab0

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020ab)
     2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.048982-2   -1   IMP:N=1
     6-        2     2  8.035742-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  355       $ INNER FUEL ZONE
    12-        2     SO  415       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 20 75
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
    22-                12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
    23-                19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
    24-                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-        mt1     lwtr.01t
    27-        c        30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
    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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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 final estimated combined collision/absorption/track-length keff = 1.00201 with an estimated standard deviation of  .00099  |
```

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

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (s3020aa)
     2-        C    Calico Hills Tuff 1.746 g/cc  .306 porosity -  sphere surrounded by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.048982-2   -1   IMP:N=1
     6-        2     2  8.035742-2  1 -2  IMP:N=1
     7-        C     OUTSIDE WORLD
     8-        3     0  2   IMP:N=0
     9-
    10-        C     SURFACE SPECIFICATIONS
    11-        1     SO  365       $ INNER FUEL ZONE
    12-        2     SO  425       $ INNER FUEL ZONE
    13-
    14-        MODE  N
    15-        KCODE  4000 1. 10 40
    16-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
    17-        C       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-        c        (30 vol% water in calico Hills tuff) x .92  8 vol% UO2
    20-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    21-        m1       1001.50c 1.845371-2   8016.50c 4.315649-2  11023.50c 4.189111-4
    22-                12000.50c 2.461111-4  13027.50c 2.774156-3  14000.50c 1.213794-2
    23-                19000.50c 5.915591-4  20000.50c 6.060152-4  26000.55c 1.493674-4
    24-                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-        mt1     lwtr.01t
    27-        c        30 vol% water in calico Hills tuff
    28-        m2       1001.50c 3.142479-2   8016.50c 3.695585-2  11023.50c 2.964542-4
    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
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 30% H2O/ 8% UO2 (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     4000 neutrons per cycle.
 this problem has run  10 inactive cycles with    40180 neutron histories and   30 active cycles with      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 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 = 1.00209 with an estimated standard deviation of  .00141
 |
```

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

```
1mcnp     version 4a    ld=10/01/93                          04/29/96 10:55:36
 ***********************************************************************                probid =   04/29/96 10:55:36
 INP=3E47W08I OUTP=3E4708.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  47% Water  8.0% U-Np O2
    2-       C    k-inf Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     8.50824092506-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       C    30   0     2                    IMP:N=0   $ Void
   10-       30   0     1                   IMP:N=0   $ Void
   11-
   12-       C    SURFACES
   13-       1*   S       0 0 0  10.00      $ *Infinite FISSILE SPHERE
   14-       C    2    S      0 0 0  174.51      $ REFLECTOR
   15-       C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-       MODE  N
   18-       KCODE  500  1  3  503
   19-       KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0  0 -1
   20-              1  1  0    1 -1  0    1  0  1    1  0 -1
   21-             -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   22-              0  1  1    0 -1  1    0  1 -1    0 -1 -1
   23-              1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   24-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 4.129133-2       $ At
   26-             1001.50C 2.891081-2                                                  $ an
   27-            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-       MT1  LWTR.01T                                                             $ Wa
   31-       C    M3    1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-       C          8016.50C 4.063067-2
   33-       C         26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-       C         11023.50C 3.477367-4  19000.50C 4.910511-4
   35-       C    MT3  LWTR.01T
   36-       PRINT
 1     initial source from ksrc card.                                                  print table 90

 1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  47% Water  8.0% U-Np O2      probid =   04/29/96 10:55:36


  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     1553 neutron histories and  500 active cycles with      250071 neutron histories.


  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

```
1mcnp     version 4a    ld=10/01/93                          04/27/96 15:54:54
 ******************************************************************************                probid =   04/27/96 15:54:54
 INP=3E40W08I OUTP=3E4008.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  40% Water  8.0% U-Np O2
    2-       C    k-inf Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     7.86236115346-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       C    30   0     2                    IMP:N=0   $ Void
   10-       30   0     1                   IMP:N=0   $ Void
   11-
   12-       C    SURFACES
   13-       1*   S       0 0 0  10.00       $ *Infinite FISSILE SPHERE
   14-       C    2    S       0 0 0  174.51       $ REFLECTOR
   15-       C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-       MODE  N
   18-       KCODE  500  1  3  503
   19-       KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0  0 -1
   20-              1  1  0    1 -1  0    1  0  1    1  0 -1
   21-             -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   22-              0  1  1    0 -1  1    0  1 -1    0 -1 -1
   23-              1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   24-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.913840-2       $ At
   26-             1001.50C 2.460494-2                                                  $ an
   27-            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-       MT1  LWTR.01T                                                             $ Wa
   31-       C    M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-       C           8016.50C 4.063067-2
   33-       C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-       C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-       C    MT3  LWTR.01T
   36-       PRINT
 1     initial source from ksrc card.                                                    print table 90

