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NUREG/CR-5360
SAND89-0943

XSOR Codes Users Manual

Manuscript Completed: October 1993
Date Published: November 1993

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Prepared for
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Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
NRC FIN L1272

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Abstract

This report describes the source term estimation codes, XSORs. The codes are written for three pressurized water reactors (Surry, Sequoyah, and Zion) and two boiling water reactors (Peach Bottom and Grand Gulf). The ensemble of codes has been named "XSOR". The purpose of XSOR codes is to estimate the source terms which would be released to the atmosphere in severe accidents. A source term includes the release fractions of several radionuclide groups, the timing and duration of releases, the rates of energy release, and the elevation of releases.

The codes have been developed by Sandia National Laboratories for the U.S. Nuclear Regulatory Commission (NRC) in support of the NUREG-1150 program. The XSOR codes are fast running parametric codes and are used as surrogates for detailed mechanistic codes. The XSOR codes also provide the capability to explore the phenomena and their uncertainty which are not currently modeled by the mechanistic codes. The uncertainty distributions of input parameters may be used by an XSOR code to estimate the uncertainty of source terms.

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1 Introduction

1.1 Background

This document describes the source term estimation codes, XSORs, which have been developed in support of the NUREG-1150 program [US90]. A "source term" includes the release fractions of several radionuclide groups, the timing and duration of the releases, the rates of energy release, and the elevation of the releases.

It was recognized early in the NUREG-1150 program that a fast running source term estimation code was needed to perform a large number of source term calculations. Therefore, a simple parametric equation is the underlying approach of XSOR codes. The codes have been written for three pressurized water reactors (PWR) (Surry, Sequoyah, and Zion) and two boiling water reactors (BWR) (Peach Bottom and Grand Gulf). The ensemble of codes has been generically named "XSOR"; the plant specific codes are SURSOR, SEQSOR, ZISOR,¹ PBSOR, and GGSOR.

1.2 Source Term Uncertainty

Mechanistic codes exist for the calculation of source terms. For example, the NRC and its contractors use the Source Term Code Package (STCP) [Ge86] and licensees widely use the Modular Accident Analysis Program (MAAP) [ID87]. Sandia National Laboratories is currently developing a new suite of codes, MELCOR [Su87].

Each of the codes or suites of codes model some phenomena but omit others. The models are not the same in all codes; in fact, there is vigorous debate about the appropriateness of models for some phenomena. Each of the codes requires input data and there is uncertainty as to the most appropriate values to use. The result of these differences and uncertainties is that there are large differences in the source terms for any given accident sequence, even if the initial and boundary conditions are well characterized. However, the initial and boundary conditions are seldom well known, and this lack of knowledge adds additional uncertainty.

The so-called "best estimate" calculations rely on the judgment of the analyst, who selects what he believes to be the most appropriate models and most likely input data and initial conditions based on a number of criteria. The analyst often bases the choice of codes (and hence phenomenological models) on availability, familiarity, and organizational preference. The choice of input data and initial conditions is usually based on the analyst's personal experience and professional judgment. The result is that calculated results tend to be idiosyncratic. Most analysts would probably say that subjectivity had been largely removed or minimized. However, the fact that different analysts often arrive at different results shows that objectivity is a goal that is seldom realized.

The NUREG-1150 program has recognized the inherent subjectivity of source term calculations, and rather than hiding the factor of personal judgment, has attempted to make judgments in a uniform and transparent manner through formalized, well documented procedures. For each of the most important source term uncertain issues, a panel of recognized experts was convened. The experts came from a broad spectrum of backgrounds: private industry, the NRC, national laboratories, consultants, and academia. Uncertainty distributions were elicited from each of the experts using formal decision analysis techniques [Ha92]. For most of the issues, the experts' distributions were elicited subject to specified initial conditions. A specified set of initial conditions is called a "case" in the vernacular of this program. The experts' distributions were then aggregated to produce a single uncertainty distribution for each case in each issue. The method of aggregation preserved the entire range of expert opinion and ensured that each expert's judgment was equally weighted.

Distributions for issues believed to be less important and for cases of lesser interest were elicited in a similar but somewhat less formal fashion from experts drawn generally from Sandia National Laboratories, and in some cases, from other institutions as well. For some parameters, single values were used; for example, the release timing and energy release parameters.

¹Sursor was modified to form ZISOR by G. Cazzoli of Brookhaven National Laboratory.

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A sample of 200 observations was then drawn using a specialized Monte Carlo sampling method, Latin Hypercube Sampling (LHS) [Im84], to select a single specified value for each uncertainty issue in each observation. The accident frequencies, containment behavior, and source terms were calculated separately for each sample observation. In LHS sampling, each observation is different and each is equally likely. The outcome of the set of calculations can then be arranged as a subjective distribution of risk, that is, the distribution of the belief of the aggregated ensemble of experts about the uncertainty risk, given their individual beliefs about the component phenomena.

The XSOR codes can also be used to give a subjective distribution of source terms. The usual descriptive statistical measures can be performed on the distributions, as well as measures of those phenomena that contribute most to risk and to the uncertainty in risk.

The resulting distributions tend to have very strong positive skew, that is, there is usually a long tail at the upper end of the distribution. A few observations in the extreme upper tail often dominate the arithmetic mean; these observations tend to be unstable from one sample to the next because of the limited sample size. The mean is thus an unstable indicator of the best estimate. The median (the observation such that half the sample is lower and half is higher) is a more suitable central measure. The extreme range of the sample is likewise unstable, and a more suitable indicator of the range of uncertainty is given by the range from the 5th to the 95th percentile. NUREG-1150 uses all of these measures.

1.3 Binning of Accident Progression

The Accident Progression Event Trees (APET) are very large and complex, and an enormous number of possible paths through the trees exist. The APETs calculate the relative frequencies of every path, although those below a very small cutoff frequency are discarded. Even after applying the cutoff, the number of possible outcomes is still large and unwieldy. Fortunately, many of the possible outcomes will be very similar or the distinctions will be too fine to be recognized given current understanding of source terms. Similar or indistinguishable APET outcomes are grouped together into "Accident Progression Bins" (APB), such that all members of an APB are expected to have similar source terms, but are distinguishable from members of other APBs.

The outcomes of important decision points in the APET describe the APBs; for example, the timing and mode of containment failure. Each of these decision points is called an "attribute". The number of attributes for the accident progression bins depend on the plant. Each attribute can take on any of several possible values. The number of apparently possible APBs is thus very large, perhaps in the hundreds of thousands. However, many combinations prove to be physically impossible and the possible combinations are usually reduced to a few thousand. Many of these have very low relative frequencies and may be omitted. The final number of APBs which could be important for risk can then be of the order of hundreds. Each of the APBs represents an adequate set of initial and boundary conditions for the source term calculation. Some of the conditions specified are the timing, size, and location of containment failure, if any; the condition of the reactor system and coolant, including the amount of Zircalloy previously oxidized; the nature of core-concrete interactions; the operation or operability of containment safety systems; and the existence and nature of containment or safety system bypass. An APB is sufficient to specify the case for every issue.

In contrast to the very large number of APBs used in this study, previous probabilistic risk assessments (PRA) have typically used a small number of bins. For example, the Reactor Safety Study [US75] used nine bins for PWRs and five bins for BWRs. Later PRAs have sometimes used more bins, although some have considered even fewer. So-called "best estimate" calculations may even use a single bin for each sequence; these calculations, by their very nature, focus only on the analyst's subjective estimate of the single most likely outcome.

The coarse binning typical of previous PRAs means that the effects of changes in the scenario cannot be readily determined because so many dissimilar scenarios are assigned to the same bins. The fine binning used in this study means that the sensitivity of the source terms to most of the major phenomena can be investigated. A disadvantage is that it is difficult to pick out these sensitivities by eye because of the large number of bins. It is customary to "rebin" the results by some combination of attributes to make the effects more clearly observable.

If uncertainty is not to be treated and the number of sequences and source term bins is small, it is possible to use a mechanistic code to calculate every source term separately. A set of such calculations presents an illusion of objectivity and certainty. The NUREG-1150 program has made the inherent subjectivity and uncertainty an integral part of the process. In order to do this we use a sample of 200 observations (corresponding to 200 distinct conventional PRAs); each observation (or sample member) has a large number of APBs. The use of mechanistic source term codes for so many source terms would be completely impractical, and the inherent uncertainty could not be treated with mechanistic codes.

1.4 Plant Differences

It was determined early in the NUREG-1150 program that plant differences (even among classes of plants) were so important that quite different treatments were required for each plant. One solution would have been to write a very large, general source term estimation code which would be applicable to almost any plant. Another option was to write a specific code for each plant. The second option was chosen because of time constraints, although it was recognized that generality would have been desirable if it had been possible. However, it was possible to produce each code in parallel by writing specific plant codes. An unfortunate side effect of this parallel development is that different analysts produced the codes for each plant and idiosyncratic coding and problem organization are apparent. However, care was taken to use the same mathematical procedures and compatible outputs for all plants.

