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CORSOR User's Manual

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Battelle's Columbus Laboratories

Prepared for
U.S. Nuclear Regulatory Commission

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ABSTRACT

The CORSOR code simulates the release of fission products and structural materials from a reactor core during the in-vessel period of a severe accident in a light water reactor. The code is a simple, empirically based treatment of release and does not treat detailed mechanisms for release from high temperature fuel. The first-order release rate coefficients for the species considered are presented, the input requirements of the code are described, and an example input and output stream is supplied in an appendix.

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January 3, 1985

Introduction

CORSOR is a FORTRAN-5 program that calculates fractions of 23 reactor core material species released during a degraded core accident in an LWR. The user supplies plant-specific information, including initial species inventories, geometric distribution of material, and core power peaking factors. The user also supplies accident-specific information, including time-temperature profiles of the core nodes and a time profile of oxidation of the zirconium cladding.

The program calculates the release of each species at specified time steps and combines appropriate releases to track the WASH-1400 groups. CORSOR also returns profiles of release rate versus time for the species subgroups for use in other calculations.

Physical Model

The core is represented by a two-dimensional array of radial and axial nodes. The core can be segmented radially into 10 or fewer "annuli" and axially into 24 or fewer "disks". The result is 240 or fewer points, each of which has its own history. The fission product species inventory is distributed among the nodes according to power peaking factors (RADDIS and AXDIS) which are specified by the user. Structural species are distributed according to a set of values (STDIS) which describes the fraction of total core volume in each radial sector. The fraction of the core volume found in each axial node is fixed and equal to the inverse of the number of such nodes specified. The fraction of the core volume found in each radial node can be established by the user through STDIS so that the power profile of the core can be better reflected in the code run. It is imperative that the values of RADDIS, AXDIS, and STDIS agree with those used in the calculations of the core nodal temperatures and Zr oxidation. It is also important that the sum of the RADDIS and STDIS arrays be equal to the number of radial nodes, and the sum of AXDIS be equal to NDZ, the number of axial nodes.

The code requires 23 values for the initial inventory of the species to be released by the core during the simulation. These masses are then distributed among the core nodes according to two different schemes. The fission products are apportioned according to the normalized product of AXDIS, RADDIS, and STDIS for each node. The structural and control rod materials are distributed according to the STDIS values radially and homogeneously in the axial direction.

At each time step the code requires the current temperature of each node and the extent of Zr oxidation at each node. Based upon the temperature read, the current inventory of the species at the node, and the appropriate coefficients stored in the core, the mass of the species released during the time step is calculated.

Three separate release mechanisms are used in CORSOR depending on species and temperature.

Gap Release

A small fraction of the volatile fission product species resides in the fuel-cladding gap during normal reactor operation and is subject to a one-time release at 900 C. This temperature corresponds to an initial fracture of the fuel rod cladding and represents the so-called gap release. This release mechanism is simulated in CORSOR by releasing the fraction of the inventory of the species in Table 1 from every axial node at a given radial position as soon as any axial node's temperature exceeds 900 C. This corresponds to the emission through the break in the fuel rod of the "gap inventory" found along the entire length of the rod. Following this release this radial position is not subject to any further gap release.

TABLE 1. GAP RELEASE FRACTIONS FOR FISSION PRODUCT SPECIES

Species	Release Fraction
Cs	0.05
I	0.017
Kr, Xe	0.03
Te, Sb	1.E-4
Ba, Sr	1.E-6

Transient Release

Two methods for calculating the transient release of all species except control rod materials are available to the user of CORSOR. Both methods assume a first order release rate from each node for each species such that:

FFP = FP*(1 - exp(-FRC*DTIME))

where FFP is the mass of the species released from the node during time period DTIME, FP is the mass of the species present at the node at the start of the time step, and FRC is the fractional release rate coefficient.

The value of FRC used in the code calculations depends upon the method selected by the user. For the default method (which was used for all calculations reported in BMI-2104), the value of FRC is species and temperature dependent, given by a relationship of the form:

FRC = A(I,J)*EXP(B(I,J)*T)

where T is the temperature in C and A and B are constants whose values are selected for the Ith species and the Jth temperature range. The three temperature regimes for which these constants are defined are 900-1400 C, 1400-2200 C, and 2200-2760 C, with all temperature values greater than this latter value set to 2760 C, since this has been taken to be the maximum credible temperature for any node in the core. The values of these constants are presented in Table 2. These are taken from NUREG-0772[1] which attempted to reduce the available experimental data from References 2, 3, and 4 into a single usable dataset through consideration of the experimental conditions and informed "engineering judgment" of the data points available. This method of calculation of the release rates is recognized as being nonmechanistic, and no attempt has been made to account for any scaling effects to which these release coefficients may be subject in the transition from the experiments to the accident situation.

TABLE 2. VALUES USED FOR THE CONSTANTS A AND B IN THE DEFAULT METHOD FOR CALCULATION OF THE RELEASE RATE COEFFICIENTS

Fission Product Group	900 C < T < 1400 C		1400 C < T < 2200 C		2200 C < T < 2760 C	
	A	B	A	B	A	B
I, Xe, Kr	7.02E-09	0.00886	2.02E-07	0.00667	1.74E-05	0.00460
Cs	7.53E-12	0.0142	2.02E-07	0.00667	1.74E-05	0.00460
Te[a]	1.62E-11	0.0106	9.04E-08	0.00522	6.02E-06	0.00312
Ag	3.88E-12	0.0135	9.39E-08	0.00630	1.18E-05	0.00411
Sb	1.90E-12	0.0128	5.88E-09	0.00708	2.56E-06	0.00426
Ba	7.50E-14	0.0144	8.26E-09	0.00631	1.38E-05	0.00290
Mo	5.01E-12	0.0115	5.93E-08	0.00523	3.70E-05	0.00200
Sr	2.74E-08	0.00360	2.78E-11	0.00853	9.00E-07	0.00370
Zr[b]	6.64E-12	0.00631	6.64E-12	0.00631	1.48E-07	0.00177
Ru	1.36E-11	0.00768	1.36E-11	0.00768	1.40E-06	0.00248
Fuel[b], La group	5.00E-13	0.00768	5.00E-13	0.00768	5.00E-13	0.00768
Cladding[b], Zr	6.64E-12	0.00631	6.64E-12	0.00631	1.48E-07	0.00177
Sn	1.90E-12	0.0128	5.88E-09	0.00708	2.56E-06	0.00426
Structure[b], (Fe, Cr, Ni, Mn)	6.64E-10	0.00631	6.64E-10	0.00631	1.48E-05	0.00177

(a) Temperature range boundaries for Te are 1600 and 2000 C.

(b) The values for A and B for these species were altered from those in Reference 1.

A second method of calculating the release rate coefficients has been added to the code and is available to the user also. This method, denoted M-Version in the code, has not yet been widely reviewed but does avoid some of the recognized deficiencies of the above model. M-Version makes use of a more physical description of the release process, although it is still quite simple and does not account for any interactions among species nor for any effects of changes in geometry of the releasing node. In this method the release rate coefficient is given by an Arrhenius type equation of the form:

FRC = KO(I)*EXP(-Q(I)/(1.987E-3*T))

where KO(I) and Q(I) are species-dependent constants, T is the nodal absolute temperature, and 1.987E-3 is the value of the gas constant multiplied by a unit conversion factor. The values of the constants KO and Q are given in Table 3. The values of these constants still represent empirical fits to the experimental data used for the default method described above. The values in Table 3 assume that release of the noble gases, Te, Cs, and I, are all controlled by migration through the fuel matrix, and so experience the same KO and Q values. Resulting release rates are almost identical to the I, Xe, and Kr release rates from the default model. The release of the refractory fission products and structural materials is assumed to be controlled by vaporization, so that the Q values are heats of vaporization for these released species. Ba, Sr, La, and fission product Zr are assumed to be released in oxide form and so the heats of vaporization of these oxides have been used for Q. The KO values are determined by adjusting the curve to the existing data. Additional information on the derivation of this model is given in Appendix A.

The interaction of Te with the Zircaloy cladding of the fuel rods has been documented experimentally[5] but is not yet well understood. An attempt to represent the holdup of Te by the unoxidized Zr in the cladding has been made and is employed for either mode of release calculation selected by the user. For the default version, the FRC value calculated using the A and B values appropriate for Te in the temperature range of interest is reduced by a factor of 40 if the nodal extent of Zr

TABLE 3. ARRHENIUS TYPE CONSTANTS USED IN CALCULATION OF RELEASE RATE COEFFICIENTS IN M-VERSION OF CORSOR

Species	KO (min^{-1})	Q (kcal/mol)
Cs, I, Kr, Xe, Te	2.0E5	63.8
Ag	7.9E3	61.4
Sb	(a)	(a)
Ba	2.95E5	100.2
Sn (clad)	5.95E3	70.8
Ru	1.62E6	152.8
UO_2	1.46E7	143.1
Zr (clad)	8.55E4	139.5
Zr	2.67E8	188.2
Fe	2.94E4	87.0
Mo	(b)	(b)
Sr	4.40E5	117.0
Cr	4.62E4	84.5
Ni	5.36E4	92.2
Mn	5.04E3	56.8
La group	0	(c)

(a) Omitted from consideration due to lack of radiologic significance and potential chemical reaction with in-core surfaces.

(b) Omitted from consideration due to very low pressure and lack of radiologic significance.

(c) La exhibits no significant vapor pressure prior to conversion to LaO which does not occur in-vessel.

oxidation is less than 70 percent. This same factor is applied to the value calculated using the M-Version calculation scheme.

Control Rod Release

There is a great deal of uncertainty regarding the nature of the release of control rod materials in accident situations. The vaporization of boron from the B_4C control rods in BWR's appears to be possible following oxidation of the boron by the steam, but such releases may be small. At this time the kinetics of this process and the possible extent and form of the release are too uncertain to include even rough estimates in the code. The release of Ag-In-Cd from control rods in PWR designs is expected to be signiciant, but the magnitude is still quite uncertain and the model incorporated in CORSOR to account for release of these species is in need of improvement.

The control rod release is calculated in the code based on the following method:

- At 1400 C, the control rods are assumed to fail and 0.05 of the inventory of Ag and In, and 0.5 of the Cd are released from the nodes reaching this temperature.
- From 1400 to 2300 C the cumulative fraction of the inventory released is calculated according to:

  Ag: FREL = 0.0005*(T-1400) + 0.05
  Cd: FREL = 0.00033*(T-1400) + 0.50
  In: FREL = 0.00011*(T-1400) + 0.05

  so that at 2300 C, 0.50 of the Ag, 0.80 of the Cd, and 0.15 of the In have been released.
- From 2300 to 2800 C the cumulative fractions of the inventory released are calculated according to:

  Ag: FREL = 0.001*(T-2300) + 0.5
  Cd: FREL = 0.0004*(T-2300) + 0.8
  In: FREL = 0.0017*(T-2300) + 0.15

  which result in complete release at 2800 C.

Note that no release rates are calculated in CONROD for these control rod species and no physical process is assumed in the calculations.

No potential for candling or for high pressure ejection of molten alloy at the time of rod failure have been taken into account in this model. Further experimental work in this area is obviously needed.

PROGRAM MECHANICS

The flow chart for CORSOR is shown in Figure 1 with all subroutines and their functions indicated.

CORSOR

CORSOR is the main routine and accepts all the user supplied input, controls program flow by calling the various subroutines and writes accumulated releases to various files for subsequent output and processing by other subroutines.

INVENT

This subroutine reads in the initial inventories and distributes them according to the user supplied geometric and power peaking factors for the core under study.

CORTEM

CORTEM reads data from input Unit 25 (TAPE25, in CDC parlance) which is presumably supplied by a thermal hydraulics code such as MARCH. The information read includes time, time step number, fraction of core melted, and, for each node, the temperature, fraction of Zircaloy oxidized, and a flag indicating whether the node is in or out of the core. This is the TAPE25 information written by MARCH.

EMIT

This subroutine calculates the releases of all fission product and fuel and structural species except for the control rod materials.