 1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  40% Water  8.0% U-Np O2      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      500 neutrons per cycle.
  this problem has run   3 inactive cycles with     1592 neutron histories and  500 active cycles with      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

```
1mcnp     version 4a    ld=10/01/93                          04/27/96 16:47:00
 ******************************************************************************                probid =   04/27/96 16:47:00
 INP=3E35W08I OUTP=3E3508.O

    1-        FarField Criticality - Sphere of Transmuted 3.0E 20GWD  35% Water  8.0% U-Np O2
    2-        C    k-inf Optimization For Positive Water Coefficient
    3-        C
    4-        C    SPHERE
    5-        1    1     7.40101845946-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-        C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-        C
    8-        C    OUTSIDE WORLD
    9-        C    30   0     2                    IMP:N=0   $ Void
   10-        30   0     1                   IMP:N=0   $ Void
   11-
   12-        C    SURFACES
   13-        1*   S       0 0 0  10.00      $ *Infinite FISSILE SPHERE
   14-        C    2    S       0 0 0  174.51      $ REFLECTOR
   15-        C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-        MODE  N
   18-        KCODE  500  1  3  503
   19-        KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0  0 -1
   20-               1  1  0    1 -1  0    1  0  1    1  0 -1
   21-              -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   22-               0  1  1    0 -1  1    0  1 -1    0 -1 -1
   23-               1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   24-        M1    92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-              92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.760059-2       $ At
   26-               1001.50C 2.152933-2                                                  $ an
   27-              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-        MT1   LWTR.01T                                                             $ Wa
   31-        C     M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-        C           8016.50C 4.063067-2
   33-        C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-        C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-        C     MT3  LWTR.01T
   36-        PRINT
 1     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 O2      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=3E30W08I OUTP=3E3008.0

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  30% Water  8.0% U-Np 02
    2-       C    k-inf Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     6.93967576546-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       C    30   0     2                    IMP:N=0   $ Void
   10-       30   0     1                   IMP:N=0   $ Void
   11-
   12-       C    SURFACES
   13-       1*   S       0 0 0  10.00       $ *Infinite FISSILE SPHERE
   14-       C    2    S       0 0 0  174.51       $ REFLECTOR
   15-       C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-       MODE  N
   18-       KCODE  500  1  3  503
   19-       KSRC   0  0  0     1  0  0    -1  0  0     0  1  0     0 -1  0     0  0  1     0  0 -1
   20-              1  1  0     1 -1  0     1  0  1     1  0 -1
   21-             -1  1  0    -1 -1  0    -1  0  1    -1  0 -1
   22-              0  1  1     0 -1  1     0  1 -1     0 -1 -1
   23-              1  1  1    -1  1  1    -1 -1  1    -1 -1 -1
   24-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.606278-2       $ At
   26-             1001.50C 1.845371-2                                                  $ an
   27-            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-       MT1  LWTR.01T                                                             $ Wa
   31-       C    M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-       C           8016.50C 4.063067-2
   33-       C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-       C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-       C    MT3  LWTR.01T
   36-       PRINT
 1     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 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 = 1.04272 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.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  25% Water  8.0% U-Np O2
    2-       C    k-inf Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     6.47833307146-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       C    30   0     2                    IMP:N=0   $ Void
   10-       30   0     1                   IMP:N=0   $ Void
   11-
   12-       C    SURFACES
   13-       1*   S       0 0 0  10.00       $ *Infinite FISSILE SPHERE
   14-       C    2    S       0 0 0  174.51       $ REFLECTOR
   15-       C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-       MODE  N
   18-       KCODE  500  1  3  503
   19-       KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0  0 -1
   20-              1  1  0    1 -1  0    1  0  1    1  0 -1
   21-             -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   22-              0  1  1    0 -1  1    0  1 -1    0 -1 -1
   23-              1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   24-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.452497-2       $ At
   26-             1001.50C 1.537809-2                                                   $ an
   27-            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-       MT1  LWTR.01T                                                              $ Wa
   31-       C    M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-       C           8016.50C 4.063067-2
   33-       C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-       C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-       C    MT3  LWTR.01T
   36-       PRINT
 1     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 O2      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.
  this problem has run   3 inactive cycles with     1500 neutron histories and  500 active 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