1.5 Goals and Objectives

The goal of each of the plant-specific XSOR programs is to provide rapid calculation of source terms for a large number of APBs for each observation of an LHS sample. The LHS program selects a single value for every issue in each observation. The XSOR codes then calculate a source term for each APB in each observation. The case structure specified by the experts is preserved, although additional cases not considered by the expert panels are also included. Distributions for additional cases are typically proportional to the distribution of the most closely analogous case considered by the experts.

The programs can also produce single point-value estimates. The point estimate can be the median (or other measure) of each issue distribution, or a simulation of the STCP or any other suite of codes.

The XSOR codes are required because:

- (a) mechanistic codes such as the STCP do not treat some phenomena which are believed to be important for risk,
- (b) uncertainty exists as to the most appropriate models,
- (c) uncertainty exists in some of the input parameters,
- (d) the STCP and other similar codes are high utilizers of resources; human resources and funding limitations make it uneconomical to run the STCP for every scenario of interest,
- (e) the relative importance of many APBs cannot be known in advance, and it is virtually impossible to run the STCP for every conceivable APB, and
- (f) the STCP and other mechanistic codes would not be suited to Latin Hypercube Sampling.

The magnitude of release for each of nine nuclide groups is required for either uncertainty or point estimate mode. The release is broken into two time resolved components, with the beginning time, duration, and energy release rate of each component. Mass conservation is required; that is, the entire fission product inventory is accounted for without elision or double counting.

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The XSOR codes are intended to be used principally in the sampling mode in support of the NUREG-1150 program. A secondary use is for calculation of "best estimate" source terms (based either on code simulations or on the experts' distributions) and for studies of sensitivity to the models used or to the shapes and ranges of the distributions used.

1.6 Requirements Specification

1.6.1 Treatment of Uncertainty and Binning

The uncertainty in each issue is represented by a subjective cumulative probability distribution (CPD) for each case of every uncertain issue. The independent variable of the CPD is a release fraction or transmission or decontamination factor. The dependent variable is the probability (in the opinion of the experts) that the independent variable could not be greater than the value specified.

The LHS program selects a random number between zero and one for each issue. These random numbers are different for every sample member; however, for any one sample member the same random number applies to all cases of an issue and to all nuclide groups; i.e., is completely correlated. The CPD is entered with this number on the vertical (probability) axis and the parameter is read from the horizontal (release fraction) axis. The LHS program operates in such a way that each probability band of the CPD of width $1/n$ (where n is the sample size) is selected once and only once.

The cases specified by the experts are recognizable from the structure of the APBs. The source term calculated is applied to every member of an APB without differentiation.

1.6.2 Output Requirements

The fraction of the core released to the environment is required for each of the following nuclide groups. These are the same nuclide groups as used in the STCP: (1) Noble gases, (2) I and Br, (3) Cs and Rb, (4) Te, (5) Sr, (6) Ru, (7) La and other transuranics, (8) Ce and other rare earths, and (9) Ba. The release fractions are divided into "early" and "late" components. The time of the beginning of the release, release duration, energy of release, and elevation are required for each component.

The output format for all plants is identical.

1.6.3 Resource Requirements

The codes are written in VAX FORTRAN77. A plant-specific code is not applicable to any other plant without considerable change. New issues or cases may not be added without modifying the individual XSOR code. There is no provision for interplant flexibility.

The codes are operable in either sampling or single-value mode without changes.

The codes should be operable on any VAX without alteration. No provision has been made for transferability to other computers; however, at least some of the codes have been used on a PC with relatively minor changes.

1.7 Test and Quality Assurance (QA)

The codes are capable of simulating the STCP or other mechanistic codes by choosing parameter values back-calculated from the large codes.

Battelle Columbus Laboratory (BCL) tested the XSOR codes against the STCP [Cy89]. Parameter values were based on STCP runs; that is, values were chosen so as to give close agreement with some modules of the STCP for specific runs.

The XSOR codes were then tested against all other runs of the STCP. Adequate agreement was found for the most important nuclide groups. In many cases, lack of agreement could be traced to changes made to the STCP between the original run and the run against which XSOR was tested.

Battelle also tested SURSOR and SEQSOR in the sampling mode. The objective was to determine whether the STCP result fell within the distribution of source terms calculated by XSOR.

Limited verification testing has also been conducted at Sandia, with results similar to those at Battelle. Blind tests have been conducted in which the outcome of the test STCP calculation was not known to the user at the time the parameter values were specified.

1.8 Summary Description

The basic mass conservation parametric equations are described in the individual chapters of XSOR codes. These equations are similar among all plants, although a few changes are needed for specific applications (for example, steam generator tube ruptures are not applicable to BWRs). Each parameter of the equation represents either a release or transmission factor for a phenomenological module of the STCP or other mechanistic codes. These are high level parameters; for example, the fraction of cesium released during core-concrete interaction is a parameter, and phenomenological data such as the gas flow through the melt are subsumed within these high level parameters. The parameters are multiplicatively combined for phenomena occurring in series and additively for some other parameters. Every part of every fission product is accounted for, although the entire inventory does not necessarily add to the release. The values of the parameters depend on the cases (initial conditions) specified by the APB and by the level for each issue as determined by LHS.

The plant-specific XSOR codes are described in Chapters 2, 3, 4, and 5.

2 SURSOR

2.0 SURSOR Code

The SURSOR code is applicable to most large dry containments, although some modifications may be required. For example, fan coolers do not operate at Surry under accident conditions, but may do so at other plants. Also, the conditions for cavity water are plant-specific. The timing and energy of releases could also be different at other plants.

The Surry containment provides major decontamination by containment sprays. In addition, some decontamination is provided by scrubbing of core-concrete releases by overlying water pools and by agglomeration and deposition of aerosols. The code allows for additions to the source term by release of volatile iodine (notably organic iodides), by releases due to high pressure ejection and direct containment heating (DCH), and by releases due to steam generator tube rupture (SGTR) as well as the usual in-vessel and core-concrete releases.

A listing of SURSOR is given in Appendix A.1.

2.1 SURSOR Parametric Equation

The basic parametric equation for SURSOR and SEQSOR has the following form:

$$ST_i = FCOR_i * [FISG_i * FOSG_i + (1 - FISG_i) * FVES_i * FCONV_i / DFE_i] + (1 - FCOR_i) * FPME * FDCH_i * FCONV_i + FPARTL * (1 - FREM - FPME) * FCCI_i * (1 - FCOR_i) * FCONC_i / DFL_i + [FCOR_i * (1 - FVES_i) * (1 - FISG_i) + FREM * (1 - FCOR_i)] * FLATE_i * FCONRL_i / DFL_i + \text{Special Terms.} \quad (2.1)$$

The definitions of parameters in Equation (2.1) are as follows.

$ST_i =$	fraction of initial inventory of nuclide group i released to the environment,
$FCOR_i =$	fraction of initial inventory of nuclide group i released from the fuel in-vessel,
$FISG_i =$	fraction of material released from the core in-vessel that enters the steam generators,
$FOSG_i =$	fraction of material entering the steam generators which leaves the steam generators and enters the environment,
$FVES_i =$	fraction of material entering the RCS which is released from the RCS,
$FCONV_i =$	fraction of the material released from the vessel which would be released from the containment in the absence of special decontamination mechanisms such as sprays which are included in DFE,
$FPME =$	fraction of core involved in high-pressure melt ejection (HPME),
$FDCH_i =$	fraction of nuclide group i released to the environment from the high-pressure ejection material,

FPARTL =	fraction of core which would participate in CCI if all of the core left the vessel and there were no HPME,
FREM =	fraction of core that never leaves the vessel,
FCCI _i =	fraction of the material remaining in the debris participating in core-concrete interaction which is released to the containment atmosphere in core-concrete interaction,
FCONC _i =	fraction of material from core-concrete interaction released from the containment, in the absence of special decontamination mechanisms included in DFL _i ,
DFE _i =	decontamination factor to be applied to release from the vessel,
DFL _i =	decontamination factor to be applied to release of nuclide group i in core-concrete interaction,
FLATE _i =	fraction of material remaining in the RCS after vessel breach which is revolatilized late in the accident, and
FCONRL =	fraction of late revolatilized material which would be released from containment in the absence of decontamination mechanisms.

The uncertainty distributions of input parameters are discussed in the following section.

2.2 Uncertainty Distribution of Parameters

Distributions were not available for some parameters; however, for some of these, a closely analogous distribution was available. Usually, some value of the new distribution would be known; for example, it was often desired that the median of the new distribution match a value back-calculated from a STCP run. If the median value was smaller than the median of the existing distribution for all nuclide groups, the new distribution could be determined from the ratio of the desired median to the median of the existing distribution. If the desired median value is M_d , the median of the existing distribution is M_e , and the i -th fractile of the existing distribution is Y_e , then the i -th fractile of the desired new distribution would be:

$$Y_d = Y_e(M_d/M_e). \quad (2.2)$$

However, if the median of the desired distribution was greater than that of the existing distribution, the ratio method might have produced fractions exceeding 1.0. Also, the new distribution would have a different range from that of the analogous distribution. In many cases, it was desired that the new distribution cover the same range as the existing distribution although the median was to match some value from a STCP run or other source. For this situation, transformation along with its inverse was used:

$$y = x/(1-x) \text{ and} \quad (2.3)$$

$$x = y/(1+y).$$

Suppose that the median of the existing distribution is M_x , the desired median of the new distribution is to be M_y , and the i -th fractile of the existing analogous distribution is X_i . Let:

$$\begin{aligned} Y_i &= X_i/(1-X_i) \\ Y_m &= M_x/(1-M_x) \end{aligned} \quad (2.4)$$

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$$Y_d = M_y/(1-M_y), \text{ and} \\ \phi = Y_d/Y_m.$$

Then the desired i-th fractile of the new distribution is

$$Q_i = \phi Y_i / (1 + \phi Y_i). \quad (2.5)$$

This procedure tends to maintain the approximate shape of the distribution in the neighborhood of the median and has approximately the same range as the analogous distribution. However, the shape of the new distribution is distorted in regions far from the median.