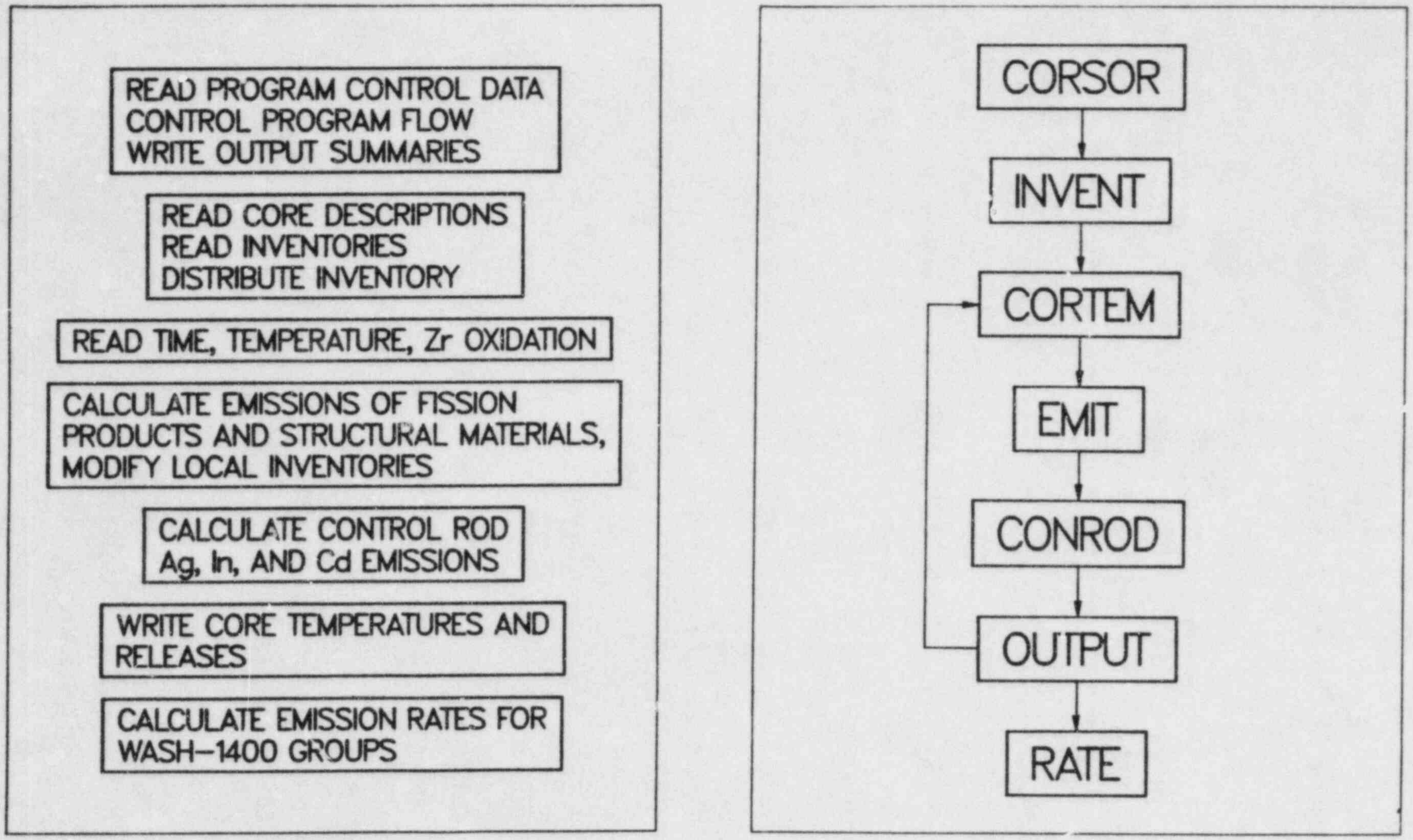

FIGURE 1. FLOW CHART OF CORSOR

CONROD

CONROD calculates the cumulative releases of the control rod Ag, In, and Cd.

OUTPUT

After return from EMIT, CORSOR writes new accumulated releases to output files which are later printed by job control. OUTPUT is then called to print the input as read by CORTEM and the new accumulated releases as calculated by EMIT. OUTPUT can be called with optional frequency, or not at all, at the discretion of the user.

RATE

After the final call to EMIT, CORSOR calls RATE. RATE uses images of the output files (created by CORSOR) to compute and print release rates for I, Cs, CsI, CsOH, Te, and aerosol as well as the WASH-1400 fission product groups. These rates are of the form "delta-mass released over delta-time" and are computed at intervals which give the best fit to actual released mass.

Program Input

User-defined information needed by CORSOR is supplied in two sources: user supplied input and MARCH supplied TAPE25.

User Supplied Input

All variables are real unless otherwise noted, and all input is read unformatted. All "cards" are required.

Card 1	ACDNAM, ACDSEQ	8 character identifiers for the run.
Card 2	MVERSN	Logical: .TRUE. selects M-Version method of calculating releases, .FALSE. utilizes default method.

Card 3	TSTRT, TFAIL, SMLT	Variables denoting starting time for calculations, time to halt calculation, and time at which core melting begins. All in minutes. SMLT is used in subroutine RATE for preparation of the TRAPMELT input dataset.
Card 4	ISTEP, OSTEP	Integer variables for controlling level of time resolution for input and output, respectively. Every $ISTEP^{th}$ input record on UNIT25 will be utilized in the calculations. Every $OSTEP^{th}$ iteration will print temperature, FZR, and S arrays for core, in addition to release information. OSTEP = 0 results in printing only the summary listing of the calculations.
Card 5	R1, R2, NDZ	Integer variables describing the core nodalization. R1 and R2 are the identifiers of the central and extreme radial nodes (e.g., 1 and 10). NDZ is the number of axial nodes in the TAPE25 dataset. Maxima for R2 and NDZ are 10 and 24. R1 is typically 1.
Card 5	RADDIS	R2 values of the radial power peaking factor which are used in INVENT to distribute the fission product inventory. These values should be normalized to sum to R2. RADDIS(1) is central value, RADDIS(R2) is for outer edge of core.
Card 7	AXDIS	NDZ values of the axial power peaking factor which are used in INVENT to distribute the fission product inventory. These values should be normalized to sum to NDS. AXDIS(1) is for bottom of core, AXDIS(2) is for the top. Equal spacing is assumed.
Card 8	STDIS	R2 values of the fraction of core volume contained in the radial nodes. This is used to distribute the structural material fuel and control rods, and is also factored into the fission product inventory distribution. These values should be normalized to R2.

Card 9	TCS, TI2, TXE, TKR, TTE, TAG, TSB, TBA, TSN, TRU, TUO2, TZRC, TZR, TFE, TMO, TSR, TCR, TNI, TMN, TLA, TAGR, TCDR, TINR	The total inventories of the species to be released in CORSOR. The order is required to be followed, and zero is an acceptable value for any species. The recommended units for these values is kg, although it's not necessary. In order, these species are cesium, iodine, xenon, krypton, tellurium, silver (fission product), antimony, barium, tin (clad), ruthenium, UO_2 (fuel), zirconium (clad), zirconium (fission product), iron (structural), molybdenum, strontium, chromium (structural), nickel (structural), manganese (structural), lanthanum, silver (control rod), cadmium (control rod), indium (control rod).

TAPE25

In job control, a MARCH output file is attached as TAPE25 and is used in CORTEM. TAPE25 is a binary file with the following input variables:

N - Time step number

TIME In minutes since start of accident

FCM - Fraction of core melted

TEMP - An array of nodal temperatures (F) with the dimension (z,r) where z is the number of axial nodes (with z = 1 representing the bottom of the core) and r is the number of radial nodes (with r = 1 representing the center of the core).

S - A similarly dimensioned array of flags (1 or 0) denoting status of the node as in-core (1) or out-of-core (0).

FZRN - A similarly dimensioned array of fractions denoting the fraction of nodal Zircaloy which is oxidized.

References

(1) U.S. Nuclear Regulatory Commission, "Technical Bases for Estimating Fission Product Behavior During LWR Accidents", NUREG-0772 (1981).

(2) Parker, G. W., et al, "Out of Pile Studies of Fission Product Release from Overheated Reactor Fuels at Oak Ridge National Laboratories, 1955-1965", Oak Ridge National Laboratory Report ORNL-3981 (1967).

(3) Lorenz, R. A., et al, "Fission Product Release from Highly Irradiated Fuel", NUREG/CR-0722 (1980).

(4) Albrecht, H., Matschoss, V., and Wild, H., "Experimental Investigation of Fission and Activation Product Release from LWR Fuel Rods at Temperatures Ranging from 1500-2800 C", proceedings of the Specialists' Meeting on the Behavior of Deflected Zirconium Alloy Clad Ceramic Fuel in Water Cooled Reactors, Chalk River, Canada, pp 141-146 (1979).

(5) Sallach, R. A., Greenholt, C. J., and Taig, A. R., "Chemical Interactions of Tellurium Vapors with Reactor Materials", NUREG/CR-2921 (1983).

APPENDIX A

CORSOR M-VERSION

APPENDIX A

CORSOR M-VERSION

The release rate coefficients used in the default version of CORSOR were arrived at by fitting curves to available data. No attempt was made to place these curves on a theoretica' basis nor to derive an understanding of the release mechanisms from the relatively sparse data. One can, however, utilize these data in an empirical fashion that is consistent with a theoretical basis for the release process. This approach turns out to be simpler than the default method and it provides some insight into the relative releases of the various materials based on their thermodynamic properties. The method used to arrive at the coefficients in Table 3 is outlined here.

One first assumes that all release rates are governed by an Arrhenius equation,

$$k = k_o \; e^{-Q/RT}$$

where k is the release rate (min^{-1}) at a given temperature T (°K) for a particular species, Q is the activation energy (cal/mol) for the release process, R the gas constant (cal/mol K), and k_o(min^{-1}) the so-called preexponential factor. That much of the available fission product release data are adequately represented by this form has been demonstrated by Kelly, et al[(1)]. Simply fitting the release data to curves of this form clearly separated the species examined (Kr, Sr, Zr, Mo, Ru, Ag, Sb, Te, I, Cs, Ba, Ce, and Nd) into two groups. One group (Zr, Ru, Ce, Nd) exhibited Q values from 170 to 270 kcal/mol, while the remainder was best described by Q values from roughly 40 to 80 kcal/mol. While the activation energies deduced in this manner do not coincide with the heats of vaporization of the species examined, there is a strong sir·ilarity between the two. This similarity, coupled with the fact that lease of the species of low volatility involves vaporization as a poten' lly rate limiting step, is sufficient justification for using the he. of vaporization for Q for these species.

The rate limiting step in the release of the volatile species (Kr, Xe, I, Cs, Te) involves migration through the UO_2 matrix so that the activation energy and preexponential factor can be reasonably determined only from prototypical experiments. Thus, a simple fit of experimental data for these species, without regard for their heats of vaporization, is the basis for the KO and Q given in Table 3. (These coefficients do not take into account the gettering of Te by the rod cladding material, and this accounting is treated as in the default method.)

The heat of vaporization for the remaining species was taken for the value of Q. The handbook of Hultgren, et al[2] provided the elemental heats of vaporization for the elemental forms given in Table 3. Note that Ba and Sr were assumed to be present in the fuel as BaO and SrO and the fission product Zr was assumed present as ZrO_2. The vapor pressures for BaO and SrO were taken from Barin's handbooks[3,4], that for ZrO_2 from Blackburn and Johnson[5], and the UO_2 heat of vaporization is based on Tetenbaum and Hunt[6]. The release rates of these species are in direct proportion to their vapor pressure, so the preexponential factor in the vapor pressure expression is adjusted by a scale factor to agree with the experimental observations. One scale factor is applied to all species. Its value (0.0247 min^{-1} atm^{-1}) was arrived at by scaling the observed release rates (min^{-1}) of Ba, Sr, Ru, and Zr to the vapor pressures (atm) of BaO, SrO, Ru, and ZrO_2 to achieve the best overall agreement.

It is recognized that the releases predicted in this way still do not have a mechanistic basis, but this approach does have the advantage of incorporating the available data into a simple framework that has some foundation in physical phenomena.

References

(1) Kelly, J. L., Reynolds, A. B., and McGown, M. E., "Temperature Dependence of Fission Product Release Rates", Nuclear Science and Engineering, 88, 184-199 (1984).

(2) Hultgren, R., Desai, P. D., Hawkins, D. T., Gleiser, M., Kelley, K. K., and Wagman, D. D., Selected Values of Thermodynamic Properties of the Elements, American Society for Metals (1973).

(3) Barin, I. and Knacke, O., Thermochemical Properties of Inorganic Substances, Springer-Verlag, p 77 (1973).

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(5) Blackburn, P. E. and Johnson, C. E., "Light Water Reactor Fission Product Data Assessment", Argonne National Laboratory's Report ANL-82-42 (1983).

(6) Tetenbaum, M. and Hunt, P. D., "Total Pressure of Uranium-Bearing Species Over Oxygen-Deficient Urania", J. Nucl. Materials, 34, 86-91 (1970).