```
1mcnp     version 4a    ld=10/01/93                          04/27/96 18:54:26
 ******************************************************************************                probid =   04/27/96 18:54:26
 INP=3E20W08I OUTP=3E2008.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  20% Water  8.0% U-Np O2
    2-       C    k-inf Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     6.01699037746-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       C    30   0     2                    IMP:N=0   $ Void
   10-       30   0     1                   IMP:N=0   $ Void
   11-
   12-       C    SURFACES
   13-       1*   S       0 0 0  10.00       $ *Infinite FISSILE SPHERE
   14-       C    2    S      0 0 0  174.51       $ REFLECTOR
   15-       C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-       MODE  N
   18-       KCODE  500  1  3  503
   19-       KSRC    0  0  0    1  0  0    -1  0  0     0  1  0     0 -1  0     0  0  1     0  0 -1
   20-               1  1  0    1 -1  0     1  0  1     1  0 -1
   21-              -1  1  0   -1 -1  0    -1  0  1    -1  0 -1
   22-               0  1  1    0 -1  1     0  1 -1     0 -1 -1
   23-               1  1  1   -1  1  1    -1 -1  1    -1 -1 -1
   24-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.298716-2       $ At
   26-             1001.50C 1.230247-2                                                   $ an
   27-            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-       MT1  LWTR.01T                                                              $ Wa
   31-       C    M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-       C           8016.50C 4.063067-2
   33-       C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-       C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-       C    MT3  LWTR.01T
   36-       PRINT
 1     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 O2      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      500 neutrons per cycle.
  this problem has run   3 inactive cycles with     1413 neutron histories and  500 active cycles with      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.O

    1-        FarField Criticality - Sphere of Transmuted 3.0E 20GWD  15% Water  8.0% U-Np O2
    2-        C    k-inf Optimization For Positive Water Coefficient
    3-        C
    4-        C    SPHERE
    5-        1    1     5.55564768346-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-        C    5    3     8.61040596000-2     1 -2   IMP:N=1   $ Tuff/Water Reflector
    7-        C
    8-        C    OUTSIDE WORLD
    9-        C    30   0     2                    IMP:N=0   $ Void
   10-        30   0     1                   IMP:N=0   $ Void
   11-
   12-        C    SURFACES
   13-        1*   S       0 0 0  10.00      $ *Infinite FISSILE SPHERE
   14-        C    2    S       0 0 0  174.51      $ REFLECTOR
   15-        C
 warning.  this surface has been replaced by a surface of type so
   16-
   17-        MODE  N
   18-        KCODE  500  1  3  503
   19-        KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0  0 -1
   20-               1  1  0    1 -1  0    1  0  1    1  0 -1
   21-              -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   22-               0  1  1    0 -1  1    0  1 -1    0 -1 -1
   23-               1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   24-        M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   25-             92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.144935-2       $ At
   26-              1001.50C 9.226854-3                                                   $ an
   27-             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-        MT1  LWTR.01T                                                              $ Wa
   31-        C    M3     1001.50C 3.142479-2  14000.50C 1.007566-2  13027.50C 2.302817-3
   32-        C           8016.50C 4.063067-2
   33-        C          26000.55C 1.239894-4  12000.50C 2.042960-4  20000.50C 5.030511-4
   34-        C          11023.50C 3.477367-4  19000.50C 4.910511-4
   35-        C    MT3  LWTR.01T
   36-        PRINT
 1     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 O2      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      500 neutrons per cycle.
  this problem has run   3 inactive cycles with     1464 neutron histories and  500 active cycles with      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.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  47% Water  8.0% U-Np O2
    2-       C    k-eff Optimization For Positive Water Volume Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     8.50824092506-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       30   0     2                  IMP:N=0   $ Void
   10-
   11-       C    SURFACES
   12-       1    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-       C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-       MODE  N
   17-       KCODE  500  1  3  1003
   18-       C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-       C            1  1  0    1 -1  0    1  0  1    1  0 -1
   20-       C           -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   21-       C            0  1  1    0 -1  1    0  1 -1    0 -1 -1
   22-       C            1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   23-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   24-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 4.129133-2       $ At
   25-             1001.50C 2.891081-2                                                   $ an
   26-            14000.50C 9.269607-3  13027.50C 2.118592-3                            $ Ca
   27-            26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
   28-            11023.50C 3.199178-4  19000.50C 4.517670-4                            $ 47
   29-       MT1  LWTR.01T                                                              $ Wa
   30-       M3    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
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  47% Water  8.0% U-Np O2      probid =   04/27/96 12:38:38