For a very few parameters (principally those dealing with release timing, elevation, and energy), distributions were not used. A single value was used for each sample member, although values could differ between APET bins (see Section 2.3).

2.2.1 In-Vessel Release from the Fuel (FCOR)

The distributions for this parameter were determined by the external expert panel. The in-vessel release from fuel is allowed to vary with the amount of zirconium oxidized prior to vessel breach. Sequences in which less than 40% is oxidized are assigned to "High Zr remaining", and those in which greater than 40% is oxidized in-vessel are assigned to "low Zr remaining". The amount of Zr oxidized prior to vessel breach is determined by the Accident Progression Event Tree (APET).

The levels accepted by the expert review group spanned a wide range. Levels within this range varied in a somewhat log-uniform fashion. Therefore, logarithmic interpolation was used to determine source term parameter values between fractiles.

2.2.2 Radioactive Material Released from the Reactor Coolant System (RCS) (FVES)

Retention in the RCS is considered to be sequence-dependent. The sequences separately presented to the expert panel were:

1. System set point pressure; release through a cycling power-operated relief valve (PORV).
2. High pressure; release through a very small break or pump seal loss of coolant accident (LOCA).
3. Intermediate pressure; release through a break of approximately two inches diameter.
4. Low pressure; release through a large break.

The expert panel combined the high and intermediate pressure cases and the same distributions are used for both.

A special set of values, FVSG, is used if an induced steam generator tube rupture (SGTR) occurs. The median values for FVSG are:

NG	I	Cs	Te	Ba	Sr	Ru	La	Ce	Ba
1.0	.17	.17	.32	.072	.058	.044	.058	.058	.058

The distribution for FVES is calculated from the experts' distribution for FVES in intermediate pressure sequences using the transformation $y = x/(1-x)$ and the inverse transformation $x = y/(1+y)$.

The sequence pressure and fraction of Zr oxidized is passed to SURSOR from the accident progression event tree (APET). This information gives the pressure in the RCS at vessel breach, hence induced LOCAs are treated the same as initial LOCAs. This treatment may not correctly represent in-vessel retention, especially if an induced LOCA occurs late in the meltdown process. The median of the distribution for FVES in the interfacing systems LOCA is made equal to values calculated from a BNL calculation of the V-sequence. The remainder of the distribution is calculated from the experts' distribution for FVES in low pressure sequences, using the transformation $y = x/(1-x)$ and its inverse $x = y/(1+y)$.

Independent sampling of nuclide groups was not allowed for this issue, for the same reasons as it was not allowed for FCOR. Distinct values are allowed for each nuclide group, but all groups are correlated. The levels chosen by the expert review group spanned the range from very high retention (low values of FVES) to very low retention, and the levels chosen were at approximately log-uniform intervals. Logarithmic interpolation is used for this issue.

2.2.3 Fractions of Nuclide Group Entering and Exiting the Steam Generator During Rupture (FISG, FOSG)

If a steam generator tube rupture occurs (either as an initiating event or as a consequence of high temperature in the steam generator tubes) the release from the RCS prior to vessel breach is:

$$FCOR_i * [FISG_i * FOSG_i + (1 - FISG_i) * FVES_i * FCONV_i / DFE_i], \quad (2.6)$$

where

$FISG_i$ = fraction of nuclide group i released from the core that enters the steam generator and

$FOSG_i$ = fraction of nuclide group i entering the steam generator which is released from the steam generator.

The factors $FCONV_i$ and DFE_i are not applied to the material leaving the steam generator. If the secondary safety relief valves (SRV) reclose, the steam generators will only blow down to the relief valve setpoint. For this case, a distribution having a median taken from a Battelle calculation was determined internally. For the higher probability case when the SRVs do not reclose, the distribution for the product of $FISG_i * FOSG_i$ was determined by an expert panel.

2.2.4 Release of RCS Material from Containment (FCONV)

Values of $FCONV$ were determined by the source term expert review panel, for the following cases:

- Case 1: Leak (0.1 ft²) at vessel breach, with dry containment.
- Case 2: Leak at vessel breach, with water in containment.
- Case 3: Rupture (7.0 ft²) at vessel breach.
- Case 4: Rupture (7.0 ft²) after core-concrete interaction, without spray operation.

Special values of $FCONV$ are used for other containment failure scenarios. The values were chosen to make the output match the predictions of the STCP, for scenarios for which a run was available, or to simulate a physical effect for other scenarios. The special values of $FCONV$ are for:

1. Catastrophic rupture at vessel breach; a median value equal to the 95-th percentile for Case 3 is used; the distribution is calculated from the distribution for Case 3, with the transformation $y = x/(1-x)$ and the inverse transformation $x = y/(1+y)$. The intent is to simulate only minimal holdup in the containment.
2. Rupture or catastrophic rupture after core-concrete interaction (CCI) has occurred and sprays operate prior to the rupture; a median value of 0.01 is used for $FCONV$. In addition, the DF for sprays is applied. The distribution is proportional to the distribution for Case 2. The intent is that the sprays will have removed a large fraction of the fission products from the atmosphere before the rupture occurs, the material removed will be largely dissolved or suspended in water pools, and resuspension will be less effective than if the containment is dry. If the sprays do not operate, the Case 4 distribution is used without change (the median for Case 4 is 0.018). Catastrophic rupture is not differentiated from rupture for this case.
3. Leak after CCI, without spray operation; a median value of 0.005 is used for $FCONV$. The distribution is made proportional to the distribution for Case 1. If the sprays operate prior to the leak, a median value of 0.001 is used for $FCONV$ and the decontamination factor (DF) for sprays is applied. The distribution was made proportional to that for Case 2. The intent is to remove almost all the RCS release if sprays operate for an appreciable period of time.

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4. Very late containment failure, whether rupture or leak or basemat melt-through; $FCONV = 10^{-6}$. The intent is to remove essentially all the RCS release before failure occurs. However, all the noble gases and organic iodine are permitted to escape. This procedure may be too conservative for basemat melt-through.
5. Rupture before core melt; the median is set equal to the 75-th percentile for Case 3, and the distribution is taken from the distribution for Case 3 using the transformation $y=x/(1-x)$ and the inverse $x=y/(1+y)$. The intent is to simulate less holdup than would occur if the rupture occurred at vessel breach; a large fraction of the RCS release occurs prior to vessel breach, and natural settling removes some of this material if there is no containment failure until after the vessel fails. If a catastrophic rupture occurs before vessel breach, the median is set equal to the 99th percentile of Case 3. The intent is to have essentially no holdup of the RCS release.
6. Leak or isolation failure before core melt; use the average $FCONV$ for cases 1 (or 2) and 3. This gives a reasonable match to the STCP for the "central" release.
7. No containment failure; $FCONV = 10^{-6}$, except for noble gases and organic iodine, for which $FCONV = 0.005$. The intent is to preclude release of material except for a limited amount of noble gases and organic iodine. The value of 0.005 represents a leakage rate of 0.1 % per day for five days.
8. Interfacing systems LOCA; the median of the distribution is the value calculated for I and Cs. The distribution is calculated from the distribution for Case 3, with the transformation $y=x/(1-x)$ and the inverse $x=y/(1+y)$. This distribution is then applied to all nuclide groups.

A large in-vessel steam explosion which fails the upper vessel head and then fails containment by a missile (also known as α -mode failure) is always considered to be a rupture and is treated as Case 3. However, if the α -mode failure occurs during an interfacing systems LOCA, little additional RCS release is expected because most of the fission products will be retained in the piping or will be in the auxiliary building, and very little will be expelled from the RCS. Therefore, the α -mode failure is ignored in the interfacing systems LOCA.

If an α -mode failure occurs coincidentally with an SGTR, both components of the release are considered.

$FCONV$ for noble gases is always 1.0 except for design basis leakage, in which case noble gas release is calculated at 0.1 % per day for a period of five days (0.005).