APPENDIX B

- Sample Input Data Set
- CORSOR Listing
- Sample Output Data Set

```
BRF,AC=[redacted],T1000,P2.
REQUEST,TAPE10,PF.
REQUEST,TAPE11,PF.
REQUEST,TAPE13,PF.
REQUEST,TAPE14,PF.
ATTACH,TAPE25,PBTW2T25,ID=KELLY.
ATTACH,X,CORSORM,ID=EBRYANT.
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.
LGO.
CATALOG,TAPE10,PBTWREL,ID=EBRYANT,RP=999.
REWIND,TAPE11.
REWIND,TAPE13.
REWIND,TAPE14.
COPYSBF,TAPE11.
COPYSBF,TAPE13.
COPYSBF,TAPE14.
CATALOG,TAPE11,PBTWT11,ID=EBRYANT,RP=999.
CATALOG,TAPE13,PBTWT13,ID=EBRYANT,RP=999.
CATALOG,TAPE14,PBTWT14,ID=EBRYANT,RP=999.
'[redacted]' '[redacted]'
.FALSE.
2620.0 3055.0 2748.0
4 0
1 10 24
1.5 1.3 1.2 1.1 1.0 .95 .90 .80 .70 .55
.47 .49 .53 .64 .77 .95 1.12 1.27 1.35 1.44
1.47 1.50 1.50 1.47 1.44 1.35 1.27 1.12 .95 .77
.64 .53 .49 .47
1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
230.3 16.7 387.0 25.5 34.8 0.0 0.0 105.0 1050.0 347.2
156555.0 64100.0 267.0 15150.0 237.0 63.0 4140.0 2560.0
432.0 1562.0 0.0 0.0 0.0
```

```
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.

      C*******************************************************************
      *DECK CORSOR
            PROGRAM CORSOR(INPUT,OUTPUT,TAPE25,TAPE11,TAPE13,TAPE14,
           &TAPE10)
      C***
      C***  CORSOR CALCULATES THE FRACTIONS OF REACTOR CORE MATERIAL
      C***  SPECIES RELEASED DURING A CORE HEAT-UP.
      C***
      C***  INPUT FILES:
      C***     1) MARCH OUTPUT FILE TAPE25 - AN ARRAY CONTAINING
      C***        CORE TIME-TEMPERATURE DATA
      C***     2) FILE (USUALLY PART OF THE SUBMIT JOB) CONTAINING
      C***        FOLLOWING DATA:
      C***          PLANT NAME
      C***          ACCIDENT SEQUENCE
      C***          MVERSN: TRUE USES CORSOR-M VERSION CALCULATIONS
      C***                  FALSE USES NORMAL CORSOR CALCULATIONS
      C***          TSTRT - ACCIDENT START TIME (MINUTES)
      C***          TFAIL - ACCIDENT END TIME (MINUTES)
      C***          SMLT - START MELT TIME (MINUTES)
      C***          ISTEP - FREQUENCY OF OUTPUT DUMPS
      C***          OSTEP - FREQUENCY OF TIME-TEMPERATURE DATA POINTS READ
      C***                  FROM MARCH TAPE25
      C***          R1-1
      C***          R2-NUMBER OF RADIAL AND STRUCTURAL FACTORS
      C***          NDZ - NUMBER OF AXIAL FACTORS
      C***          TXX - INITIAL INVENTORIES OF FOLLOWING SPECIES:
      C***            1=CESIUM          2=IODINE          3=XENON
      C***            4=KRYPTON         5=TELLURIUM       6=SILVER
      C***            7=ANTIMONY        8=BARIUM          9=TIN(CLAD)
      C***           10=RUTHENIUM      11=FUEL(UO2)      12=ZIRCONIUM(CLAD)
      C***           13=ZIRCONIUM(FP)  14=IRON(STRUCTURE) 15=MOLYBDENUM
      C***           16=STRONTIUM      17=CHROMIUM       18=NICKEL
      C***           19=MANGENESE      20=LANTHANUM      21=SILVER(ROD)
      C***           22=CADMIUM(ROD)   23=INDIUM(ROD)
      C***
            COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,TSTRT,TFAIL
            COMMON /M/MVERSN
            COMMON /EMT/TO,TFP(23),TEMP(2,24,10),FZRN(24,10)
            COMMON /CTEMP/K,R3,R4,FLAG1,TIMEO,ISTEP
            COMMON /INVNT/FP(23,24,10),PWR
            COMMON /TOT/TCK(23)
            COMMON /RATES/STOR(9,1000),DIVTIM(8,20),TST,NUM,SMLT
            CHARACTER*8 FPNAME(23),ACDNAM,ACDSEQ
            INTEGER R1,R2,R3,R4,OSTEP
            LOGICAL MVERSN,PWR
            LOGICAL FLAG1
            DATA FPNAME/'CS','I2','XE','KR','TE','AG','SB','BA','SN','RU',
           &      'UO2','ZR CLAD','ZR','FE','MO','SR','CR','NI','MN','LA',
           &      'AG ROD','CD ROD','IN ROD'/
      C***
      C**** MVERSN -  IF MVERSN=.TRUE. THEN CORSOR-M OPTIONS ARE SELECTED
      C***
            FLAG1=.FALSE.
            K=0
```

```
      T0=0
      READ *,ACDNAM,ACDSEQ
      PRINT 11,ACDNAM,ACDSEQ
      READ *,MVERSN
      IF(MVERSN)THEN
         PRINT 16
      ELSE
         PRINT 15
      ENDIF
      READ *,TSTRT,TFAIL,SMLT
      PRINT 120,TSTRT,SMLT,TFAIL
C***
C*** SMLT IS START-MELT TIME IN MINUTES
C***
      READ *,ISTEP,OSTEP
      READ *,R1,R2,NDZ
      NUM=1
      REWIND 25
      R3=R2/2
      R4=R3+1
      CALL INVENT
      WRITE(11,200)
      WRITE(13,300)
      WRITE(14,400)
C***
C*** BEGIN MAIN LOOP
C***
 10    CONTINUE
      CALL CORTEM
      IF(FLAG1)THEN
           PRINT 25
           GO TO 100
      ELSE
           CALL EMIT
           TPAR=TFP(6)
           TCOR=TFP(9)+TFP(11)+TFP(12)+TFP(14)+TFP(21)+TFP(22)+TFP(23)
           TNG=TFP(3)+TFP(4)
           WRITE(11,500) TIME,TFP(1),TFP(2),TFP(5),TNG,TPAR,TCOR,TFP(20)
           STOR(1,NUM)=TIME
           STOR(2,NUM)=TFP(1)
           STOR(3,NUM)=TFP(2)
           STOR(4,NUM)=TFP(5)+TFP(7)
           STOR(5,NUM)=TPAR+TCOR
           STOR(6,NUM)=TFP(8)+TFP(16)
           STOR(7,NUM)=TFP(10)+TFP(15)
           STOR(8,NUM)=TFP(20)+TFP(13)
           STOR(9,NUM)=TNG
           WRITE(13,550) TIME,TFP(6),TFP(7),TFP(8),TFP(10),TFP(13),
     &        TFP(15),TFP(16)
           WRITE(14,550) TIME,TFP(9),TFP(11),TFP(12),TFP(14),TFP(21),
     &        TFP(22),TFP(23)
           IF(OSTEP.GT.0) THEN
              IF(MOD(NUM,OSTEP).EQ.0) CALL OUTPUT
           ENDIF
           NUM=NUM+1
           IF(TFAIL.GT.TIME)GOTO 10
      ENDIF
```

```
  100 CONTINUE
      CALL RATE
      DO 55 I=1,23
            TFP(I)=TCK(I)-TFP(I)
   55 CONTINUE
      PRINT 600,(FPNAME(I),TCK(I),TFP(I),I=1,23)
      PRINT 90,TIME
      PRINT 110
   11 FORMAT('1CORSOR RUN FOR ',A8,' ACCIDENT SEQUENCE ',A8)
   15 FORMAT('0CORSOR--ORIGINAL RELEASE RATE METHOD SELECTED.',/)
   16 FORMAT('0CORSOR--M RELEASE RATE METHOD SELECTED.',/)
   25 FORMAT(1H0,'END OF TAPE 25')
   90 FORMAT(1H0,'END OF RUN, TIME=',F10.3)
  110 FORMAT(1H0,'RUN SUMMARY',100('-'))
  120 FORMAT(' CORE UNCOVERED:          ',F7.2,' MIN',/,
     &       ' MELT BEGINS:             ',F7.2,' MIN',/,
     &       ' BOTTOM HEAD FAILURE:  ',F7.2,' MIN.',/)
  200 FORMAT('TIME  TOT REL:CS',12X,'I2',14X,'TE',13X,'NOBLE GAS',7X,
     &'OTHER F.P.',6X,'NON F.P.',8X,'LA')
  300 FORMAT('TIME  TOT REL:AG',12X,'SB',14X,'BA',14X,'RU',14X,'ZR',14X,
     &'MO',14X,'SR')
  400 FORMAT('TIME  TOT REL:SN',12X,'UO2',12X,'ZR(CLAD)',9X,'FE',12X,'AG
     &ROD',10X,'CDROD',10X,'INROD')
  500 FORMAT(F6.0,7(E16.4))
  550 FORMAT(F6.0,7(E16.3))
  600 FORMAT(1H1,'SPECIES     INITIAL INVENTORY   FINAL INVENTORY'/,
     &((2X,A8,9X,1PE10.4,8X,1PE11.4)))
      STOP
      END
```

```
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.
```

```
C*********************************************************************
      SUBROUTINE INVENT
      COMMON /INVNT/FP(23,24,10),PWR
      COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,TSTRT,TFAIL
      INTEGER R1,R2
      COMMON /TOT/ICK(23)
      EQUIVALENCE (TOTAL(1),TCS),(TOTAL(2),TI2),(TOTAL(3),TXE),
     &(TOTAL(4),TKR),(TOTAL(5),TTE),(TOTAL(6),TAG),(TOTAL(7),TSB),