 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     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

```
 mcnp     version 4a    ld=10/01/95                    04/27/96 14:15:37
 ******************************************************************************                probid =   04/27/96 14:15:37
 INP=3E40W08C OUTP=3C4008.0

     1-        FarField Criticality - Sphere of Transmuted 3.0E 20GWD  40% Water  8.0% U-Np O2
     2-        C    k-eff Optimization For Positive Water Volume Coefficient
     3-        C
     4-        C    SPHERE
     5-        1    1     7.86236115346-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    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-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE  500  1  3  1003
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
    24-             92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.913840-2       $ At
    25-              1001.50C 2.460494-2                                                   $ an
    26-             14000.50C 9.269607-3  13027.50C 2.118592-3                            $ Ca
    27-             26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
    28-             11023.50C 3.199178-4  19000.50C 4.517670-4                            $ 47
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    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
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  40% Water  8.0% U-Np O2      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.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  35% Water  8.0% U-Np O2
    2-       C    k-eff Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     7.40101845946-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       30   0     2                  IMP:N=0   $ Void
   10-
   11-       C    SURFACES
   12-       1    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-       C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-       MODE  N
   17-       KCODE  500  1  3  1003
   18-       C    KSRC   0  0  0    1  0  0    -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-       C           1  1  0    1 -1  0     1  0  1    1  0 -1
   20-       C          -1  1  0   -1 -1  0    -1  0  1   -1  0 -1
   21-       C           0  1  1    0 -1  1     0  1 -1    0 -1 -1
   22-       C           1  1  1   -1  1  1    -1 -1  1   -1 -1 -1
   23-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   24-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.760059-2       $ At
   25-             1001.50C 2.152933-2                                                  $ an
   26-            14000.50C 9.269607-3  13027.50C 2.118592-3                           $ Ca
   27-            26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
   28-            11023.50C 3.199178-4  19000.50C 4.517670-4                           $ 47
   29-       MT1  LWTR.01T                                                             $ Wa
   30-       M3    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
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  35% Water  8.0% U-Np O2      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      500 neutrons per cycle.
 this problem has run   3 inactive cycles with     1433 neutron histories and 1000 active cycles with      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
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/02/96 14:50:47
 ******************************************************************************                probid =   05/02/96 14:50:47
 INP=3E30W08C OUTP=3E3008.O

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  30% Water  8.0% U-Np O2
    2-       C    k-eff Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     6.93967576546-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       30   0     2                  IMP:N=0   $ Void
   10-
   11-       C    SURFACES
   12-       1    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-       C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-       MODE  N
   17-       KCODE  500  1  3  1003
   18-       C    KSRC   0  0  0    1  0  0    -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-       C           1  1  0    1 -1  0     1  0  1    1  0 -1
   20-       C          -1  1  0   -1 -1  0    -1  0  1   -1  0 -1
   21-       C           0  1  1    0 -1  1     0  1 -1    0 -1 -1
   22-       C           1  1  1   -1  1  1    -1 -1  1   -1 -1 -1
   23-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   24-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.606278-2       $ At
   25-             1001.50C 1.845371-2                                                  $ an
   26-            14000.50C 9.269607-3  13027.50C 2.118592-3                           $ Ca
   27-            26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
   28-            11023.50C 3.199178-4  19000.50C 4.517670-4                           $ 47
   29-       MT1  LWTR.01T                                                             $ Wa
   30-       M3    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
1     initial source from file   srctp

1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  30% Water  8.0% U-Np O2      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

```
1mcnp     version 4a    ld=10/01/93                          05/02/96 16:50:03
 ******************************************************************************                probid =   05/02/96 16:50:03
 INP=3E25W08C OUTP=3E2508.O