2.2.5 Spray Decontamination of RCS Releases (DFSPV)

In high pressure scenarios in which the containment fails at vessel breach, the sprays have only a limited effect. Material released prior to vessel breach is assumed to be fully decontaminated. However, the puff of material released at vessel breach is assumed to be unaffected by the sprays. Calculations with the STCP indicate that the average release in the puff is 36 % of the total release from the RCS. The decontamination factor for high pressure scenarios with failure of containment at nearly the same time as failure of the reactor vessel is:

$$DFSPV = 3.78/(1 + 2.78/DF'), \quad (2.7)$$

where DF' is the decontamination factor which would be applied if the containment did not fail, that is, the value of the decontamination factor selected by the Latin Hypercube Sampling. This "puff" decontamination factor is between 2.0 and 4.0 for all reasonable values of the long term decontamination factor.

For high pressure scenarios in which the containment does not fail at vessel breach, and for low and intermediate pressure scenarios, the RCS sprays decontamination factor, $DFSPV$, is set equal to the long term DF' . An internal panel determined that the range and distribution used in the draft version of NUREG/CR-4551 was adequate. The prior distribution adequately covered the range of decontamination factors and the distribution was believed to be adequate. Furthermore, it has been found that although the risk is sensitive to whether the sprays operate, the sensitivity to the precise value of $DFSPV$ is not

high. However, more recent STCP calculations using a 400 μm drop diameter indicated a spray DF that was from 40 to 130 times greater than the DF using a 1000 μm spray drop size. The 5th percentile of the distribution was increased by a factor of 72 (the geometric mean of 40 and 130, the distribution was fixed at the 95th percentile from draft NUREG/CR-4551, and other percentiles were adjusted between these points. Logarithmic interpolation was used for other percentiles, but the DF was never allowed to exceed 10^4 .

2.2.6 Overall Decontamination Factor for RCS Releases (DFE)

For the scrubbed interfacing system LOCA, DFE is set equal to the scrubbing DF (VDF) which is logarithmically interpolated from levels selected by an internal expert review panel. The panel determined that the range and distribution used for the draft version of NUREG/CR-4551 was appropriate. For the unscrubbed interfacing system LOCA, DFE is set to 1.0. Decontamination in the auxiliary building is assumed to be included in FCONV.

For other sequences, DFE is set to the spray DF if the sprays operate for an appreciable period prior to containment failure, or to 1.0 if the sprays do not operate.

2.2.7 Fraction of Core Participating in CCI (FPART)

Fractions of core participating in core-concrete interaction are passed to SURSOR by the APET. The fractions are: none, small (nominally 15%), moderate (nominally 50%), and large (nominally 100%). Note that FPART is the fraction of core leaving the vessel that does not participate in high-pressure melt ejection but does participate in core-concrete interactions (CCI). If a fraction of the core participates in HPME, the fraction actually involved in CCI would be less than FPART. If FPARTL is the fraction of core involved in CCI, as passed by the APET in the accident progression bin, then the fraction used in the calculation is $\text{FPART} = \text{FPARTL} * (1 - \text{FPME} - \text{FREM})$.

At the present time, the only mechanisms suggested for scattering core debris are HPME or an ex-vessel steam explosion. If HPME occurs, the consensus of the containment loads experts is that water in the cavity would be swept away and none would be available for a later ex-vessel steam explosion. The current model using both FPME and FPART has been retained for flexibility should another scattering mechanism be postulated.

2.2.8 Releases from CCI (FCCI)

Releases due to core-concrete interaction were selected by the source term expert panel. Interpolation for this effect is logarithmic and all nuclide groups are correlated.

There are four cases:

- Case 1: Low Zr oxidation (high Zr remaining), no water.
- Case 2: High Zr oxidation (low Zr remaining), no water.
- Case 3: Low Zr oxidation, water present.
- Case 4: High Zr oxidation, water present.

2.2.9 Spray Decontamination of CCI Releases (DFSPC)

Distinct decontamination factors are allowed for late (core-concrete interaction) releases. DFSPC is the decontamination factor for late sprays, which is applied if sprays operate through the period of core-concrete interaction.

DFSPC is logarithmically interpolated between levels selected by the internal expert review panel. The panel concluded that the range and distribution used for the draft version of NUREG/CR-4551 were adequate; therefore, new values were not elicited. The lower fractile end of the distribution was widened as described for spray decontamination of RCS releases.

2.2.10 Decontamination of CCI Releases by Pool Scrubbing (VPS)

If the reactor cavity is water-filled and the debris non-coolable, core-concrete interactions will take place under water. The value of the decontamination factor for pool scrubbing was calculated by comparing material released from the core in CCI to material released to the containment. A value of VPS of 4.6 was calculated for aerosols if only the accumulator water is present. If the cavity is filled up to the level of the reactor vessel, the DF is 25.7 for aerosols. Other estimates have shown that DFs applicable to Te and Ru are approximately half the value for aerosols. These values are used as the medians of distributions calculated from the distribution for scrubbing in the interfacing systems LOCA from draft NUREG/CR-4551, using the transformation $y=x/(1-x)$ and the inverse $x=y/(1+y)$. If the pool is later evaporated, the more volatile fission products could be released again.

2.2.11 Release of CCI Material from Containment (FCONC)

The cases for which distributions were provided by the expert panel are similar to those for FCONV:

Case 1: Leak occurring before the start of CCI, dry containment,

Case 2: Leak occurring before the start of CCI, water present,

Case 3: Rupture occurring before the start of CCI, and

Case 4: Rupture occurring soon after the end of CCI.

Separate values are used for each nuclide group and all nuclides are considered to be correlated.

As for FCONV, special values are used for cases not considered by the expert panel. The special values used are for:

1. Catastrophic rupture before the start of CCI; a median value equal to the 95-th percentile for Case 3 is used. The distribution is calculated from the distribution for Case 3, with the transformation $y=x/(1-x)$ and the inverse transformation $x=y/(1+y)$. The intent is to simulate only minimal holdup in the containment.
2. Leak after CCI, without spray operation; a median value of 0.01 is used for FCONC, except for Te and Ru, for which Case 1 is used unchanged. The distribution is made proportional to the distribution for Case 1. If the sprays operate after CCI starts and prior to the leak, a median value of 0.005 is used and the decontamination factor for sprays is also applied. The distribution with spray operation is made proportional to that for Case 2. The intent is to remove more of the CCI release for leaks than for ruptures because both the sprays and natural mechanisms have longer to operate on the airborne material.
3. Very late containment failure, whether rupture or leak or basemat melt-through; the median is set equal to 10^{-4} for all nuclides except noble gases, and the distribution is made proportional to the distribution for Case 1. The intent is to remove essentially all the CCI release before failure occurs. However, allowing a complete escape of noble gases is too conservative for basemat melt-through. The timing of release in a basemat melt-through would be very much delayed relative to a leak or rupture due to very late pressurization. The source term is very small and is not important to risk.
4. No containment failure; $FCONC = 10^{-6}$, except for noble gases and organic iodine for which $FCONV = 0.005$. The intent is to preclude release of material except noble gases and organic iodine.
5. Interfacing systems LOCA; the median of the distribution is the value calculated for I and Cs. The distribution is calculated from the distribution for Case 3, with the transformation $y=x/(1-x)$ and the inverse $x=y/(1+y)$. However, if another opening in containment occurs, for example, due to α -mode failure, FCONC for Case 2 or 3 is used, rather than for interfacing systems LOCA. In this case, most of the CCI release is expected to go through the hole in the containment.

The effect of failure before core melt is the same as failure at core melt for CCI. If CCI is long delayed, even a late containment failure will have the same effect on CCI as an early failure.

2.2.12 Combined Late Decontamination Factor (DFL)

The combined late decontamination factor should be the maximum of spray DF or pool scrubbing DF. By an oversight, the value of DFL never exceeds the value which the spray DF would have if sprays were operating. Therefore, when sprays are operating, pool scrubbing is effectively never applied. The total DF when both pool and sprays are available should be greater than that for sprays alone. Although this has introduced some conservatism, the low importance of the pool scrubbing DF makes it unlikely that the conservatism is important for risk.

2.2.13 Late Revolatilization (FLATE)

The parameter FLATE represents the revolatilization of radionuclides from the RCS at late times. The parameter is chosen by linear interpolation between levels suggested by the expert review group. There are two cases for this parameter, depending on whether there are one or two large openings in the RCS after vessel breach. $FLATE_i$ is multiplied by $FCOR_i \cdot (1 - FVES_i) + FREM_i \cdot (1 - FCOR_i)$ to calculate the material released to containment. The value of FCONC for tellurium, as modified by spray decontamination factors (but not by pool scrubbing), is used to estimate the amount escaping containment. The intent is to simulate the escape of material released over a long period, which is typical of the release of tellurium during CCI.

2.2.14 Miscellaneous Late Sources of Iodine (XLATE)

The parameter XLATE represents all late sources of iodine other than that from CCI or revolatilization from the RCS. Organic iodine is a principal component of this late iodine release. All the late iodine is treated as if it were organic so no decontamination factors or holdup in containment is applied.

The internal review panel considered two choices for distributions for this parameter; the distribution elicited for late iodine revolatilization from the suppression pool at Grand Gulf or the distribution elicited from the expert panel for the draft version of NUREG/CR-4551. The expert panel determined that the latter was the more appropriate for this case. Linear interpolation is used for this parameter.