     &(TOTAL(8),TBA),(TOTAL(9),TSN),(TOTAL(10),TRU),(TOTAL(11),TUO2),
     &(TOTAL(12),TZRC),(TOTAL(13),TZR),(TOTAL(14),TFE),(TOTAL(15),TMO),
     &(TOTAL(16),TSR),(TOTAL(17),TCR),(TOTAL(18),TNI),(TOTAL(19),TMN),
     &(TOTAL(20),TLA),(TOTAL(21),TAGR),(TOTAL(22),TCDR),(TOTAL(23),TINR)
      DIMENSION RADDIS(10),AXDIS(24),STDIS(10),TOTAL(23)
      LOGICAL FLAG2,PWR
C***
C***     READ RADIAL,AXIAL AND STRUCTURAL DISTRIBUTION FACTORS
C***
      READ *,(RADDIS(I),I=1,R2)
      PRINT 641
      PRINT 645,(RADDIS(I),I=1,R2)
      READ *,(AXDIS(I),I=1,NDZ)
      PRINT 642
      PRINT 645,(AXDIS(I),I=1,NDZ)
      READ *,(STDIS(I),I=1,R2)
      PRINT 643
      PRINT 645,(STDIS(I),I=1,R2)
  641 FORMAT(/1X,' RADIAL DISTRIBUTION FACTORS ARE: ')
  642 FORMAT(/1X,' AXIAL DISTRIBUTION FACTORS ARE: ')
  643 FORMAT(/1X,' STRUCTURAL DISTRIUBTION FACTORS ARE: ')
  645 FORMAT(36X,F6.4)
C***
C***     VERIFY DISTRIBUTION FACTORS SUM TO CORRESPONDING NUMBER
C***
      XNORM=0.
      PWR=.FALSE.
      FLAG2=.FALSE.
      RDSUM=0
      STSUM=0
      AXDSUM=0
      DO 5 I=1,R2
         RDSUM=RDSUM+RADDIS(I)
         STSUM=STSUM+STDIS(I)
    5 CONTINUE
      DO 6 I=1,NDZ
         AXDSUM=AXDSUM+AXDIS(I)
    6 CONTINUE
      IF((ABS(RDSUM/R2)-1.0).GT.0.01)FLAG2=.TRUE.
      IF((ABS(STSUM/R2)-1.0).GT.0.01)FLAG2=.TRUE.
      IF((ABS(AXDSUM/NDZ)-1.0).GT.0.01)FLAG2=.TRUE.
C***
C***     ERROR OUT OF PROGRAM IF SUM OF FACTORS NOT CORRECT
C***
      IF(FLAG2) THEN
         PRINT 200,R2,R2,NDZ,RDSUM,STSUM,AXDSUM
  200    FORMAT(1X,'%%% - POWER OR STRUCTURAL FACTORS NOT PROPERLY',
```

```
     &          ' NORMALIZED: ',/5X,'RADIAL,STRUCTURAL AND AXIAL ',
     &          'FACTORS SHOULD SUM TO: ',3I4,/5X,'GIVEN VALUES ',
     &          'SUM TO: ',3F6.2)
         STOP
       ENDIF
C***
C***      READ INITIAL INVENTORIES
C***
       READ *,TCS,TI2,TXE,TKR,TTE,TAG,TSB,TBA,TSN,TRU,TUO2,TZRC,TZR,TFE,
     &      TMO,TSR,TCR,TNI,TMN,TLA,TAGR,TCDR,TINR
       IF(TAGR.NE.0) PWR=.TRUE.
       DO 10 I=R1,R2
          XNORM=XNORM+RADDIS(I)*STDIS(I)
   10  CONTINUE
       DEM=NDZ*XNORM
       DES=NDZ*R2
       DO 60 I=R1,R2
       DO 60 J=1,NDZ
          DO 55 K=1,8
             FP(K,J,I)=TOTAL(K)/DEM*RADDIS(I)*AXDIS(J)*STDIS(I)
             TCK(K)=TCK(K)+FP(K,J,I)
   55     CONTINUE
       DO 60 K=9,23
          GOTO(57,57,57,57,57,57,57,58,57,58,57,57,58,57,58,58,57,
     &         57,57,58,57,57,57)K
   57     FP(K,J,I)=TOTAL(K)/DES*STDIS(I)
          TCK(K)=TCK(K)+FP(K,J,I)
          GOTO 60
   58     FP(K,J,I)=TOTAL(K)/DEM*RADDIS(I)*AXDIS(J)*STDIS(I)
          TCK(K)=TCK(K)+FP(K,J,I)
   60  CONTINUE
       PRINT 100,(TCK(K),K=1,23)
  100  FORMAT(1H0,'TOTAL INITIAL INVENTORIES:',//,
     &   6X,'CS',8X,'I2',8X,'XE',8X,'KR',8X,'TE',8X,'AG',8X,'SB',
     &   8X,'BA',/,8F10.2,//,
     &   6X,'SN',8X,'RU',7X,'UO2',5X,'ZRCLAD',7X,'ZR',8X,'FE',8X,'MO',
     &   8X,'SR',/,8F10.2,//,
     &   6X,'CR',8X,'NI',8X,'MN',8X,'LA',/,4F10.2,//,
     &   5X,'AGROD',5X,'CDROD',5X,'INROD',/,3F10.2)
  900  CONTINUE
       RETURN
       END
```

```
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.
```

```
C**********************************************************************
      SUBROUTINE CONROD
C***
C***    CONROD CALCULATES THE RELEASE OF CONTROL ROD ALLOY MATERIAL
C***
C***    INPUTS-
C***    FP     - FISSION PRODUCT INVENTORY ARRAY
C***    TEMP   - CORE NODAL TEMPERATURE ARRAY(DEGREES FAHRENHEIT)
C***    REPMAX - ARRAY OF MAXIMUM RELEASED CONTROL ROD MATERIAL
C***             BY CORE NODE
C***
C***    OUTPUTS-
C***    TFP    - TOTAL RELEASED CONTROL ROD MATERIAL ARRAY
C***             (21=SILVER,22=CADMIUM,23=INDIUM)
C***
      INTEGER R1,R2
      COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,TSTRT,TFAIL
      COMMON /EMT/TO,TFP(23),TEMP(2,24,10),FZRN(24,10)
      COMMON /INVNT/FP(23,24,10),PWR
      DIMENSION REPMAX(3,24,10)
      DATA REPMAX/720*0./
C***
      DO 100 I1=1,NDZ
      DO 100 I2=R1,R2
          T=(TEMP(2,I1,I2)+TEMP(1,I1,I2))/2.
          T=(T-32.)/1.8
          IF(T.LT.1400.) GO TO 100
          DO 11 J=1,3
              IF(T.LT.2300.) GO TO(21,22,23)J
              IF(T.LT.2800.) GO TO(31,32,33)J
              REPMAX(J,I1,I2)=FP(J+20,I1,I2)
              GOTO 11
 21       CONTINUE
              FREL=5.E-4*(T-1400.)+0.05
              GO TO 5
 22       CONTINUE
              FREL=3.33333E-4*(T-1400.)+0.5
              GO TO 5
 23       CONTINUE
              FREL=1.11111E-4*(T-1400.)+0.05
              GO TO 5
 31       CONTINUE
              FREL=1.E-3*(T-2300.)+0.5
              GO TO 5
 32       CONTINUE
              FREL=4.E-4*(T-2300.)+0.8
              GO TO 5
 33       CONTINUE
              FREL=1.7E-3*(T-2300.)+0.15
 5        CONTINUE
              FREL=FREL*FP(J+20,I1,I2)
              IF(FREL.GT.REPMAX(J,I1,I2)) REPMAX(J,I1,I2)=FREL
   11 CONTINUE
  100 CONTINUE
      DO 222 J=1,3
```

```
              TOT=0.
              DO 200 I1=1,NDZ
              DO 200 I2=R1,R2
                 TOT=TOT + REPMAX(J,I1,I2)
  200         CONTINUE
           TEP(J+20)=TOT
  222      CONTINUE
           RETURN
           END
```

```
SUBROUTINE CORTEM     74/74    OPT=1,ROUND= A/ S/ M/-D,-DS      FTN 5.1+577          02/04/85  09.06.54          PAGE      1
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.

C***********************************************************************
      SUBROUTINE CORTEM
C***
C***
C***    SUBROUTINE CORTEM READS A 24 X 10 TIME-TEMPERATURE PROFILE OF
C***    THE CORE FROM THE MARCH TAPE25 OUTPUT FILE WITH A CORRESPONDING
C***    24 X 10 IDENTIFIER PROFILE INDICATING WHETHER OR NOT THE NODE
C***    REMAINS IN THE CORE  (S=0 => OUT-OF-CORE; S=1 => IN-CORE)
C***
C***
C***      -- R1-ZONE = NUMBER OF INNERMOST RADIAL REGION
C***      -- R2-ZONE = NUMBER OF OUTERMOST RADIAL REGION
C***      -- NDZ = NUMBER OF AXIAL NODES
C***
C***
      COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,TSTRT,TFAIL
      COMMON /CTEMP/K,R3,R4,FLAG1,TIME0,ISTEP
      COMMON /FMT/T0,TEP(23),TEMP(2,24,10),FZRU(24,10)
      INTEGER R,R1,R2,R3,R4
      LOGICAL FLAG1
C***
C***     READ UP TO START-MELT TIME FOR INPUT DATA
C***
      I1=1
   10 CONTINUE
      READ (25,END=200) N,TIME,FCM
      IF(TIME.LT.TSTRT)THEN
          DO 20 I=1,NDZ
               READ(25) (DUMA,DUMB,DUMC,R=R1,R2)
   20     CONTINUE
          GOTO 10
      ENDIF
      IF(MOD(I1,ISTEP).EQ.0) THEN
          K=K+1
          DO 30 I=1,NDZ
               READ(25) (TEMP(2,I,R),S(I,R),FZRU(I,R),R=R1,R2)
               DO 40 R=R1,R2
                    IF(S(I,R).NE.0) S(I,R)=1.
   40          CONTINUE
   30     CONTINUE
          GOTO 250
      ELSE
          DO 50 J=1,NDZ
               READ(25) (DUMA,DUMB,DUMC,R=R1,R2)
   50     CONTINUE
          I1=I1+1
          GOTO 10
      ENDIF
  200 CONTINUE
      FLAG1=.TRUE.
  250 CONTINUE
      RETURN
      END
```

DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.

```
      C***********************************************************************
            SUBROUTINE EMIT
      C***
      C***
      C***   THIS SUBROUTINE CALCULATES EMISSION RATES AND THE REMAINING
      C***   AMOUNTS OF FISSION PRODUCTS AT EACH OF THE USER SPECIFIED NODES
      C***   IN A CORE (UP TO 240). TIME STEPS AND TEMPERATURES ARE OBTAINED
      C***   FROM THE MARCH CODE, AND FISSION PRODUCT INITIAL INVENTORIES ARE
      C***   FROM THE ORIGEN CODE.
      C***
      C***     TIME-FROM MARCH (MINUTES)
      C***     TEMP(2,24,10)-NODE TEMPERATURE FROM MARCH(DEGREES FAHRENHEIT)
      C***     TFP-TOTAL FISSION PRODUCT RELEASED(KILOGRAMS)
      C***     TPAR-TOTAL FISSION PRODUCTS RELEASED EXCLUDING CS,I & TE (KG)
      C***     TCOR-TOTAL CORE PRODUCTS RELEASED(KILOGRAMS)
      C***     FRC-FRACTION RELEASE COEFFICIENT(INVERSE MINUTES)
      C***     FP(TXX,NDZ,R2-R1) FISSION PRODUCT INVENTORY
      C***     FFP-FRACTION OF FISSION PRODUCT RELEASED
      C***     A,B-FRACTIONAL RELEASE RATE COEFFICIENT CONSTANTS
      C***     I1,I2,J-DUMMY VARIABLES FOR NODE (AXIAL & RADIAL), AND SPECIES.
      C***
      C***     SPECIES ARE IDENTIFIED IN ARRAYS FP AND TFP AS FOLLOWS:
      C***       1=CESIUM            2=IODINE            3=XENON
      C***       4=KRYPTON           5=TELLURIUM         6=SILVER
      C***       7=ANTIMONY          8=BARIUM            9=TIN(CLADDING)
      C***      10=RUTHENIUM        11=FUEL(UO2)        12=ZIRCONIUM(CLADDING)
      C***      13=ZIRCONIUM(FP)    14=IRON(STRUCTURE)  15=MOLYBDENUM
      C***      16=STRONTIUM        17=CHROMIUM         18=NICKEL
      C***      19=MANGENESE        20=LANTHANUM        21=SILVER(ROD)
      C***      22=CADMIUM(ROD)     23=INDIUM(ROD)
      C***
            COMMON /M/MVERSN
            LOGICAL MVERSN,PWR
            REAL KO(20),Q(20)
            COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,TSTRT,TFAIL
            COMMON /INVNT/FP(23,24,10),PWR
            COMMON /EMT/TO,TFP(23),TEMP(2,24,10),FZRN(24,10)
            DIMENSION A(60),B(60)
            INTEGER R1,R2
            LOGICAL FLAG(24,10)
            DATA FLAG/240*.FALSE./
            DATA KO/4*2.0E+05,5.0E+3,7.9E+3,0.0,2.95E+5,5.95E+3,1.62E+6,
           & 1.46E+7,8.55E+4,2.67E+8,2.94E+4,0.0,4.4E+5,4.62E+4,5.36E+4,
           & 5.04E+3,0.0/
            DATA Q/5*63.8,61.4,0.,100.2,70.8,152.8,143.1,139.5,188.2,
           &87.0,0.,117.0,84.5,92.2,56.8,188.2/
            DATA FNINE/0.5555556/
            DATA A/7.53E-12,3*7.02E-9,2*3.88E-12,1.9E-12,7.5E-14,1.90E-12,
           &       1.36E-11,5.0E-13,2*6.64E-12,6.64E-10,5.01E-12,2.74E-08,
           &       3*6.64E-10,5.0E-13,4*2.02E-07,2*9.39E-08,5.88E-09,
           &       8.26E-09,5.88E-09,1.36E-11,5.0E-13,2*6.64E-12,6.64E-10,
           &       5.93E-08,2.78E-11,3*6.64E-10,5.0E-13,4*1.74E-05,
           &       2*1.18E-05,2.56E-6,1.38E-5,2.56E-06,1.4E-06,5.00E-13,
           &       2*1.48E-07,1.48E-05,3.70E-05,9.00E-07,3*1.48E-05,5.0E-13/
```

```
     &      .0115,.0036,3*.00631,.00768,4*.00667,2*.0063,.00708,
     &      .00631,.00708,2*.00768,3*.00631,.00523,.00853,3*.00631,
     &      .00768,4*.0046,2*.00411,.00426,.0029,.00426,.00248,
     &      .00768,3*.00177,.00200,.00370,3*.00177,.00768/
C***
C***  TOP OF LOOP...
C***  (CONVERT TEMPERATURE TO CELSIUS FOR EMISSION CALCULATIONS)
C***
      DTIME=TIME-TO
      DO 100 I1=1,NDZ
      DO 100 I2=R1,R2
         T=(TEMP(2,I1,I2)+TEMP(1,I1,I2))/2.
         T=(T-32.)*FNINE
         IF(T.LT.900.) GO TO 100
         IF(FLAG(I1,I2))GOTO 40
         DO 44 I3=1,NDZ
            DO 42 JJ=1,20
               GOTO(31,32,33,[illegible],34,42,34,36,42,42,42,42,42,42,42,
     &              36,42,42,[illegible],42)JJ
   31          CONTINUE
                 FRI=.05*FP(1,I3,I2)
                 GO TO 39
   32          CONTINUE
                 FRI=.017*FP(2,I3,I2)
                 GOTO 39
   33          CONTINUE
                 FRI=.03*FP(JJ,I3,I2)
                 GO TO 39
   34          CONTINUE
                 FRI=.0001*FP(JJ,I3,I2)
                 GO TO 39
   36          CONTINUE
                 FRI=.000001*FP(JJ,I3,I2)
   39          CONTINUE
                 FP(JJ,I3,I2)=FP(JJ,I3,I2)-FRI
                 TFP(JJ)=TFP(JJ)+FRI
   42       CONTINUE
            FLAG(I3,I2)=.TRUE.
   44    CONTINUE
   40    K=0
         IF(T.GT.1400.) K=20
         IF(T.GT.2200.) K=40
         IF(T.GT.2760.) T=2760.
         TKELVN=T+273.0
         DO 90 J=1,20
            IF(J.EQ.5) GO TO 90
            IF(MVERSN)THEN
               FRC=KO(J)*EXP(-Q(J)/(1.987E-3*TKELVN))
            ELSE
               FRC=A(K+J)*EXP(B(K+J)*T)
            ENDIF
C***  THE FOLLOWING ADJUSTMENT TO FRC IS TO AVOID UNDERFLOW ERRORS
C           IF(FRC.LT.1.0E-06) FRC=1.0E-06
C           IF(TIME.GE.2748.0) THEN
C              PRINT *,' FRC=',FRC,'  DTIME=',DTIME
C              XCHK=EXP(-FRC*DTIME)
C              PRINT *,' XCHK=',XCHK
```

```
      C                ENDIF
                       FFP=FP(J,I1,I2)*(1.-EXP(-FRC*DTIME))
                       FP(J,I1,I2)=FP(J,I1,I2)-FFP
                       IF(FP(J,I1,I2).GT.0.)GOTO50
                       FFP=FFP+FP(J,I1,I2)
                       FP(J,I1,I2)=0
         50            TFP(J)=TFP(J)+FFP
         90        CONTINUE
      C***
      C***   CALCULATE TE RELEASE DEPENDENT ON ZIRCALLOY OXIDATION AND TEMP
      C***
                   IF(MVERSN)THEN
                     FRC=K0(5)*EXP(-Q(5)/(1.987E-3*TKELVN))
                   ELSE
                     ATE=1.625E-11
                     BTE=0.01061
                     IF(T.LT.1600.) GO TO 98
                     ATE=9.04E-8
                     BTE=5.22E-3
                     IF(T.LT.2000.) GO TO 98
                     ATE=6.025E-6
                     BTE=3.12E-3
         98          FRC=ATE*EXP(BTE*T)
                   ENDIF
                   IF(FZRN(I1,I2).GT.0.7) FRC=40.*FRC
      C***  THE FOLLOWING ADJUSTMENT TO FRC IS TO AVOID UNDERFLOW ERRORS
      C            IF(FRC.LT.1.0E-06) FRC=1.0E-06
                   FFP=FP(5,I1,I2)*(1.-EXP(-FRC*DTIME))
                   FP(5,I1,I2)=FP(5,I1,I2)-FFP
                   IF(FP(5,I1,I2).GT.0.)GO TO 99
                   FFP=FFP+FP(5,I1,I2)
                   FP(5,I1,I2)=0.
         99        TFP(5)=TFP(5)+FFP
        100 CONTINUE
            IF(PWR) CALL CONROD
            TO=TIME
            DO 80 I1=1,NDZ
            DO 80 I2=R1,R2
                TEMP(1,I1,I2)=TEMP(2,I1,I2)
         80 CONTINUE
            RETURN
            END
```

```
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.
```

```
C************************************************************************
      SUBROUTINE OUTPUT
      COMMON /EMT/TO,TFP(23),TEMP(2,24,10),FZRN(24,10)
      COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIME,N,ZSTPT,TFAIL
      COMMON /CTEMP/K,R3,R4,FLAG1,TIMEO,ISTEP
      LOGICAL FLAG1
      INTEGER R,R1,R2,R3,R4
      PRINT 90
   90 FORMAT(1H1)
      IF(K.LE.1) THEN
            PRINT 91,TIME
   91       FORMAT(20X,'TIME SINCE START OF ACCIDENT =',E10.4,' MIN'///)
      ENDIF
      PRINT 92,K,TIME,FCM
   92 FORMAT(10X,'N =',I5,10X,'TIME =',E10.4,10X,'FCM =',E10.4//)
      PRINT 93, (R,R,R=R1,R3)
   93 FORMAT(8X,5('TRD(',I2,')',6X,'S(',I2,')',7X))
      DO 60 I=1,NDZ
            PRINT 94,(TEMP(2,I,R),S(I,R),R=R1,R3)
   94       FORMAT(1H ,2X,5(3X,E10.3,2X,E10.3))
   60 CONTINUE
      PRINT 95
   95 FORMAT(5(/))
      PRINT 93, (R,R,R=R4,R2)
      DO 70 I=1,NDZ
      PRINT 94,(TEMP(2,I,R),S(I,R),R=R4,R2)
   70 CONTINUE
      PRINT 95
      PRINT 200,(TFP(J),J=1,8)
      PRINT 205,(TFP(J),J=9,16)
      PRINT 206,(TFP(J),J=17,20)
  206 FORMAT('0TOTAL RELEASE CR',13X,'NI',13X,'MN',7X,'LA-GROUP',
     &//10X,8E15.5)
      PRINT 190,(TFP(J),J=21,23)
  190 FORMAT(1H0,'TOTAL RELEASE AG(ROD)',9X,'CD(ROD)',9X,'IN(ROD)',
     &//10X,3E15.5)
  200 FORMAT(1H0,'TOTAL RELEASE CS',13X,'I2',13X,'XE',13X,'KR',13X,'TE',
     &13X,'AG',13X,'SB',13X,'BA'//10X,8E15.5)
  205 FORMAT(1H0,'TOTAL RELEASE SN',13X,'RU',12X,'UO2',10X,'ZR(CLAD)',8X
     &,'ZR(FP)','1X,'FE',13X,'MO',13X,'SR'//10X,8E15.5)
      RETURN
      END
```

DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.

```
C*********************************************************************
      SUBROUTINE RATE
C***
C*** RATE CALCULATES AND PRINTS RELEASE RATES TO A FILE FOR
C*** INPUT TO THE TRAPMELT PROGRAM.
C***
      COMMON /RATES/STOR(9,1000),DIVTIM(8,20),TST,ICOUNT,SMLT
      CHARACTER*2 SPNAME
      CHARACTER*5 SPSTAT
      DIMENSION IREL(8,20),TRPTIM(8,20),RAT(10,20),SUM(8),FCTR(8),
     &KAR(8),KP1AR(8)
      SPNAME=' '
      ICOUNT=ICOUNT-1
C***
C*** ICOUNT IS THE NUMBER OF ENTRIES IN THE RELEASE TABLES.
C***
      DO 245 J=1,8
C***
C*** THIS LOOP LOOPS ON SPECIES. (CESIUM,TELLURIUM,AEROSOL,STRONTIUM,
C*** RUTHENIUM,UO2, AND NOBLE GASES)
C*** IT CHOOSES WHICH ENTRIES IN THE RELEASE TABLES WILL BE THE END
C*** POINTS FOR DIFFERENTIATION BY MOVING DOWN THE RELEASE TABLES
C*** IN STEPS OF MASS WHICH ARE EQUAL TO 7% OF THE FINAL RELEASE FOR
C*** THAT SPECIES.  IODINE USES THE SAME STEPS AS CESIUM, SO J=2 IN THE
C*** LOOP IS SKIPPED.
C***
       K=J+1
       IF(J.EQ.2)GOTO 245
       CUT=.07
   90  FRAC=CUT*STOR(K,ICOUNT)
       DO 100 I=1,ICOUNT
C***
C***  RELEASES BEGIN BEFORE START-MELT, BUT TRAP DOESN'T.  FIND
C***  WHICH ENTRY IN THE TABLES CORRESPONDS TO START-MELT, AND
C***  MAKE IT THE INITIAL POINT.
C***
        IF(STOR(1,I).LT.SMLT)GOTO 100
        DIVTIM(J,1)=STOR(1,I)
        TRPTIM(J,1)=STOR(1,I)
        IREL(J,1)=I
        GOTO 105
  100  CONTINUE
  105  DO 120 L=1,20
C***
C*** STEP DOWN IN 7% STEPS UNTIL THE BOTTOM OF THE TABLE IS REACHED.
C***
      LP1=L+1
      LP2=L+2
      IROW=IREL(J,L)
      XTST=STOR(K,IROW)+FRAC
      IF(XTST.GT.STOR(K,ICOUNT))GOTO 130
      DO 110 I=IROW,ICOUNT
       IF(STOR(K,I).LT.XTST)GOTO 110
       DIVTIM(J,LP1)=STOR(1,I)
       IREL(J,LP1)=I
```

```
                IF(I.EQ.ICOUNT)GOTO 135
                GOTO 120
  110         CONTINUE
  120         CONTINUE
  130         DIVTIM(J,LP1)=STOR(1,ICOUNT)
              IREL(J,LP1)=ICOUNT
  135         I=0
              KOUNT=LP1
C
C*** THE FOLLOWING IF LOOP TAKES THE PREVIOUS SET OF STEPS AND
C*** DETERMINES IF ANY ARE TOO BIG OR TOO SMALL.  THE CRITERION
C*** FOR ACCEPTABLE STEP SIZE IS GREATER THAN .4 AND LESS THAN 2.5
C*** TIMES THE PREVIOUS STEP SIZE.  THIS WILL PREVENT TOO DRASTIC
C*** A DIFFERENCE IN SLOPE OF TWO NEIGHBORING LINEAR SEGMENTS OF THE
C*** PIECE-WISE LINEAR APPROXIMATION OF THE RELEASE-TIME PROFILE.
C
  140         I=I+1
              IP1=I+1
              IP2=I+2
              XLO=(DIVTIM(J,IP1)-DIVTIM(J,I))*.4
              XHI=XLO*6.25
              TST=DIVTIM(J,IP2)-DIVTIM(J,IP1)
              IF(TST.LT.XLO)GOTO 150
              IF(TST.GT.XHI)GOTO 180
              IF(IP2.EQ.KOUNT)GOTO 230
              GOTO 140
  150         KOUNT=KOUNT+1
C
C*** A LARGE SLOPE FOLLOWS A SMALL ONE.  INSERT AN EXTRA STEP BEFORE THE
C*** SMALL SLOPE STEP.  NOW THE SEQUENCE IS SMALL-MEDIUM-LARGE.
C
              IF(KOUNT.GT.19)GOTO 210
              IP3=I+3
              DO 152 NM=IP2,KOUNT
               M=KOUNT+IP2-NM
               MM1=M-1
               DIVTIM(J,M)=DIVTIM(J,MM1)
  152         CONTINUE
              DIVTIM(J,IP1)=DIVTIM(J,IP2)-XLO
              IND=IREL(J,I)
              DO 155 M=IND,ICOUNT
               IF(STOR(1,M).LT.DIVTIM(J,IP1))GOTO 155
               DIVTIM(J,IP1)=STOR(1,M)
               IF(DIVTIM(J,IP1).NE.DIVTIM(J,IP2))GOTO 160
               DO 154 MM=IP2,KOUNT
C
C*** THERE IS NO SPACE FOR THE EXTRA STEP.  REVERT TO ORIGINAL SEQUENCE.
C
                MMM1=MM-1
                DIVTIM(J,MMM1)=DIVTIM(J,MM)
  154          CONTINUE
               DIVTIM(J,KOUNT)=0.
               KOUNT=KOUNT-1
               GOTO 140
  155         CONTINUE
  160         DO 170 NIM=IP2,KOUNT
C
```

```
C*** IREL IS A LIST OF TABLE LINES WHERE END POINT INFORMATION IS
C*** STORED.  IT IS AN INDEX.
C
        IM=IP2+KOUNT-NIM
        IMM1=IM-1
        IREL(J,IM)=IREL(J,IMM1)
  170  CONTINUE
       IREL(J,IP1)=M
       GOTO 140
  180  KOUNT=KOUNT+1
C
C*** A SMALL SLOPE FOLLOWS A LARGE ONE.  ADD AN EXTRA STEP BETWEEN THEM
C*** SO THE SEQUENCE WILL BE LARGE-MEDIUM-SMALL.
C
       IF(KOUNT.GT.19)GOTO 210
       IP3=I+3
       DO 182 MM=IP3,KOUNT
        M=IP3+KOUNT-MM
        MM1=M-1
        DIVTIM(J,M)=DIVTIM(J,MM1)
  182  CONTINUE
       DIVTIM(J,IP2)=DIVTIM(J,IP1)+XHI
       IND=IREL(J,IP1)
       DO 185 M=IND,ICOUNT
        IF(STOR(1,M).LT.DIVTIM(J,IP2))GOTO 185
        DIVTIM(J,IP2)=STOR(1,M)
        IF(DIVTIM(J,IP2).NE.DIVTIM(J,IP3))GOTO 190
        DO 184 MM=IP3,KOUNT
C
C*** NO ROOM EXISTS FOR THE EXTRA STEP.  REVERT TO THE ORIGINAL SEQUENCE.
C
         MMM1=MM-1
         DIVTIM(J,MMM1)=DIVTIM(J,MM)
  184   CONTINUE
        DIVTIM(J,KOUNT)=0.
        KOUNT=KOUNT-1
        GOTO 140
  185  CONTINUE
  190  DO 200 NIM=IP3,KOUNT
C
C*** CORRECT THE INDEX.
C
        IM=IP3+KOUNT-NIM
        IMM1=IM-1
        IREL(J,IM)=IREL(J,IMM1)
  200  CONTINUE
       IREL(J,IP2)=M
       GOTO 140
  210  CUT=CUT+.01
C
C*** THE MAXIMUM NUMBER OF ENTRIES IN THE TRAPMELT RELEASE TABLE
C*** IS 20.  THIS MAXIMUM HAS BEEN REACHED BEFORE THE CONDITIONING
C*** OF THE PIECEWISE LINEAR APPROXIMATION IS COMPLETE.  INCREASE
C*** THE STEP SIZE BETWEEN ENDPOINTS AND START OVER.
C
       DO 220 I=1,20
        DIVTIM(J,I)=0.
```

```
             TRPTIM(J,I)=0.
             IREL(J,I)=0.
  220     CONTINUE
          GOTO 90
  230     DO 240 I=2,KOUNT
C
C*** THE ENDPOINT TABLE IS COMPLETE.  NOW MIDPOINTS WILL BE CALCULATED
C*** TO WHICH THE SLOPE OF THE LINEAR SEGMENTS WILL BE ASSIGNED.  THESE
C*** MIDPOINTS ARE THE ACTUAL TRAPMELT TIMES.
C
             IM1=I-1
             TRPTIM(J,I)=(DIVTIM(J,I)+DIVTIM(J,IM1))/2.
  240     CONTINUE
          KP1=KOUNT+1
          TRPTIM(J,KP1)=STOR(1,ICOUNT)
C
C*** THE LAST TIME IN THE CORSOR RELEASE TABLES IS USED TWICE.  FIRST IT
C*** APPEARS AS THE ENDPOINT OF THE SEGMENT WHICH HAS AS ITS BEGINNING
C*** POINT THE LAST 7% SUBTOTAL WHICH IS LESS THAN THE TOTAL RELEASE.
C*** THE LAST TIME IN THE CORSOR RELEASE TABLE IS ALSO USED WITH THE
C*** NEXT-TO-LAST TIME IN THE CORSOR RELEASE TABLE TO ARRIVE AT A
C*** SLOPE WHICH IS ASSIGNED TO THE LAST TIME IN THE CORSOR RELEASE
C*** TABLE, AND IS ALSO THE FINAL TIME IN THE TRAPMELT RELEASE TABLES.
C*** THIS PROVIDES THE MOST ACCURATE RATE FOR THE HEAD-FAIL TIME.
C*** THIS MIGHT PROVIDE PROBLEMS IF THE NEXT-TO-LAST SEGMENT IS
C*** LONG AND MUCH DIFFERENT FROM THIS LAST, VERY SHORT, SEGMENT.
C
          KAR(J)=KOUNT
          KP1AR(J)=KP1
  245 CONTINUE
      IND=KAR(1)
      DO 246 I=1,IND
C
C*** THE IODINE TIMES ARE MADE IDENTICAL TO THE CESIUM TIMES.  THIS IS
C*** NECESSARY FOR PROPER DETERMINATION OF CSI AND CSOH RATES.
C
          DIVTIM(2,I)=DIVTIM(1,I)
          IREL(2,I)=IREL(1,I)
          TRPTIM(2,I)=TRPTIM(1,I)
  246 CONTINUE
      TRPTIM(2,KP1AR(1))=TRPTIM(1,KP1AR(1))
      KAR(2)=KAR(1)
      KP1AR(2)=KP1AR(1)
      DO 400 J=1,8
       K=J+1
      RAT(J,2)=(STOR(K,IREL(J,2))-STOR(K,IREL(J,1)))/(DIVTIM(J,2)-DIVTI
     * M(J,1))/60.*1000.
C
C*** THE SECOND RATE IS SIMPLY DELTA-RELEASE OVER DELTA-TIME.
C
          ITST=IREL(J,2)-IREL(J,1)
          IF(ITST.EQ.1)GOTO 265
          IND=IREL(J,1)
          DO 250 I=IND,ICOUNT
           IF(STOR(1,I).LT.TRPTIM(J,2))GOTO 250
           TACK=STOR(K,I)*1000.
           GOTO 260
```

```
  250  CONTINUE
  260  RAT(J,1)=TACK/(TRPTIM(J,2)-TRPTIM(J,1))/30.-RAT(J,2)
C
C*** THE FIRST RATE IS CALCULATED SO THAT INTEGRATION OF IT AND THE
C*** SECOND RATE WILL EQUAL THE CORSOR RELEASE AT THE TIME OF THE
C*** SECOND RATE.  THIS COVERS ALL RELEASES PRIOR TO START-MELT TIME.
C
       IF(RAT(J,1).LT.0.)RAT(J,1)=0.
       SUM(J)=(RAT(J,1)+RAT(J,2))*(TRPTIM(J,2)-TRPTIM(J,1))*30./1000.
C
C*** A RUNNING INTEGRATION OF THESE SLOPES WILL BE MAINTAINED.  AT
C*** THE END OF CONSTRUCTION OF THE PIECEWISE LINEAR PROFILE, THE
C*** INTEGRATION WILL BE COMPARED TO THE ACTUAL CORSOR RELEASE, AND
C*** ALL RATES WILL BE ADJUSTED BY A FACTOR TO BRING THE INTEGRATION
C*** INTO LINE WITH THE ACTUAL RELEASE.
C
       GOTO 270
  265  TACK=(STOR(K,IREL(1,1))+STOR(K,IREL(1,2)))/2.*1000.
C
C*** THIS STEP INTERPOLATES A RELEASE FOR THE TIME OF THE SECOND RATE,
C*** WHICH IS NOT IN THE CORSOR TABLES.  THIS STEP IS ONLY PERFORMED
C*** WHEN THE FIRST TIME AFTER START-MELT TIME IN THE CORSOR TABLES
C*** IS ITSELF THE ENDPOINT OF THE FIRST LINEAR SEGMENT.
C
       GOTO 260
  270  KOUNT=KAR(J)
       KP1=KP1AR(J)
       DO 280 I=3,KOUNT
C
C*** ALL SUBSEQUENT RATES ARE SIMPLY DELTA-RELEASE OVER DELTA-TIME.
C
        IM1=I-1
        RAT(J,I)=(STOR(K,IREL(J,I))-STOR(K,IREL(J,IM1)))/(DIVTIM(J,I)-DI
     *  VTIM(J,IM1))/60.*1000.
        SUM(J)=SUM(J)+(RAT(J,I)+RAT(J,IM1))*(TRPTIM(J,I)-TRPTIM(J,IM1))*
     *  30./1000.
  280  CONTINUE
       RAT(J,KP1)=(STOR(K,ICOUNT)-STOR(K,ICOUNT-1))/(STOR(1,ICOUNT)-STOR
     * (1,ICOUNT-1))/60.*1000.
C
C*** THIS IS THE INSTANTANEOUS RATE IN EFFECT RIGHT AT HEAD-FAIL
C*** TIME.  IT IS ASSIGNED TO HEAD-FAIL TIME IN THE TRAPMELT TABLES.
C
       SUM(J)=SUM(J)+(RAT(J,KOUNT)+RAT(J,KP1))*(TRPTIM(J,KP1)-TRPTIM(J,K
     * OUNT))*30./1000.
       FCTR(J)=STOR(K,ICOUNT)/SUM(J)
       DO 290 I=1,KP1
        RAT(J,I)=RAT(J,I)*FCTR(J)
  290  CONTINUE
       SUB=0.
       DO 399 I=1,KP1
        TRPTIM(J,I)=(TRPTIM(J,I)-SUB)*60.
C
C  TURN TRAPMELT TIMES INTO SECONDS MEASURED FROM MARCH ZERO.
C
  399  CONTINUE
  400 CONTINUE
```

```
      C1=260./127.
      C2=133./260.
      C3=150./133.
      IND=KP1AR(1)
      DO 410 I=1,IND
C
C*** TURN CESIUM AND IODINE RATES INTO CSI AND CSOH RATES.
C
      RAT(9,I)=C1*RAT(2,I)
       RAT(10,I)=(RAT(1,I)-C2*RAT(9,I))*C3
  410 CONTINUE
      CSISUM=C1*STOR(3,ICOUNT)
      CHSUM=(STOR(2,ICOUNT)-C2*CSISUM)*C3
      SPSTAT='10000'
      SPNAME = 'CS'
      PRINT 480
  480 FORMAT(1H1)
      PRINT 490,SPNAME
      WRITE(10,1490)SPNAME,SPSTAT,IND
      IND=KP1AR(1)
      DO 411 K=1,IND
      PRINT 550,TRPTIM(1,K),RAT(1,K)
      WRITE(10,1550)TRPTIM(1,K),RAT(1,K)
  411 CONTINUE
      DO 420 I=2,10
       IF(I.EQ.2)GOTO 412
       IF(I.EQ.3)GOTO 413
       IF(I.EQ.4)GOTO 414
       IF(I.EQ.5)GOTO 415
       IF(I.EQ.6)GOTO 416
       IF(I.EQ.7)GOTO 4170
       IF(I.EQ.8)GOTO 4180
       IF(I.EQ.9)GOTO 4190
       GOTO 4200
  412  IND=KP1AR(1)
       J=2
       L=1
       SPSTAT='10000'
       SPNAME='I2'
       GOTO 417
  413  IND=KP1AR(1)
       J=9
       L=1
       SPSTAT='10000'
       SPNAME='CI'
       GOTO 417
  414  IND=KP1AR(1)
       L=1
       J=10
       SPSTAT='10000'
       SPNAME='CH'
       GOTO 417
  415  IND=KP1AR(4)
       J=4
       L=4
       SPSTAT='01000'
       SPNAME='PS'
```

```
              GOTO 417
        416   IND=KP1AR(3)
              J=3
              L=3
              SPSTAT='10000'
              SPNAME='TE'
              GOTO 417
        4170  IND=KP1AR(5)
              J=5
              L=5
              SPSTAT='01000'
              SPNAME='SR'
              GOTO 417
        4180  IND=KP1AR(6)
              J=6
              L=6
              SPSTAT='01000'
              SPNAME='RU'
              GOTO 417
        4190  IND=KP1AR(7)
              J=7
              L=7
              SPSTAT='01000'
              SPNAME='LA'
              GOTO 417
        4200  IND=KP1AR(8)
              J=8
              L=8
              SPSTAT='10000'
              SPNAME='NG'
        417   CONTINUE
              PRINT 490,SPNAME
              WRITE(10,1490)SPNAME,SPSTAT,IND
               DO 419 K=1,IND
                  PRINT 550,TRPTIM(L,K),PAT(J,K)
                  WRITE(10,1550)TRPTIM(L,K),RAT(J,K)
        419    CONTINUE
        420 CONTINUE
            PRINT 560
            PRINT 570,FCTR(1),FCTR(2),FCTR(3),FCTR(4),FCTR(5),FCTR(6),FCTR(7),
           & FCTR(8)
            PRINT 580
            PRINT 590,STOR(3,ICOUNT),CSISUM,CHSUM,STOR(4,ICOUNT),
           &          STOR(5,ICOUNT),STOR(6,ICOUNT),STOR(7,ICOUNT),
           &          STOR(8,ICOUNT),STOR(9,ICOUNT)
            PRINT 600,CUT
            RETURN
        490 FORMAT(//1X,A2,' RELEASE RATES IN G/S')
       1490 FORMAT(1X,'*** ',A2,' RELEASE RATES IN G/S',
           &     /1X,A5,/1X,I2)
        550 FORMAT(1X,2F15.4)
       1550 FORMAT(2F15.4)
        560 FORMAT(1H1,1X,'MULTIPLICATION FACTORS:    CS',6X,'I2',6X,'TE',3X,
           &              'AEROSOL',4X,'SR',6X,'RU',6X,'LA',6X,'NG'/)
        570 FORMAT(24X,8F8.4,//)
        580 FORMAT(1X,'FINAL RELEASES (KG):   I2',10X,'CSI',9X,'CSOH',8X,
```