     1-        FarField Criticality - Sphere of Transmuted 3.0E 20GWD  25% Water  8.0% U-Np 02
     2-        C    k-eff Optimization For Positive Water Coefficient
     3-        C
     4-        C    SPHERE
     5-        1    1     6.47833307146-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    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-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE  500  1  3  1003
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
    24-             92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.452497-2       $ At
    25-              1001.50C 1.537809-2                                                   $ an
    26-             14000.50C 9.269607-3  13027.50C 2.118592-3                            $ Ca
    27-             26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
    28-             11023.50C 3.199178-4  19000.50C 4.517670-4                            $ 47
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    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
 1     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.
  this problem has run   3 inactive cycles with     1488 neutron histories and 1000 active 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
 ******************************************************************************                probid =   05/02/96 18:10:20
 INP=3E20W08C OUTP=3E2008.O

     1-        FarField Criticality - Sphere of Transmuted 3.0E 20GWD  20% Water  8.0% U-Np O2
     2-        C    k-eff Optimization For Positive Water Coefficient
     3-        C
     4-        C    SPHERE
     5-        1    1     6.01699037746-2    -1       IMP:N=1   $ Uranium/Tuff/Water
     6-        5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
     7-        C
     8-        C    OUTSIDE WORLD
     9-        30   0     2                  IMP:N=0   $ Void
    10-
    11-        C    SURFACES
    12-        1    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-        C
 warning.  this surface has been replaced by a surface of type so
    15-
    16-        MODE  N
    17-        KCODE  500  1  3  1003
    18-        C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
    19-        C           1  1  0    1 -1  0    1  0  1    1  0 -1
    20-        C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
    21-        C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
    22-        C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
    23-        M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
    24-             92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.298716-2       $ At
    25-              1001.50C 1.230247-2                                                   $ an
    26-             14000.50C 9.269607-3  13027.50C 2.118592-3                            $ Ca
    27-             26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
    28-             11023.50C 3.199178-4  19000.50C 4.517670-4                            $ 47
    29-        MT1  LWTR.01T                                                              $ Wa
    30-        M3    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
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  20% Water  8.0% U-Np O2      probid =   05/02/96 18:10:20


  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
 ******************************************************************************                probid =   05/02/96 19:26:16
 INP=3E15W08C OUTP=3E1508.0

    1-       FarField Criticality - Sphere of Transmuted 3.0E 20GWD  15% Water  8.0% U-Np O2
    2-       C    k-eff Optimization For Positive Water Coefficient
    3-       C
    4-       C    SPHERE
    5-       1    1     5.55564768346-2    -1       IMP:N=1   $ Uranium/Tuff/Water
    6-       5    3     8.61040596000-2     1 -2    IMP:N=1   $ Tuff/Water Reflector
    7-       C
    8-       C    OUTSIDE WORLD
    9-       30   0     2                  IMP:N=0   $ Void
   10-
   11-       C    SURFACES
   12-       1    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-       C
 warning.  this surface has been replaced by a surface of type so
   15-
   16-       MODE  N
   17-       KCODE  500  1  3  1003
   18-       C    KSRC   0  0  0    1  0  0   -1  0  0    0  1  0    0 -1  0    0  0  1    0
   19-       C           1  1  0    1 -1  0    1  0  1    1  0 -1
   20-       C          -1  1  0   -1 -1  0   -1  0  1   -1  0 -1
   21-       C           0  1  1    0 -1  1    0  1 -1    0 -1 -1
   22-       C           1  1  1   -1  1  1   -1 -1  1   -1 -1 -1
   23-       M1   92234.50C 4.694450-7  92235.50C 3.825286-5  92236.50C 9.153184-6       $ Fi
   24-            92238.50C 1.905500-3  93237.50C 2.182926-6   8016.50C 3.144935-2       $ At
   25-             1001.50C 9.226854-3                                                  $ an
   26-            14000.50C 9.269607-3  13027.50C 2.118592-3                           $ Ca
   27-            26000.55C 1.140702-4  12000.50C 1.879523-4  20000.50C 4.628070-4       $ Wi
   28-            11023.50C 3.199178-4  19000.50C 4.517670-4                           $ 47
   29-       MT1  LWTR.01T                                                             $ Wa
   30-       M3    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
 1     initial source from file   srctp

 1keff results for: FarField Criticality - Sphere of Transmuted 3.0E 20GWD  15% Water  8.0% U-Np O2      probid =   05/02/96 19:26:16