The "late" iodine is assumed to be:

$$ADDI2 = XLATE \cdot (RELIV - RELIC), \quad (2.8)$$

where ADDI2 is the total late iodine term and RELIV is iodine previously released to the containment:

$$RELIV = FCOR_2 \cdot FVES_2 + FPART \cdot (1 - FCOR_2) \cdot FCCI_2 + \text{iodine released in direct heating, but not including the iodine released in revolatilization because revolatilization is also assumed to occur late.}$$

RELIC is the iodine already released from containment. If the iodine already released exceeds 50% of the initial inventory, ADDI2 is reduced linearly until at 100% release, $ADDI2 = 0$. For design leakage only, ADDI2 is multiplied by the same factor as the noble gases (0.005).

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2.2.15 Fraction of Core Involved in HPME (FPME)

This fraction is passed from the APET. Four discrete values are passed, corresponding to no HPME and the 25th, 50th, and 75th percentiles of the in-vessel panel's distributions for HPME. The value passed from the APET in the accident progression bin is multiplied by (1-FREM). The fraction FPME is not available for CCI.

2.2.16 Direct Heating Release (FDCH)

Two cases were considered for the direct heating release corresponding to high and intermediate RCS pressure at the time of vessel breach. The value used is determined by logarithmic interpolation between the values suggested by the expert review group. The direct heating release is only allowed to go to the environment if the containment fails at or before vessel breach. Sprays are assumed to have no effect on the release if the failure is a rupture, because the high pressure in containment is expected to cause a rapid puff of material which would be ejected before the sprays had any effect. No DCH release is allowed if the containment failure is a leak and the sprays continue to operate following vessel breach, because the sprays would have removed most of the DCH component during the relatively long release time. The same value of FCONV is used as for the RCS release, although the atmosphere would probably be moist for the RCS release and superheated at the time of the DCH release. The use of the regular value for FCONV may overestimate retention in the containment, and therefore underestimate the release.

2.3 Parameters with Fixed Values

A few parameters have fixed values depending on the accident progression bins. These parameters are discussed in the following paragraphs.

2.3.1 Fraction of Core Remaining in RCS (FREM)

Although a distribution was not elicited for this quantity, there was general agreement among the expert panel that the fraction was small. This parameter has been arbitrarily set to 5% to represent a small, probably unimportant fraction. Material remaining in vessel is not available for CCI but is available for revolatilization.

2.3.2 Timing and Characteristics of Release

The calculated results include the warning time (TW), the time and duration of the early component of release (T1 and DT1), the time and duration of the late component (T2 and DT2), the elevation of the release (ELEV), the rate of energy release in the early component (E1), and the rate of energy release in the late component (E2). The values have been taken from STCP runs, when available, or have been estimated when no calculations were available. The times given by the STCP have been extensively modified by information from MAAP, MELPROG, and subsequent calculations.

The timing information is used in a later code to determine whether the release starts before, during, or after evacuation. This information can be important if the release is large enough to cause early fatalities, but is not a major determinant of consequences otherwise. Because of the lesser importance of the timing information, uncertainty ranges were not specified even though this information is highly uncertain. If distributions were desired for the timing information, they could be determined by eliciting an expert panel in the same way that distributions for other parameters were determined.

The warning time (TW) is the time at which plant personnel have a clear indication that a core melt is in progress or is almost certain to start. For most sequences this is the time of core collapse, because at that time radiation monitors in containment would indicate a sudden, very high increase in containment radiation. The time of core uncover is used for the interfacing systems LOCA because there is clear indication of a severe accident earlier in the progression. If there is a steam generator tube rupture, STCP calculations have shown that the release to the environment begins before core collapse; therefore the warning time and beginning of the release are taken to be coincidental.

The time of core uncover is estimated to be 20 minutes after scram for the interfacing systems LOCA and 5 hours after scram for other sequences. The latter figure is an average over many sequences; large break LOCAs have core uncover considerably earlier, and transients in which the operators depressurize the primary or secondary could be longer. Core collapse is estimated to be 72 minutes after core uncover for these sequences.

The time of the early release (T1) is estimated to be 40 minutes after TW for the interfacing systems LOCA and 102 minutes after TW for containment failure before core melt. STCP calculations have shown releases beginning at 9000 seconds for a steam generator tube rupture. For other sequences, in which containment fails at vessel breach, T1 is estimated to be 72 minutes after TW. If the containment does not fail at or before vessel breach, there is no early release; however, if a steam generator tube rupture occurs, the release from the steam generators is assumed to be "early" even if no containment failure occurs.

The duration of the early release (DT1) varies with the size of containment opening. The "nominal" sizes of containment failure openings are actually a surrogate for a wide range of sizes. For example, 7 ft², which is the nominal size of a rupture, is used to represent holes ranging from 1 ft² to perhaps 10 ft². There is a wide range of possible pressures inside containment, which will also influence the duration of the release. The durations are considered to be reasonable for the range of hole sizes covered, but do not exactly correspond to every combination of internal pressure and hole size. DT1 is estimated to be 10 seconds for catastrophic rupture, 200 seconds for an ordinary rupture, and 3 hours for a leak. The total energy is estimated to be 5.6×10^9 joules so that the average energy rate is $5.6 \times 10^9 / DT1$ watts. For the interfacing systems LOCA the release takes place during the time that the core is melting and the energy rate is estimated to be 3.7×10^6 watts. The duration of the release for a steam generator tube rupture is estimated to be 900 seconds based on STCP calculations.

If CCI occurs promptly and the containment has failed early, T2 is estimated to be 3 hours after the core is uncovered or about 1.9 hours after the initial release. Some of the nuclides (iodine and cesium) are released very soon after the start of CCI, whereas tellurium and ruthenium may emerge very slowly. A duration of 6 hours is taken as a reasonable average over all nuclide groups for DT2. There is an additional 83 minute delay for T2 if the CCI is "short delayed" and an additional 4.75 hours if the CCI is "long delayed". The same value of DT2 is used as for prompt and delayed CCI. For late containment failure (after CCI) T2 is 8 hours after the core uncovers. Very late containment failure is estimated to occur at 24 hours.

If the containment fails prior to CCI, the energy rate (E2) is quite low because the release occurs over such a long period of time. A nominal rate of 1.6×10^6 watts is used. The rate would probably be considerably higher at the start of CCI and considerably lower near the end. If the containment fails after CCI the total energy is 7×10^9 joules and the durations are the same as for failure at vessel breach.

If the failure is very late, T2 is assumed to be 24 hours after vessel breach, the duration is one day, and the energy rate is negligible.

The elevation of release is estimated as 0.0 meters for the interfacing systems LOCA and no containment failure, and 10 meters for all others.

2.4 Accident Progression Bin

Table 2.1 shows the accident progression bin definition for SURSOR. For Surry, eleven attributes are used to describe the accident progression bin characteristics used for the source term estimation. Please refer to NUREG/CR-4551, Vol.3 (Surry), for discussion of accident progression bin and accident progression event tree [Bre90].

Table 2.1

**SORSOR Accident Progression Bin
Attribute Definition and Corresponding Possible Values**

	<u>Attribute Element</u>	<u>Possible Value</u>
1	Containment Failure Time	<p>A V-Dry; event V and break location not submerged</p> <p>B V-Wet; event V and break location submerged</p> <p>C Early-CF; containment failure before vessel breach</p> <p>D CF-at-VB; containment failure at vessel breach</p> <p>E VLate-CF; late or very late containment failure (during CCI, nominally several hours after VB)</p> <p>F Final-CF; containment failure in the final period (nominally about 24 hours after VB)</p> <p>G No-CF; no containment failure</p>
2	Containment Sprays	<p>A Sp-Early; sprays operate only in the early period</p> <p>B Sp-E+I; sprays operate only in the early and intermediate periods</p> <p>C Sp-E+I+L; sprays operate only in the early, intermediate, and late periods</p> <p>D Sp-Always; sprays always operate during the periods of interest for fission product removal</p> <p>E Sp-Late; sprays operate only in the late period</p> <p>F Sp-L+VL; sprays operate only in the late and very late periods</p> <p>G Sp-VL; sprays operate only in the very late period</p> <p>H Sp-NonOp; sprays never operate during the accident, or operate only during the final period, which is not of interest for fission product removal</p>

3	Core-Concrete Interaction	A Prmpt-Dry; CCI takes place promptly following vessel breach. There is no overlying water pool to scrub the releases. B Prmpt-Shlw; CCI takes place promptly following vessel breach. There is a shallow (about 4.5 feet) overlying water pool to scrub the releases. C No-CCI; CCI does not take place. D Prmpt-Deep; CCI takes place promptly following vessel breach. There is a deep (about 14 feet) overlying water pool to scrub the releases. E SDlyd-Dry; CCI takes place after a short delay. The debris bed is coolable, but the water in the cavity is not replenished. The delay is the time needed to boil off the accumulator water. F LDlyd-Dry; CCI takes place after a long delay. The debris bed is coolable, but the water in the cavity is not replenished. The delay is the time needed to boil off the water in a full cavity.
4	RCS Pressure before VB	A SSPr; system setpoint pressure (2500 psia) B HiPr; high pressure (1000 to 2000 psia) C ImPr; intermediate pressure (200 to 1000 psia) D LoPr; low pressure (less than 200 psia)
5	Mode of Vessel Breach	A VB-HPME; high pressure melt ejection occurs - direct heating always occurs to some extent. B VB-Pour; the molten core pours out of the vessel, driven primarily by the effects of gravity. C VB-BtmHd; gross failure of a large portion of the bottom head of the vessel occurs, perhaps as a result of a circumferential failure. D Alpha; alpha mode failure occurs resulting in containment failure as well as vessel failure. E Rocket; A rocket mode failure occurs resulting in containment failure as well as vessel failure. F No-VB; no vessel breach occurs.