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```
      590 FORMAT(16X,9(2X,F10.4))
      600 FORMAT(1X,'CUT =',F5.2)
          END
```

```
DO=-LONG/-OT,ARG=-COMMON/-FIXED,CS= USER/-FIXED,DB=-TB/-SB/-SL/-ER/-ID/-PMD/-ST,PL=20000
FTN5,I=X,LO=S/A/R,OPT=1,PL=20000.

      C***********************************************************************
            BLOCK DATA ZERO
            COMMON /FMT/TO,TEP(23),TEMP(2,24,10),FZRN(24,10)
            COMMON /CTEMP/K,R3,R4,FLAG1,TIMEO,ISTEP
            COMMON /INVNT/FP(23,24,10),PWR
            COMMON /TOT/TCK(23)
            COMMON /MELT/R1,R2,NDZ,S(24,10),FCM,TIFE,N,TSTRT,TFAIL
            LOGICAL PWR
            DATA S/240*1./
            DATA TEP/23*0./
            DATA TCK/23*0./
            DATA TEMP/480*0./
            END
```

CORSOR RUN FOR [redacted] ACCIDENT SEQUENCE [redacted]

CORSOR--ORIGINAL RELEASE RATE METHOD SELECTED.

CORE UNCOVERED: 2620.00 MIN
MELT BEGINS: 2748.00 MIN
BOTTOM HEAD FAILURE: 3055.00 MIN.

RADIAL DISTRIBUTION FACTORS ARE:

1.5000
1.3000
1.2000
1.1000
1.0000
.9500
.9000
.8000
.7000
.5500

AXIAL DISTRIBUTION FACTORS ARE:

.4700
.4900
.5300
.6400
.7700
.9500
1.1200
1.2700
1.3500
1.4400
1.4700
1.5000
1.5000
1.4700
1.4400
1.3500
1.2700
1.1200
.9500
.7700
.6400
.5300
.4900
.4700

STRUCTURAL DISTRIUBTION FACTORS ARE:

1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
1.0000

TOTAL INITIAL INVENTORIES:

CS I2 XE KR TE AG SB BA

CS	I2	XE	KR	TE	AG	SB	BA
230.30	16.70	387.00	25.50	34.80	0.00	0.00	105.00

SN	RU	UO2	ZRCLAD	ZR	FE	MO	SR
1050.00	347.20	156555.00	64100.00	267.00	15150.00	237.00	63.00

CR	NI	MN	LA
4140.00	2560.00	432.00	1562.00

AGROD	CDROD	INROD
0.60	0.00	0.00

END OF TAPE 25

CS RELEASE RATES IN G/S

164917.9308	54.3404
165337.9308	21.2495
166027.9308	35.9296
166507.9308	43.8824
166927.9308	46.2461
167347.9308	48.6147
167737.9308	57.0324
168037.9308	77.6769
168277.9308	87.2539
168607.9308	49.4294
168967.9308	69.8896
169501.9308	1.7854
170857.9308	.0021
174271.9308	.2722
179953.9308	2.0729
183193.9308	.6115

I2 RELEASE RATES IN G/S

164917.9308	2.0686
165337.9308	1.4789
166027.9308	2.6919
166507.9308	3.1930
166927.9308	3.4638
167347.9308	3.5689
167737.9308	4.2729
168037.9308	5.8216
168277.9308	6.5411
168607.9308	3.7050
168967.9308	5.2371
169501.9308	.1331
170857.9308	.0007
174271.9308	.0186
179953.9308	.1566
183193.9308	.0462

CI RELEASE RATES IN G/S

164917.9308	4.2349
165337.9308	3.0276
166027.9308	5.5109
166507.9308	6.5368
166927.9308	7.0913
167347.9308	7.3063
167737.9308	8.7476
168037.9308	11.9182
168277.9308	13.3912
168607.9308	7.5851
168967.9308	10.7216
169501.9308	.2724
170857.9308	.0015
174271.9308	.0382
179953.9308	.3205
183193.9308	.0946

CH RELEASE RATES IN G/S

164917.9308	58.8430
165337.9308	22.2189

	[illegible]
166927.9308	48.0661
167347.9308	50.6135
167737.9308	59.2756
168037.9308	80.7296
168277.9308	90.6809
168607.9308	51.3715
168967.9308	72.6373
169501.9308	1.8564
170857.9308	.0016
174271.9308	.2849
179953.9308	2.1529
183193.9308	.6351

PS RELEASE RATES IN G/S

164917.9308	3.4536
165457.9308	26.2444
166327.9308	80.9568
166987.9308	126.9057
167557.9308	173.0911
167977.9308	236.6107
168277.9308	369.3587
168487.9308	601.3996
168667.9308	570.8108
168877.9308	446.1565
169309.9308	83.4183
170413.9308	.0513
173239.9308	.4666
177433.9308	7.0303
1807[illegible]3.9308	37.1394
182593.9308	85.9387
183193.9308	104.6508

TE RELEASE RATES IN G/S

164917.9308	0.0000
165727.9308	.3607
167077.9308	1.1735
167797.9308	2.5166
168067.9308	7.9564
168217.9308	16.0846
168337.9308	22.6062
168457.9308	22.7986
168607.9308	11.5382
168787.9308	14.8200
168937.9308	19.1818
169153.9308	5.0533
169705.9308	.0168
171127.9308	.0009
174793.9308	.0555
178753.9308	.4332
180913.9308	.4746
182473.9308	.4459
183193.9308	.4697

SR RELEASE RATES IN G/S

164917.9308	.1069
165397.9308	.9405
166177.9308	3.0032
16677[illegible].9308	4.9997

[illegible]	6.6076
167677.9308	8.2157
168007.9308	10.0403
168277.9308	13.4770
168487.9308	21.0313
168637.9308	23.5219
168787.9308	15.4706
168967.9308	15.3784
169291.9308	1.6277
170113.9308	.0006
172267.9308	.0025
175993.9308	.0965
179473.9308	.6059
181633.93 8	1.7571
182833.9308	3.0662
183193.9308	3.3975

RU RELEASE RATES IN G/S

164917.9308	.1363
165457.9308	.9666
166327.9308	3.0405
166987.9308	4.9363
167557.9308	6.7495
167977.9308	8.5011
168307.9308	11.5338
168577.9308	15.7233
168817.9308	12.8842
169243.9308	4.7783
170317.9308	.0010
172939.9308	.0171
176233.9308	.3582
178633.9308	1.1235
180313.9308	2.2584
181513.9308	3.6617
182353.9308	5.0908
182953.9308	6.3307
183193.9308	6.5926

LA RELEASE RATES IN G/S

164917.9308	.0007
165547.9308	.0295
166567.9308	.1091
167317.9308	.1722
167917.9308	.2481
168247.9308	.3815
168397.9308	1.0076
168487.9308	2.0937
168547.9308	2.8867
168607.9308	3.4926
168667.9308	3.6299
168787.9308	.7458
168997.9308	.4944
169429.9308	.0034
170533.9308	.0000
173419.9308	.0002
179353.9308	.0141
183193.9308	.0590

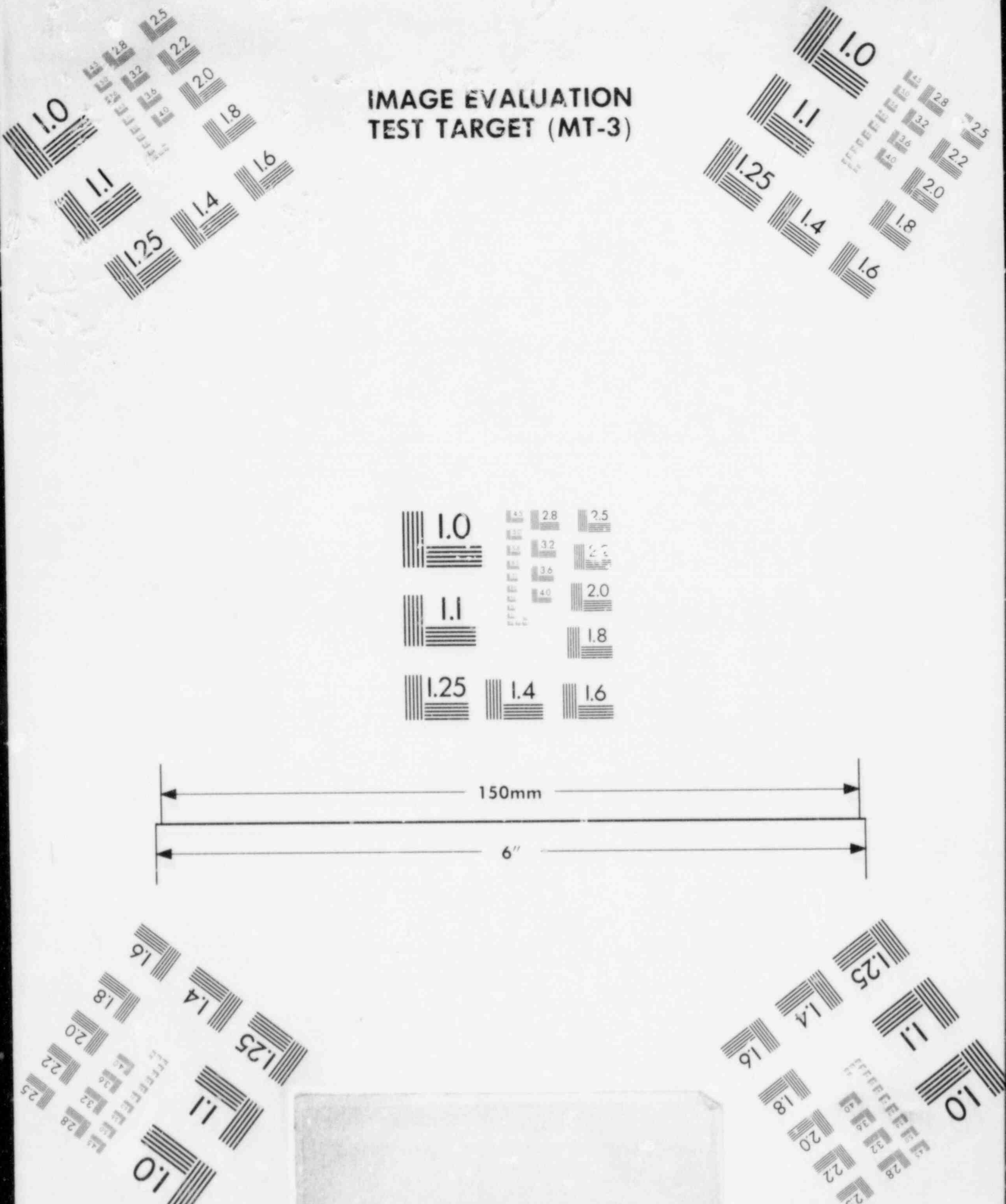
NG RELEASE RATES IN G/S

164917.9308	70.6627

NG RELEASE RATES IN G/S

164917.9308	70.6627
165367.9308	37.9912
166057.9308	67.2747
166507.9308	78.5610
166927.9308	84.2727
167347.9308	87.5175
167707.9308	107.5212
168007.9308	130.5348
168277.9308	159.1407
168607.9308	90.140[illegible]
168967.9308	127.4159
169501.9308	3.2372
170857.9308	.0175
174271.9308	.4536
179953.9308	3.8094
183193.9308	1.1238

IMAGE EVALUATION
TEST TARGET (MT-3)



SPECIES	INITIAL INVENTORY	FINAL INVENTORY
CS	2.3030E+02	2.3904E-01
I2	1.6700E+01	1.8080E-02
XE	3.8700E+02	4.1343E-01
KR	2.5500E+01	2.7241E-02
TE	3.4800E+01	9.4011E+00
AG	0.	0.
SB	0.	0.
BA	1.0500E+02	7.2987E+01
SN	1.0500E+03	4.2580E+02
RU	3.4720E+02	3.4273E+02
UO2	1.5656E+05	1.5643E+05
ZR CLAD	6.4100E+04	6.4085E+04
ZR	2.6700E+02	2.6692E+02
FE	1.5150E+04	1.4793E+04
MO	2.3700E+02	1.9605E+02
SR	6.3000E+01	5.4676E+01
CR	4.1400E+03	4.0424E+03
NI	2.5600E+03	2.4997E+03
MN	4.3200E+02	4.2182E+02
LA	1.5620E+03	1.5602E+03
AG ROD	0.	0.
CD ROD	0.	0.
IN ROD	0.	0.

END OF RUN, TIME= .306E+04

RUN SUMMARY---

TIME	TOT RELICS	I2	TE	NOBLE GAS	OTHER F.P.	NON F.P.	LA
2729.	0.	0.	0.	0.	0.	0.	0.
2729.	.3224E+01	.7952E-01	.9753E-03	.3466E+01	0.	.1747E-03	.5630E-07
2729.	.3224E+01	.7955E-01	.9762E-03	.3466E+01	0.	.3643E-03	.1166E-06
2730.	.4606E+01	.1137E+00	.1395E-02	.4952E+01	0.	.5693E-03	.1817E-06
2730.	.4607E+01	.1137E+00	.1396E-02	.4953E+01	0.	.7852E-03	.2504E-06
2731.	.4607E+01	.1137E+00	.1397E-02	.4954E+01	0.	.1019E-02	.3243E-06
2731.	.4607E+01	.1138E+00	.1398E-02	.4955E+01	0.	.1270E-02	.4041E-06
2731.	.4607E+01	.1138E+00	.1400E-02	.4956E+01	0.	.1536E-02	.4884E-06
2732.	.4607E+01	.1139E+00	.1401E-02	.4957E+01	0.	.1817E-02	.5777E-06
2732.	.4608E+01	.1139E+00	.1403E-02	.4959E+01	0.	.2131E-02	.6769E-06
2733.	.4608E+01	.1140E+00	.1405E-02	.4960E+01	0.	.2463E-02	.7820E-06
2733.	.4608E+01	.1140E+00	.1407E-02	.4961E+01	0.	.2815E-02	.8934E-06
2733.	.4609E+01	.1141E+00	.1409E-02	.4963E+01	0.	.3189E-02	.1012E-05
2734.	.4609E+01	.1142E+00	.1412E-02	.4965E+01	0.	.3592E-02	.1140E-05
2734.	.4610E+01	.1142E+00	.1415E-02	.4966E+01	0.	.4027E-02	.1278E-05
2735.	.4610E+01	.1143E+00	.1418E-02	.4968E+01	0.	.4490E-02	.1425E-05
2735.	.4611E+01	.1144E+00	.1421E-02	.4971E+01	0.	.4991E-02	.1582E-05
2735.	.4611E+01	.1145E+00	.1424E-02	.4973E+01	0.	.5526E-02	.1749E-05
2736.	.5879E+01	.1458E+00	.1811E-02	.6337E+01	0.	.6106E-02	.1930E-05
2736.	.5880E+01	.1459E+00	.1815E-02	.6340E+01	0.	.6734E-02	.2124E-05
2737.	.5881E+01	.1461E+00	.1820E-02	.6343E+01	0.	.7417E-02	.2333E-05
2737.	.5882E+01	.1462E+00	.1826E-02	.6346E+01	0.	.8158E-02	.2557E-05
2737.	.5884E+01	.1463E+00	.1832E-02	.6349E+01	0.	.8960E-02	.2798E-05
2738.	.5885E+01	.1465E+00	.1838E-02	.6353E+01	0.	.9830E-02	.3057E-05
2738.	.5887E+01	.1467E+00	.1846E-02	.6357E+01	0.	.1079E-01	.3337E-05
2739.	.5890E+01	.1469E+00	.1854E-02	.6362E+01	0.	.1183E-01	.3638E-05
2739.	.5892E+01	.1471E+00	.1863E-02	.6367E+01	0.	.1299E-01	.3966E-05
2739.	.5896E+01	.1473E+00	.1873E-02	.6373E+01	0.	.1426E-01	.4323E-05
2740.	.5899E+01	.1476E+00	.1885E-02	.6379E+01	0.	.1567E-01	.4712E-05
2740.	.5904E+01	.1478E+00	.1898E-02	.6386E+01	0.	.1724E-01	.5136E-05
2741.	.5909E+01	.1482E+00	.1913E-02	.6394E+01	0.	.1900E-01	.5598E-05
2741.	.5914E+01	.1485E+00	.1930E-02	.6402E+01	0.	.2096E-01	.6103E-05
2741.	.7071E+01	.1774E+00	.2298E-02	.7651E+01	0.	.2314E-01	.6656E-05
2742.	.7078E+01	.1778E+00	.2321E-02	.7662E+01	0.	.2554E-01	.7264E-05
2742.	.7085E+01	.1784E+00	.2347E-02	.7675E+01	0.	.2821E-01	.7934E-05
2743.	.7094E+01	.1790E+00	.2377E-02	.7690E+01	0.	.3118E-01	.8675E-05
2743.	.7102E+01	.1797E+00	.2413E-02	.7707E+01	0.	.3450E-01	.9496E-05
2743.	.7112E+01	.1804E+00	.2455E-02	.7725E+01	0.	.3820E-01	.1041E-04