  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     1435 neutron histories and 1000 active cycles with      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

```
1mcnp     version 4a    ld=10/01/93                          05/16/96 11:06:44
 ******************************************************************************                probid =   05/16/96 11:06:44
 inp=s3020mz outp=s3020mz0

    1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mz)
    2-        C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-        C     CELL SPECIFICATIONS
    4-        C     INNER WATER REGION
    5-        1     1  8.374149-2   -1   IMP:N=1
    6-        2     2  8.509901-2  1 -2  IMP:N=1
    7-        3     3  8.610406-2  2 -3  IMP:N=1
    8-        C     OUTSIDE WORLD
    9-        4     0  3   IMP:N=0
   10-
   11-        C     SURFACE SPECIFICATIONS
   12-        1     SO  40.       $ INNER FUEL ZONE
   13-        2     SO  80.       $ INNER FUEL ZONE
   14-        3     SO  140.       $ INNER FUEL ZONE
   15-
   16-        MODE  N
   17-        KCODE  4000 1. 30 130
   18-        C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-        C       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-        c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-        m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-                 12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-                 19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-                 92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-                 92238.50c 4.406469-3  93237.50c 5.048015-6
   28-        mt1      lwtr.01t
   29-        c        (47 vol% water in calico Hills tuff) x .9213  7.87 vol% UO2
   30-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   31-        m2       1001.50c 2.895166-2   8016.50c 4.128059-2  11023.50c 3.203698-4
   32-                 12000.50c 1.882179-4  13027.50c 2.121585-3  14000.50c 9.282705-3
   33-                 19000.50c 4.524054-4  20000.50c 4.634610-4  26000.55c 1.142314-4
   34-                 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-        mt2      lwtr.01t
   37-        c        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-        mt3      lwtr.01t
   42-        PRINT
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mz)        probid =   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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120411 neutron histories and  100 active cycles with      399532 neutron histories.

 this calculation has completed the requested number of keff cycles using a total of      519943 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 = .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

```
1mcnp     version 4a    ld=10/01/93                          05/16/96 07:29:34
 ******************************************************************************                    probid =   05/16/96 07:29:34
 inp=s3020my outp=s3020my0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020my)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.374149-2   -1   IMP:N=1
    6-       2     2  8.509901-2  1 -2  IMP:N=1
    7-       3     3  8.610406-2  2 -3  IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       4     0  3   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  50.       $ INNER FUEL ZONE
   13-       2     SO  100.       $ INNER FUEL ZONE
   14-       3     SO  160.       $ INNER FUEL ZONE
   15-
   16-       MODE  N
   17-       KCODE  4000 1. 30 130
   18-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-       C       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-       c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-       m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-                12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-                19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-                92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-                92238.50c 4.406469-3  93237.50c 5.048015-6
   28-       mt1      lwtr.01t
   29-       c        (47 vol% water in calico Hills tuff) x .9213  7.87 vol% UO2
   30-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   31-       m2       1001.50c 2.895166-2   8016.50c 4.128059-2  11023.50c 3.203698-4
   32-                12000.50c 1.882179-4  13027.50c 2.121585-3  14000.50c 9.282705-3
   33-                19000.50c 4.524054-4  20000.50c 4.634610-4  26000.55c 1.142314-4
   34-                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-       mt2      lwtr.01t
   37-       c         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-       mt3      lwtr.01t
   42-       PRINT
1     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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120414 neutron histories and  100 active cycles with      400502 neutron histories.