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6	Steam Generator Tube Rupture	A SGTR; a steam generator tube rupture occurs. The SRVs on the secondary system are not stuck open. B SGTR-SRVO; a steam generator tube rupture occurs. The SRVs on the secondary system are stuck open. C No-SGTR; a steam generator tube rupture does not occur.
7	Amount of Core not in HPME available for CCI	A Lrg-CCI; a core-concrete interaction occurs and involves a large amount of the core (70-100%). B Med-CCI; a core-concrete interaction occurs and involves a medium amount of the core (30-70%). C Sml-CCI; a core-concrete interaction occurs and involves a small amount of the core (0-30%). D No-CCI; no core-concrete interaction occurs.
8	Zr Oxidation	A Lo-ZrOx; a low amount of the core zirconium was oxidized in the vessel prior to vessel breach. This implies a range from 0 to 40% oxidized, with a nominal value of 25%. B Hi-ZrOx; a high amount of the core zirconium was oxidized in the vessel prior to vessel breach. This implies that more than 40% of the Zr was oxidized, with a nominal value of 65%.
9	High Pressure Melt Ejection (HPME)	A Hi-HPME; a high fraction (>40%) of the core was ejected under pressure from the vessel at failure. B Md-HPME; a moderate fraction (20-40%) of the core was ejected under pressure from the vessel at failure. C Lo-HPME; a low fraction of the core (<20%) was ejected under pressure from the vessel at failure. D No-HPME; no HPME at vessel failure.

10	Containment Failure Size	A Cat-Rupt; containment failed by catastrophic rupture, resulting in a very large hole and gross structural failure. B Rupture; containment failed by the development of a large hole or rupture; nominal hole size is 7 ft². C Leak; containment failed by the development of a leak (nominal size 0.1 ft²) or basemat melt-through (BMT). D No-CF; containment did not fail. Containment may have been bypassed.
11	Holes in the RCS	A 1-Hole; there is only One large Hole in the RCS following vessel breach, so there is no effective natural circulation through the RCS after breach. B 2-Holes; there are two large holes in the RCS following vessel breach, so there will be effective natural circulation through the RCS after breach.

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2.5 Input Data Structure

The data base of SURSOR which contains all the parameter values and uncertainty distributions is shown in Appendix A.2. The other input data files are shown in Appendix A.3. The format of each input data block is described as follows.

2.5.1 I/O Control Data

The controlling data for SURSOR is always assigned to file unit 5. The control data sets the unit numbers for input and output, the size of the sample, and tells which issues apply to the source term calculations. The control data are:

Record 1: NAMRUN (A Format). Identification of the run.

Record 2: IPRINT, IBINNR, ISAMPL, IWROUT, IRELOUT, ISTDAT

(Free Format, all integers)

IPRINT=Unit number for diagnostic output.

IBINNR=Unit number for accident progression bins.

ISAMPL=Unit number for LHS sample.

IWROUT=Unit number for effect weight outputs.

IRELOUT=Unit number for release outputs.

ISTDAT=Unit number for parameter input.

Record 3: NISST, NISS, NSAM (Free Format, all integers)

NISST=Total number of issues

NISS=Number of source term issues (10 for Surry)

NSAM=Sample size.

Record 4: (ISST(K),K=1,NISS) (Free format, all integers)

ISST(K) is a pointer from the sample to a source term issue. ISST(K) is the location of an issue in the LHS sample. K refers to a source term parameter, as follows:

follows:

K=1, FCOR

K=2, FVES

K=3, VDF

K=4, FCONV

K=5, FCCI

K=6, FCONC,

K=7, Spray DFs

K=8, XLATE

K=9, FLATE

K=10, FDCH.

K=11, FISG and FOSG (SGTRs)

K=12, Pool scrubbing of CCI

Record 5: DIAG (Format L1)

If DIAG=.TRUE., a complete set of diagnostics will be written on unit IPRINT.

This ends the input file unit 5.

2.5.2 Accident Progression Bin Data

The accident progression bins are found on unit IBINNR. Each accident progression bin identifier is an 11-letter word, where each letter provides a single bin attribute. The meanings of the attributes and the values assigned to each letter are explained in Table 2.1.

Record 1: NAMBIN Format(2X,A)

Identification of the accident progression bins.

Record 2: NDIM,NBIN (Free format)

NDIM is the number of bin attributes (11 for Surry).

NBIN is the number of bins to follow.

Records 3 to NBIN+2: Format (2X,A)

(BINJ(J),J=1,NBIN)

BINJ is the 11-letter designator for the accident progression bin. Each bin is on a separate record.

This ends the binning input data.

2.5.3 LHS Sample Data

The LHS sample is given on unit ISAMPL. The input is free format. Each record (or set of records, if a sample member will not fit on a single record) is:

IOBS,NRLHS,(XNDX(J), J=1,NISST) (Free format).

IOBS is the observation number,

NRLHS is the number of pieces of LHS data, and

XNDX(J) is the value selected for issue "J" for the

particular sample member. For all the source term issues,

XNDX(J) is a real number between 0.0 and 1.0.

2.5.4 Source Term Parameter Data

The distribution for each parameter is given by a set of 10 values. The first 9 are the 0th, 1st, 5th, 25th, 50th, 75th, 95th, 99th, and 100th percentiles of the distribution. These percentiles were chosen because they are approximately equally spaced in a normal distribution, and their logarithms are approximately equally spaced in a lognormal distribution. The 10th number is the "central" value (for example, the value of the parameter that approximates the STCP). The "central" value is chosen by giving a negative number for XNDX(J). The data are arranged in blocks, in which each block defines a parameter with all its cases. If distinct values for each nuclide group are required, the values for all nine groups can be placed in a single record. All data are free format and spaces may be used between blocks for ease of review.

Block 1 (FCOR)

((FCORL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Each record gives the values of FCOR for nine nuclide groups, for level L, case IC. There are 10 levels (as above) and two cases. Case 1 is low Zr oxidation (high Zr remaining). Case 2 is high Zr oxidation. If all nine nuclide groups are placed in a single record, there are 20 records in block 1.

Block 2 (FVES)

((FVHH(L,ISP),ISP=1,NSP),L=1,10)

((FVHP(L,ISP),ISP=1,NSP),L=1,10)

((FVIP(L,ISP),ISP=1,NSP),L=1,10)

((FVLP(L,ISP),ISP=1,NSP),L=1,10)

((FVV(L,ISP),ISP=1,NSP),L=1,10)

((FVSG(L,ISP),ISP=1,NSP),L=1,10)

FVHH is the distribution for FVES for RCS pressure at the system setpoint. FVHP is the distribution for FVES for high pressure at vessel breach, FVIP for intermediate pressure, FVLP for low pressure, FVV for the interfacing systems LOCA,

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and FVSG for steam generator tube rupture (SGTR). FVHP and FVIP were combined by the expert panel. The same distributions are used for both, although the "central" values differ.

Block 3 (FISG and FOSG)

((FISG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
((FOSG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

FISG(ISP) is the fraction of nuclide group (ISP) entering the steam generator in an SGTR. FOSG(ISP) is the fraction of nuclide group (ISP) leaving the steam generator that is released to the atmosphere. Case 1 is for Steam Safety Relief Valves (SRVs) which close when the secondary pressure is reduced to the SRV setpoint. Case 2 is for SRVs which stick and remain open throughout the accident sequence.

Block 4 (VDF)

(VDF(L),L=1,10)

VDF is the decontamination factor to be applied to material released in the interfacing systems LOCA when the break is under water.

Block 5 (FCONV)

((FCONVI(L,ICASE),L=1,10),ICASE=1,5)

Block 5 contains values of FCONV for level L, case ICASE. There are four cases. Case 1 is early leak (dry), case 2 is early leak (wet), case 3 is early rupture, case 4 is late rupture, and case 5 is the interfacing systems LOCA. The same value of FCONV is used for all nuclide groups except noble gases.

Block 6: (FCONC)

((FCONCI(L,ISP,ICASE),ISP=1,NSP),L=1,10),ICASE=1,5)

The cases are the same as for FCONV. However, there is a distinct value of FCONC for each nuclide group.

Block 7 (FCCI)

((CCI(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,4)

This block contains values of FCCI for nuclide group ISP, level L, case IC. There are four cases: low Zr oxidation without water, high Zr oxidation without water, low Zr oxidation with water present, and high Zr oxidation with water present.