2744.	.7123E+01	.1813E+00	.2504E-02	.7746E+01	0.	.4232E-01	.1144E-04
2744.	.7135E+01	.1822E+00	.2563E-02	.7769E+01	0.	.4694E-01	.1260E-04
2745.	.7149E+01	.1833E+00	.2635E-02	.7795E+01	0.	.5218E-01	.1390E-04
2745.	.7166E+01	.1846E+00	.2727E-02	.7826E+01	0.	.5836E-01	.1547E-04
2745.	.7187E+01	.1862E+00	.2848E-02	.7865E+01	0.	.6632E-01	.1753E-04
2746.	.7217E+01	.1884E+00	.3016E-02	.7920E+01	0.	.7757E-01	.2062E-04
2746.	.8358E+01	.2189E+00	.3588E-02	.9181E+01	0.	.9521E-01	.2588E-04
2747.	.8428E+01	.2242E+00	.3932E-02	.9311E+01	0.	.1227E+00	.3474E-04
2747.	.8534E+01	.2322E+00	.4417E-02	.9506E+01	0.	.1646E+00	.4945E-04
2748.	.8794E+01	.2518E+00	.5383E-02	.9984E+01	0.	.2702E+00	.9239E-04
2749.	.9442E+01	.3005E+00	.7805E-02	.1117E+02	0.	.5905E+00	.2707E-03
2750.	.1020E+02	.3571E+00	.1122E-01	.1255E+02	0.	.1031E+01	.5406E-03
2751.	.1107E+02	.4229E+00	.1556E-01	.1415E+02	0.	.1634E+01	.9830E-03
2752.	.1169E+02	.4696E+00	.2029E-01	.1529E+02	0.	.2253E+01	.1439E-02
2753.	.1363E+02	.5629E+00	.2648E-01	.1806E+02	0.	.3023E+01	.2003E-02
2754.	.1442E+02	.6220E+00	.3313E-01	.1950E+02	0.	.3872E+01	.2706E-02
2755.	.1512E+02	.6744E+00	.4069E-01	.2078E+02	0.	.4772E+01	.3442E-02
2756.	.1640E+02	.7708E+00	.5014E-01	.2312E+02	0.	.5957E+01	.4386E-02
2757.	.1762E+02	.8617E+00	.6090E-01	.2534E+02	0.	.7305E+01	.5512E-02
2758.	.1886E+02	.9553E+00	.7299E-01	.2762E+02	0.	.8816E+01	.6760E-02
2759.	.2034E+02	.1066E+01	.8673E-01	.3032E+02	0.	.1052E+02	.8202E-02
2760.	.2196E+02	.1188E+01	.1078E+00	.3328E+02	0.	.1248E+02	.1914E-01

TIME	TOT REL:AG	SB	BA	RU	ZR	MO	SR
2729.	0.	0.	0.	0.	0.	0.	0.
2729.	0.	0.	.301E-04	.340E-06	.311E-07	.460E-05	.195E-04
2729.	0.	0.	.308E-04	.705E-06	.642E-07	.964E-05	.215E-04
2730.	0.	0.	.442E-04	.110E-05	.997E-07	.152E-04	.312E-04
2730.	0.	0.	.451E-04	.151E-05	.137E-06	.212E-04	.334E-04
2731.	0.	0.	.461E-04	.196E-05	.176E-06	.278E-04	.357E-04
2731.	0.	0.	.473E-04	.244E-05	.219E-06	.351E-04	.382E-04
2731.	0.	0.	.485E-04	.295E-05	.264E-06	.431E-04	.407E-04
2732.	0.	0.	.500E-04	.349E-05	.310E-06	.518E-04	.433E-04
2732.	0.	0.	.516E-04	.409E-05	.362E-06	.615E-04	.462E-04
2733.	0.	0.	.534E-04	.473E-05	.416E-06	.721E-04	.491E-04
2733.	0.	0.	.555E-04	.540E-05	.474E-06	.838E-04	.522E-04
2733.	0.	0.	.578E-04	.612E-05	.533E-06	.966E-04	.554E-04
2734.	0.	0.	.604E-04	.689E-05	.598E-06	.111E-03	.587E-04
2734.	0.	0.	.634E-04	.772E-05	.667E-06	.127E-03	.623E-04
2735.	0.	0.	.668E-04	.861E-05	.739E-06	.144E-03	.659E-04
2735.	0.	0.	.706E-04	.956E-05	.816E-06	.163E-03	.697E-04
2735.	0.	0.	.750E-04	.106E-04	.896E-06	.185E-03	.737E-04
2736.	0.	0.	.916E-04	.117E-04	.982E-06	.208E-03	.847E-04
2736.	0.	0.	.974E-04	.128E-04	.107E-05	.235E-03	.890E-04
2737.	0.	0.	.104E-03	.141E-04	.117E-05	.264E-03	.934E-04
2737.	0.	0.	.112E-03	.155E-04	.127E-05	.297E-03	.981E-04
2737.	0.	0.	.121E-03	.169E-04	.138E-05	.334E-03	.103E-03
2738.	0.	0.	.131E-03	.185E-04	.150E-05	.376E-03	.108E-03
2738.	0.	0.	.143E-03	.202E-04	.162E-05	.423E-03	.113E-03
2739.	0.	0.	.157E-03	.220E-04	.175E-05	.476E-03	.118E-03
2739.	0.	0.	.174E-03	.240E-04	.189E-05	.536E-03	.124E-03
2739.	0.	0.	.194E-03	.261E-04	.205E-05	.604E-03	.130E-03
2740.	0.	0.	.217E-03	.285E-04	.221E-05	.682E-03	.136E-03
2740.	0.	0.	.245E-03	.311E-04	.238E-05	.771E-03	.143E-03
2741.	0.	0.	.281E-03	.338E-04	.257E-05	.893E-03	.150E-03
2741.	0.	0.	.323E-03	.369E-04	.277E-05	.103E-02	.157E-03
2741.	0.	0.	.388E-03	.402E-04	.299E-05	.122E-02	.171E-03
2742.	0.	0.	.448E-03	.439E-04	.322E-05	.143E-02	.179E-03
2742.	0.	0.	.516E-03	.480E-04	.347E-05	.166E-02	.187E-03
2743.	0.	0.	.593E-03	.525E-04	.374E-05	.191E-02	.197E-03
2743.	0.	0.	.686E-03	.574E-04	.403E-05	.223E-02	.206E-03
2743.	0.	0.	.790E-03	.630E-04	.435E-05	.258E-02	.217E-03
2744.	0.	0.	.906E-03	.692E-04	.470E-05	.297E-02	.229E-03
2744.	0.	0.	.104E-02	.762E-04	.508E-05	.339E-02	.242E-03
2745.	0.	0.	.118E-02	.841E-04	.550E-05	.386E-02	.256E-03
2745.	0.	0.	.136E-02	.935E-04	.599E-05	.439E-02	.273E-03
2745.	0.	0.	.158E-02	.106E-03	.657E-05	.505E-02	.295E-03
2746.	0.	0.	.190E-02	.125E-03	.735E-05	.592E-02	.327E-03
2746.	0.	0.	.240E-02	.156E-03	.848E-05	.711E-02	.390E-03
2747.	0.	0.	.315E-02	.210E-03	.101E-04	.881E-02	.492E-03
2747.	0.	0.	.428E-02	.299E-03	.126E-04	.112E-01	.668E-03
2748.	0.	0.	.713E-02	.559E-03	.186E-04	.164E-01	.123E-02
2749.	0.	0.	.155E-01	.153E-02	.370E-04	.265E-01	.303E-02
2750.	0.	0.	.276E-01	.288E-02	.625E-04	.419E-01	.570E-02
2751.	0.	0.	.443E-01	.494E-02	.981E-04	.587E-01	.961E-02
2752.	0.	0.	.618E-01	.708E-02	.136E-03	.775E-01	.137E-01
2753.	0.	0.	.851E-01	.987E-02	.185E-03	.105E+00	.193E-01
2754.	0.	0.	.111E+00	.131E-01	.241E-03	.130E+00	.254E-01
2755.	0.	0.	.139E+00	.166E-01	.302E-03	.160E+00	.319E-01
2756.	0.	0.	.176E+00	.213E-01	.383E-03	.198E+00	.408E-01
2757.	0.	0.	.217E+00	.266E-01	.474E-03	.239E+00	.508E-01
2758.	0.	0.	.264E+00	.327E-01	.578E-03	.285E+00	.620E-01
2759.	0.	0.	.319E+00	.397E-01	.698E-03	.340E+00	.754E-01

TIME	TOT REL:SN	UO2	ZR(CLAD)	FE	AGROD	CDROD	INROD
2729.	0.	0.	0.	0.	0.	0.	0.
2729.	.240E-04	.448E-05	.594E-05	.140E-03	0.	0.	0.
2729.	.508E-04	.935E-05	.123E-04	.292E-03	0.	0.	0.
2730.	.804E-04	.146E-04	.193E-04	.455E-03	0.	0.	0.
2730.	.113E-03	.202E-04	.265E-04	.626E-03	0.	0.	0.
2731.	.149E-03	.262E-04	.342E-04	.809E-03	0.	0.	0.
2731.	.190E-03	.327E-04	.425E-04	.101E-02	0.	0.	0.
2731.	.234E-03	.395E-04	.512E-04	.121E-02	0.	0.	0.
2732.	.283E-03	.468E-04	.604E-04	.143E-02	0.	0.	0.
2732.	.338E-03	.548E-04	.705E-04	.167E-02	0.	0.	0.
2733.	.400E-03	.634E-04	.812E-04	.192E-02	0.	0.	0.
2733.	.468E-03	.725E-04	.923E-04	.218E-02	0.	0.	0.
2733.	.543E-03	.821E-04	.104E-03	.246E-02	0.	0.	0.
2734.	.628E-03	.925E-04	.117E-03	.275E-02	0.	0.	0.
2734.	.723E-03	.104E-03	.130E-03	.307E-02	0.	0.	0.
2735.	.829E-03	.115E-03	.144E-03	.340E-02	0.	0.	0.
2735.	.948E-03	.128E-03	.159E-03	.376E-02	0.	0.	0.
2735.	.108E-02	.142E-03	.175E-03	.413E-02	0.	0.	0.
2736.	.123E-02	.157E-03	.191E-03	.453E-02	0.	0.	0.
2736.	.140E-02	.172E-03	.209E-03	.495E-02	0.	0.	0.
2737.	.160E-02	.189E-03	.229E-03	.540E-02	0.	0.	0.
2737.	.182E-02	.208E-03	.249E-03	.588E-02	0.	0.	0.
2737.	.207E-02	.228E-03	.271E-03	.639E-02	0.	0.	0.
2738.	.235E-02	.249E-03	.293E-03	.693E-02	0.	0.	0.
2738.	.268E-02	.272E-03	.318E-03	.752E-02	0.	0.	0.
2739.	.306E-02	.297E-03	.344E-03	.813E-02	0.	0.	0.
2739.	.350E-02	.324E-03	.372E-03	.880E-02	0.	0.	0.
2739.	.400E-02	.353E-03	.402E-03	.950E-02	0.	0.	0.
2740.	.459E-02	.385E-03	.434E-03	.103E-01	0.	0.	0.
2740.	.528E-02	.420E-03	.469E-03	.111E-01	0.	0.	0.
2741.	.609E-02	.459E-03	.506E-03	.120E-01	0.	0.	0.
2741.	.703E-02	.500E-03	.545E-03	.129E-01	0.	0.	0.
2741.	.811E-02	.546E-03	.588E-03	.139E-01	0.	0.	0.
2742.	.932E-02	.596E-03	.634E-03	.150E-01	0.	0.	0.
2742.	.107E-01	.652E-03	.684E-03	.162E-01	0.	0.	0.
2743.	.123E-01	.714E-03	.738E-03	.174E-01	0.	0.	0.
2743.	.141E-01	.783E-03	.797E-03	.188E-01	0.	0.	0.
2743.	.161E-01	.860E-03	.861E-03	.204E-01	0.	0.	0.
2744.	.184E-01	.946E-03	.932E-03	.220E-01	0.	0.	0.
2744.	.210E-01	.104E-02	.101E-02	.238E-01	0.	0.	0.
2745.	.241E-01	.115E-02	.109E-02	.259E-01	0.	0.	0.
2745.	.277E-01	.129E-02	.119E-02	.282E-01	0.	0.	0.
2745.	.325E-01	.146E-02	.131E-02	.310E-01	0.	0.	0.
2746.	.396E-01	.173E-02	.147E-02	.347E-01	0.	0.	0.
2746.	.512E-01	.217E-02	.170E-02	.401E-01	0.	0.	0.
2747.	.697E-01	.291E-02	.203E-02	.480E-01	0.	0.	0.
2747.	.987E-01	.411E-02	.251E-02	.593E-01	0.	0.	0.
2748.	.173E+00	.740E-02	.363E-02	.858E-01	0.	0.	0.
2749.	.400E+00	.205E-01	.692E-02	.164E+00	0.	0.	0.
2750.	.713E+00	.396E-01	.113E-01	.267E+00	0.	0.	0.
2751.	.114E+01	.693E-01	.172E-01	.407E+00	0.	0.	0.
2752.	.158E+01	.999E-01	.235E-01	.554E+00	0.	0.	0.
2753.	.212E+01	.136E+00	.313E-01	.738E+00	0.	0.	0.
2754.	.271E+01	.180E+00	.399E-01	.942E+00	0.	0.	0.
2755.	.333E+01	.227E+00	.494E-01	.116E+01	0.	0.	0.
2756.	.415E+01	.285E+00	.618E-01	.146E+01	0.	0.	0.
2757.	.508E+01	.355E+00	.760E-01	.179E+01	0.	0.	0.
2758.	.612E+01	.434E+00	.921E-01	.217E+01	0.	0.	0.
2759.	.729E+01	.522E+00	.110E+00	.260E+01	0.	0.	0.
2760.	.864E+01	.635E+00	.130E+00	.307E+01	0.	0.	0.

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The CORSOR code simulates the release of fission products and structural materials from a reactor core during the in-vessel period of a severe accident in a light water reactor. The code is a simple, empirically based treatment of release and does not treat detailed mechanisms for release from high temperature fuel. The first-order release rate coefficients for the species considered are presented, the input requirements of the code are described, and an example input and output stream is supplied in an appendix.

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