 this calculation has completed the requested number of keff cycles using a total of      520916 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 = 1.01402 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 = 7.57E-05 seconds with an estimated standard deviation of 1.83E-07

```
1mcnp     version 4a    ld=10/01/93                          05/15/96 16:51:53
 ******************************************************************************                probid =   05/15/96 16:51:53
 inp=s3020mx outp=s3020mx0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mx)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.374149-2   -1   IMP:N=1
    6-       2     2  8.509901-2  1 -2  IMP:N=1
    7-       3     3  8.610406-2  2 -3  IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       4     0  3   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  57.4       $ INNER FUEL ZONE
   13-       2     SO  114.8       $ INNER FUEL ZONE
   14-       3     SO  174.8       $ INNER FUEL ZONE
   15-
   16-       MODE  N
   17-       KCODE  4000 1. 30 130
   18-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-       C       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-       c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-       m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-               12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-               19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-               92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-               92238.50c 4.406469-3  93237.50c 5.048015-6
   28-       mt1     lwtr.01t
   29-       c        (47 vol% water in calico Hills tuff) x .9213  7.87 vol% UO2
   30-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   31-       m2       1001.50c 2.895166-2   8016.50c 4.128059-2  11023.50c 3.203698-4
   32-               12000.50c 1.882179-4  13027.50c 2.121585-3  14000.50c 9.282705-3
   33-               19000.50c 4.524054-4  20000.50c 4.634610-4  26000.55c 1.142314-4
   34-               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-       mt2     lwtr.01t
   37-       c        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-       mt3     lwtr.01t
   42-       PRINT
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mx)        probid =   05/15/96 16:51:53

 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   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:
```

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

```
1mcnp     version 4a    ld=10/01/93                          05/16/96 12:46:13
 ******************************************************************************                    probid =   05/16/96 12:46:13
 inp=s3020ms outp=s3020ms0

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mr)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.374149-2   -1   IMP:N=1
    6-       2     2  8.577020-2  1 -2  IMP:N=1
    7-       3     3  8.610406-2  2 -3  IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       4     0  3   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  53.0       $ INNER FUEL ZONE
   13-       2     SO  106.0       $ INNER FUEL ZONE
   14-       3     SO  166.0       $ INNER FUEL ZONE
   15-
   16-       MODE  N
   17-       KCODE  4000 1. 30 130
   18-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-       C       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-       c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-       m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-                12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-                19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-                92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-                92238.50c 4.406469-3  93237.50c 5.048015-6
   28-       mt1      lwtr.01t
   29-       c        (47 vol% water in calico Hills tuff) x .973857  2.6143 vol% UO2
   30-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   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-                19000.50c 4.782136-4  20000.50c 4.898998-4  26000.55c 1.207479-4
   34-                92234.50c 1.534087-7  92235.50c 1.250056-5  92236.50c 2.991146-6
   35-                92238.50c 6.226936-4  93237.50c 7.133528-7
   36-       mt2      lwtr.01t
   37-       c        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-       mt3      lwtr.01t
   42-       PRINT
1     initial source from file   srctp
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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   119975 neutron histories and  100 active cycles with      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:
```

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

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mr)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.374149-2   -1   IMP:N=1
    6-       2     2  8.577020-2  1 -2  IMP:N=1
    7-       3     3  8.610406-2  2 -3  IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       4     0  3   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  55.0       $ INNER FUEL ZONE
   13-       2     SO  110.0       $ INNER FUEL ZONE
   14-       3     SO  170.0       $ INNER FUEL ZONE
   15-
   16-       MODE  N
   17-       KCODE  4000 1. 30 130
   18-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-       C       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-       c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-       m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-                12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-                19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-                92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-                92238.50c 4.406469-3  93237.50c 5.048015-6
   28-       mt1      lwtr.01t
   29-       c        (47 vol% water in calico Hills tuff) x .973857  2.6143 vol% UO2
   30-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   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-                19000.50c 4.782136-4  20000.50c 4.898998-4  26000.55c 1.207479-4
   34-                92234.50c 1.534087-7  92235.50c 1.250056-5  92236.50c 2.991146-6
   35-                92238.50c 6.226936-4  93237.50c 7.133528-7
   36-       mt2      lwtr.01t
   37-       c        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-       mt3      lwtr.01t
   42-       PRINT
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mr)        probid =   05/16/96 11:07:55