Block 8 (Spray DF)

(DFSPR1(L),L=1,10)
(DFSPR2(L),L=1,10)
(DFSPRC(L),L=1,10)

DFSPR1(L) is the value of spray DF at level L to be applied to the RCS release for high pressure sequences with containment failure at vessel breach. DFSPR2 is the DF to be applied to the RCS release for all other sequences. DFSPRC is the DF to be applied to the CCI release for all sequences.

Block 9 (Miscellaneous late sources of iodine):

(LATEIL(L),L=1,10)

Values of XLATE for level L.

Block 10 (Late revolatilization):

((FLATE(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Values of FLATE for nuclide group ISP, level L, case IC. There are two cases, corresponding to one large opening in the RCS after vessel breach and two large openings.

Block 11 (FDCH)

((FDCHL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Levels of FDCH for nuclide group ISP, level L, case IC. Case 1 is high pressure, case 2 is intermediate pressure in the RCS at vessel breach.

Block 12 (DF for pool scrubbing)

((VPSL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Values of the DF for pool scrubbing of CCI releases to be applied to nuclide group ISP, case IC. There are two cases: case 1 is deep scrubbed (full cavity), case 2 is shallow scrubbed (accumulator water only).

Block 13 (fractions of core in HPME):

(FPMEL(L),L=1,3)

The APET indicates only whether the fraction of core in HPME is low, moderate, high, or none. The actual fractions of core are given by FPMEL. FPMEL(1) is the fraction of core to be used for "high" FPME, FPMEL(2) for "moderate", and FPMEL(3) for "low". FPMEL(4) is internally set to 0.0.

This ends the parameter distribution data. The current parameter distribution data for SURSOR is given in Appendix A.2.

2.6 Sample Problem

Ten accident progression bins are used in the sample problem. A brief description of the characteristics of each accident progression bin is shown in Table 2.2.

Table 2.2

Accident Progression Bins for the Sample Problem

Description and Major Characteristics		
1	AHADBCAADDA	Interfacing systems LOCA, not scrubbed, no other CF.
2	BHADBCAADDA	Interfacing systems LOCA, scrubbed, no other CF.
3	DHADDCCBBDBB	Early CF, α -mode.
4	DDCAACDAABA	Early rupture, DCH.
5	EHADBCAADBB	Late rupture.
6	FDDDBCAADCB	Very late leak.
7	FHADBBAADCA	SGTR, SRV sticks open, late containment leakage.
8	FDDDBAABDCB	SGTR, SRV recloses, late containment leakage.
9	GHACABABDDA	SGTR, SRV sticks open, no other CF.
10	GDCDFADBDDA	SGTR, SRV recloses, no other CF.

SURSOR was run with these ten bins, using a LHS sample which has two observations. Note that no frequencies are attached to the APBs.

The results of these accident progressions are shown in the Appendix A.5.

3 SEQSOR

3.0 SEQSOR Code

The SEQSOR code is very similar to the SURSOR code. However, changes have been made to allow for plant specific conditions. A decontamination factor has been included for the ice condenser, as well as the possibility of a containment failure in the lower compartment that bypasses the ice condenser.

The distributions for the data files are different for many of the parameters. The bin definitions are also more extensive, to allow for dimensions describing the condition of the ice condenser.

A listing of the SEQSOR code is given in Appendix B.1.

3.1 SEQSOR Parametric Equation

The parametric equation for SEQSOR is similar to SURSOR. See Section 2.1.

3.2 Uncertainty Distribution of Parameters

The uncertainty distributions for SEQSOR are discussed in the following paragraphs.

3.2.1 In-Vessel Release from the Fuel (FCOR)

The format, cases, and distributions are identical to those used in SURSOR.

3.2.2 Radioactive Material Released from the RCS (FVES)

The format, cases, and distributions are identical to those used in SURSOR.

3.2.3 Radioactive Material Entering the Steam Generators (FISG)

The values and format are identical to those used in SURSOR.

3.2.4 Radioactive Material Emitted From the Steam Generators (FOSG)

The values and format are identical to those used in SURSOR.

3.2.5 Release of RCS Material from Containment (FCONV)

Values of FCONV were chosen by the source term expert review panel for the following cases:

Case 1: Leak (0.1 ft²) at vessel breach, with dry containment.

Case 2: Leak at vessel breach, with water in containment.

Case 3: Rupture (7.0 ft²) or large leak (1.0 ft²) in upper compartment at or before vessel breach.

Case 4: Rupture (7.0 ft²) or large leak (1.0 ft²) in lower compartment at or before vessel breach.

Case 5: Rupture (7.0 ft²) or large leak (1.0 ft²) after core-concrete interaction without spray operation.

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Special values of FCONV are used for other containment failure scenarios. The values were chosen to make the output match the predictions of the STCP for scenarios for which a run was available, or to simulate a physical effect for other scenarios. The special values of FCONV are identical to those used in SURSOR.

3.2.6 Spray Decontamination of RCS Releases

The format, cases, and distributions are identical to those used in SURSOR.

3.2.7 Decontamination of the RCS release by the ice condenser (DFICV)

There are four cases for decontamination of the RCS release by the ice condenser:

- Case 1: Fans operating, no prior containment failure.
- Case 2: Fans operating, containment already failed.
- Case 3: Fans not operating (default case).
- Case 4: Direct Containment Heating (DCH) event.

The logic behind the case structure is that multiple passes through the ice condenser are possible if the fans are operating unless the containment is failed. If the fans are not operating, there would tend to be only a single pass through the ice condenser. A special case is used for a DCH event at vessel breach because conditions are very different from normal blowdown.

A bypass fraction is passed by the accident progression event tree for one of the following conditions: no bypass, partial bypass, or ice completely bypassed or melted. Decontamination by the ice condenser is:

$$ST(out) = ST(in) * ((1 - FBYPV) / DFICV + FBYPV)$$

where FBYPV is the effective bypass fraction for RCS release. For completely melted ice FBYPV = 1.0 except when fans are operating, in which case FBYPV = 0.8. The intent is to simulate the limited effectiveness of empty ice baskets which would be slightly more effective with multiple passes than with a single pass.

HECTR [Di86] calculations have shown that even extensive disturbances of ice geometry result in very little bypass if the containment is intact. However, if the containment is failed in the bypassed region, approximately 10% of the steam flow goes through the failed region. For partial bypass, FBYPV is set to zero when the ice condenser wall is intact, and to 0.10 if there is a rupture in the ice condenser wall. If there is a catastrophic rupture, the bypass fraction is set to 1.0.

3.2.8 Overall Decontamination Factor for RCS Releases (DFE)

For the scrubbed interfacing system LOCA, DFE is set equal to the scrubbing DF (VDF) which is logarithmically interpolated from levels selected by the expert review panel for draft NUREG-1150. For the unscrubbed interfacing system LOCA, DFE is set to 1.0; decontamination in the auxiliary building is assumed to be included in FCONV.

For other sequences, DFE is set to the product of the ice condenser DF and the spray DF.

3.2.9 Fraction of Core Participating in CCI (FPART)

The logic and values are identical to those used in SURSOR.

3.2.10 Releases from CCI, FCCI

The logic and cases are the same as those used in SURSOR but the distributions are different.

3.2.11 Spray Decontamination of CCI Releases

The logic and values are identical to those used in SURSOR.

3.2.12 Decontamination of CCI Releases by Pool Scrubbing (VPS)

The logic, cases, and values are identical to those used in SURSOR. Under some conditions the pool of water in the cavity at Sequoyah can be deeper than at Surry. The decontamination factors for pool scrubbing are quite large, so it is more important from a risk standpoint to know whether or not pool scrubbing occurs, rather than the precise value of the DF.

3.2.13 Decontamination of the CCI release by the ice condenser (DFICC)

There are three cases, which are the same as for DFICV. A separate bypass fraction for the CCI release (FBYPC) is defined in the APET.

3.2.14 Release of CCI Material from Containment (FCONC)

The cases for which distributions were provided by the expert panel are similar to those for FCONV:

Case 1: Leak occurring before the start of CCI with no water present.

Case 2: Leak occurring before the start of CCI with water present.

Case 3: Rupture or large leak in the upper compartment occurring before the start of CCI.

Case 4: Rupture or large leak in the lower compartment occurring before the start of CCI.

Case 5: Rupture occurring soon after the end of CCI.

Separate values are used for each nuclide group, and all nuclides are considered to be correlated.

The special values used for cases not considered by the expert panel are the same as those used for SURSOR.

3.2.15 Combined Late Decontamination Factor (DFL)

The combined late decontamination factor is the product of the maximum of spray DF or pool scrubbing DF and the ice condenser DF. The value of the part of DFL which represents sprays or pool scrubbing never exceeds the value which the spray DF would have if sprays were operating. Therefore, when sprays are operating, pool scrubbing is effectively never applied. The total DF when both pool and sprays are available should be greater than that for sprays alone. This is reflected through the use of larger values of spray DF for CCI release than for RCS release.

3.2.16 Late Revolatilization (FLATE)

The cases, logic, and distributions are identical to those used in SURSOR.

3.2.17 Miscellaneous Late Sources of Iodine (XLATE)

The logic and values are identical to those used in SURSOR.