 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     4000 neutrons per cycle.
 this problem has run  30 inactive cycles with   120047 neutron histories and  100 active cycles with      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:
```

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

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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

    1-       Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mq)
    2-       C    Calico Hills Tuff 1.137 g/cc  .47 porosity -  shells surrounded by tuff
    3-       C     CELL SPECIFICATIONS
    4-       C     INNER WATER REGION
    5-       1     1  8.374149-2   -1   IMP:N=1
    6-       2     2  8.577020-2  1 -2  IMP:N=1
    7-       3     3  8.610406-2  2 -3  IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       4     0  3   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  57.4       $ INNER FUEL ZONE
   13-       2     SO  114.8       $ INNER FUEL ZONE
   14-       3     SO  174.8       $ INNER FUEL ZONE
   15-
   16-       MODE  N
   17-       KCODE  4000 1. 30 130
   18-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 15  0 0 -55  -10 0 -40
   19-       C       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-       c        (47 vol% water in calico Hills tuff) x .815  18.5 vol% UO2
   22-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   23-       m1       1001.50c 2.561121-2   8016.50c 4.215845-2  11023.50c 2.834054-4
   24-                12000.50c 1.665012-4  13027.50c 1.876796-3  14000.50c 8.211662-3
   25-                19000.50c 4.002067-4  20000.50c 4.099866-4  26000.55c 1.010513-4
   26-                92234.50c 1.085591-6  92235.50c 8.845975-5  92236.50c 2.116674-5
   27-                92238.50c 4.406469-3  93237.50c 5.048015-6
   28-       mt1      lwtr.01t
   29-       c        (47 vol% water in calico Hills tuff) x .973857  2.6143 vol% UO2
   30-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   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-                19000.50c 4.782136-4  20000.50c 4.898998-4  26000.55c 1.207479-4
   34-                92234.50c 1.534087-7  92235.50c 1.250056-5  92236.50c 2.991146-6
   35-                92238.50c 6.226936-4  93237.50c 7.133528-7
   36-       mt2      lwtr.01t
   37-       c        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-       mt3      lwtr.01t
   42-       PRINT
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 47% H2O/ 18.5% UO2 (s3020mq)        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

```
1mcnp     version 4a    ld=10/01/93                          05/28/96 12:45:58
 ******************************************************************************                probid =   05/28/96 12:45:58
 inp=c3020nb outp=c3020nb0

     1-        Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 4.6% UO2 (c3020nb)
     2-        C    Calico Hills Tuff 1.5095 g/cc .40 porosity - inf cylinder reflected by tuff
     3-        C     CELL SPECIFICATIONS
     4-        C     INNER WATER REGION
     5-        1     1  8.372894-2   -1 3 -4  IMP:N=1
     6-        2     2  8.423019-2  1 -2 3 -4 IMP:N=1
     7-        C     3     2  8.610406-2    -2 4 -5 IMP:N=1
     8-        C     OUTSIDE WORLD
     9-        4     0  2:-3:4   IMP:N=0
    10-
    11-        C     SURFACE SPECIFICATIONS
    12-        1     cz  61       $ INNER FUEL ZONE
    13-        2     cz  121      $ reflector
    14-        3*    pz  0        $ center
    15-        4*    pz  385      $ end
    16-        5     pz  445      $ reflector
    17-
    18-        MODE  N
    19-        KCODE  4000 1. 25 125
    20-        C    KSRC   0 0 1  0 0 10  0 0 20  0 0 29  0 20 15  0 0 55  -10 0 40
    21-        C       0 -5 20 -30 0 13 0 -10 26 5 50 125 -3 15 56 5 5 80 10 30 17
    22-        C       0 0 100  0 0 200  0 0 20  0 0 290  0 20 150  0 0 355  -10 0 240
    23-        C       0 -5 220 -30 0 313 0 -10 260 5 -30 325 -3 15 356 5 5 380 10 30 317
    24-        C      MATERIAL SPECIFICATIONS
    25-        c        (40 vol% water in calico Hills tuff) x .954  4.6 vol% UO2
    26-        c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
    27-        m1       1001.50c 2.551426-2   8016.50c 4.191775-2  11023.50c 3.75556-4
    28-                 12000.50c 2.206397-4  13027.50c 2.487043-3  14000.50c 1.088171-2
    29-                 19000.50c 5.303352-4  20000.50c 5.432952-4  26000.55c 1.339085-4
    30-                 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-        c         40 vol% water in calico Hills tuff
    34-        m2       1001.50c 2.674450-2   8016.50c 4.158162-2  11023.50c 3.936641-4
    35-                 12000.50c 2.312785-4  13027.50c 2.606963-3  14000.50c 1.140641-2
    36-                 19000.50c 5.559069-4  20000.50c 5.694918-4  26000.55c 1.403653-4
    37-        mt2      lwtr.01t
    38-        PRINT
1     initial source from file   srctp
1keff results for: Far-Field Criticality Study - 3.0% /20 GWD/mt - 40% H2O/ 4.6% UO2 (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     4000 neutrons per cycle.
 this problem has run  25 inactive cycles with    99796 neutron histories and  100 active cycles with     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