3.2.18 Fraction of Core Involved in HPME (FPME)

The treatment of FPME is identical to that used in SURSOR.

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3.2.19 Direct Heating Release (FDCH)

The treatment is identical to that used in SURSOR and the same distributions are used.

3.3 Parameters with Fixed Values

The following parameters have fixed values in SEQSOR.

3.3.1 Fraction of Core Remaining in RCS (FREM)

This is identical to the value used in SURSOR.

3.3.2 Timing and Characteristics of Release

The treatment of timing and energy of release is the same as used in SURSOR.

The elevation of release is estimated as 0.0 meters for the interfacing systems LOCA, containment failure in the lower compartment, and no containment failure, and 10 meters for all others.

3.4 Accident Progression Bin

Table 3.1 shows the accident progression bin definition for SEQSOR. For Sequoyah, 14 attributes are used to describe the characteristics of each accident progression bin. Please refer to NUREG/CR-4551 Vol. 5 for discussion of the accident progression event tree and accident progression bin for Sequoyah [Gr90].

Table 3.1

**SEQSOR Accident Progression Bin
Attribute Definition and Corresponding Possible Values**

<u>Attribute Element</u>	<u>Possible Value</u>
1	Containment Failure Time
	A V-Dry; Event V, break location not submerged
	B V-Wet; Event V, break location submerged
	C CF-Early; Containment failure before vessel breach
	D CF-atVB; Containment failure at vessel breach
	E CF-Late; Late containment failure (during the initial part of CCI, nominally a few hours after VB)
	F CF-VLate; Very late containment failure (from 12 to 24 hours after VB)
	G NoCF; No containment failure

2	Containment Sprays	<p>A Sp-Early; The sprays operate only in the Early period.</p> <p>B Sp-E+I; The sprays operate only in the Early and Intermediate periods.</p> <p>C Sp-E+I+L; The sprays operate only in the Early, Intermediate, and Late periods.</p> <p>D SpAlways; The sprays Always operate during the periods of interest for fission product removal.</p> <p>E Sp-Late; The sprays operate only in the Late period.</p> <p>F Sp-L+VL; The sprays operate only in the Late and Very Late periods.</p> <p>G Sp-VL; The sprays operate only in the Very Late period.</p> <p>H Sp-NonOp; The sprays either never operate during the accident or operate only in the Final period (not of interest for fission product removal).</p>
3	Core-Concrete Interactions	<p>A Prmt-Dry; CCI takes place promptly following vessel breach. There is no overlying water pool to scrub the releases.</p> <p>B Prmt-Shl; CCI takes place promptly following vessel breach. There is a shallow (about 5 feet) overlying water pool to scrub the releases.</p> <p>C No-CCI; CCI does not take place.</p> <p>D Prmt-Dp; CCI takes place promptly following vessel breach. There is a deep (at least 15 feet) overlying water pool to scrub the releases.</p> <p>E SDly-Dry; CCI takes place after a short delay. The debris bed is coolable but the water in the cavity is not replenished. The delay is the time required to boil off the accumulator water.</p> <p>F LDly-Dry; CCI takes place after a long delay. The debris bed is coolable but the water in the cavity is not replenished. The delay is the time required to boil off the water in a full cavity.</p>
4	RCS Pressure before VB	<p>A SSPr; System Setpoint Pressure (2500 psia)</p>

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		B	HiPr; High Pressure (1000 to 2000 psia)
		C	ImPr; Intermediate Pressure (200 to 1000 psia)
		D	LoPr; Low Pressure (less than 200 psia)
5	Mode of Vessel Breach	A	VB-HPME; High Pressure Melt Ejection occurs, direct heating always occurs to some extent.
		B	VB-Pour; The molten core pours out of the vessel driven primarily by the effects of gravity.
		C	VB-BtmHd; Gross failure of a large portion of the bottom head of the vessel occurs.
		D	Alpha; An Alpha mode failure occurs, resulting in containment and vessel failure.
		E	Rocket; A Rocket mode failure occurs, resulting in containment and vessel failure.
		F	No-VB; No Vessel Breach occurs.
6	Steam Generator Tube Rupture	A	SGTR; A Steam Generator Tube Rupture occurs. The SRVs on the secondary system are not stuck open.
		B	SG-SRVO; A Steam Generator Tube Rupture occurs. The SRVs on the secondary system are stuck open.
		C	No-SGTR; A Steam Generator Tube Rupture does not occur.
7	Amount of Core Available for CCI	A	Hi-CCI; core-concrete interaction occurs and involves a large amount of the core (70-100%).
		B	Med-CCI; core-concrete interaction occurs and involves an Intermediate amount of the core (30-70%).
		C	Lo-CCI; core-concrete interaction occurs and involves a Small amount of the core (0-30%).
		D	No-CCI; No core-concrete interaction occurs.
8	Zr Oxidation	A	Lo-ZrOx; A low amount of the core zirconium was oxidized in the vessel prior to vessel breach. This implies a range from 0 to 40% oxidized, with a nominal value of 25%.

- 9 High Pressure Melt Ejection (HPME)
- B Hi-ZrOx; A high amount of the core zirconium was oxidized in the vessel prior to vessel breach. This implies that more than 40% of the Zr was oxidized, with a nominal value of 65%.
- 10 Containment Failure Size
- A Hi-HPME; A high fraction ($> 40\%$) of the core was ejected under pressure from the vessel at failure.
 - B Md-HPME; A moderate fraction (20- 40%) of the core was ejected under pressure from the vessel at failure.
 - C Lo-HPME; A low fraction ($< 20\%$) of the core was ejected under pressure from the vessel at failure.
 - D No-HPME; No HPME at vessel failure.
- 11 Holes in the RCS
- A Cat-Rpt; The containment failed by catastrophic rupture resulting in a very large hole and gross structural failure.
 - B Rupture; The containment failed by the development of a large hole or rupture; nominal hole size is 7 ft².
 - C Leak; The containment failed by the development of a small hole or a leak; nominal hole size is 0.1 ft², or the containment failed by basemat melt-through.
 - D No-CF; The containment either did not fail or was bypassed by event V or an SGTR.
- 12 Ice Condenser Function Before VB
- A E2-InBy; No bypass of the ice condenser (IC) before VB. The IC is intact and is credited with the full DF for the RCS releases.
 - B E2-IpBy; Partial bypass of the IC before VB. The effective bypass level is nominally 10%.

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i.e., the IC is credited with an effective DF that is 90% of the DF for E2- InByp.

- C E2-IByp; Total bypass of the IC or the ice is completely melted from the IC before VB. If the ice is melted and the fans are operating, the IC is still credited with an effective DF that is 20% of the DF for E2-InByp.

13 Ice Condenser Function During CCI

- A I2-InByp; No bypass of the ice condenser (IC) during the initial phase of CCI. The IC is intact and is credited with the full DF for the CCI releases.
- B I2-IpByp; Partial bypass of the IC during the initial phase of CCI. The effective bypass level is nominally 10%, i.e., the IC is credited with an effective DF that is 90% of the DF for I2-InByp.
- C I2-IByp; Total bypass of the IC or the ice is completely melted from the IC during the initial phase of CCI. If the ice is melted and the fans are operating, the IC is still credited with an effective DF that is 20% of the DF for I2-InByp.

14 Status of Air Return Fans

- A ARF-Erly; Air return fans (ARFs) operate only in the Early period (before and during the RCS releases).
- B ARF-E+L; ARFs operate in both the early and late periods (during RCS and CCI releases).
- C ARF-Late; ARFs operate only in the late period (during the CCI releases).
- D No-ARF; ARFs do not operate for the early or late periods.

3.5 Input Data Structure

The input data structure of SEQSOR is similar to that of SURSOR.

3.5.1 I/O Control Data

The controlling data for SEQSOR is always assigned to file unit 5. The control data sets the unit numbers for input and output, the size of the sample, and tells which issues apply to the source term calculations. The control data are:

Record 1: NAMRUN (A Format). Identification of the run.

Record 2: IPRINT, IBINNR, ISAMPL, IWROUT, IRELOUT, ISTDAT

(Free Format, all integers)

IPRINT=Unit number for diagnostic output.

IBINNR=Unit number for accident progression bins.

ISAMPL=Unit number for LHS sample.

IWROUT=Unit number for effect weight outputs.

IRELOUT=Unit number for release outputs.

ISTDAT=Unit number for parameter input.

Record 3: NISST, NISS, NSAM (Free Format, all integers)

NISST=Total number of issues

NISS=Number of source term issues (11 for Sequoyah)

NSAM=Sample size.

Record 4: (ISST(K),K=1,NISS) (Free format, all integers)

ISST(K) is a pointer from the sample to a source term issue. ISST(K) is the location of an issue in the LHS sample. K refers to a source term parameter, as follows:

K=1, FCOR

K=2, FVES

K=3, VDF

K=4, FCONV

K=5, FCCI

K=6, FCONC,

K=7, Spray DFs

K=8, XLATE

K=9, FLATE

K=10, FDCH

K=11, DFIC.

K=12, FISG and FOSG (SGTRs)

K=13, Pool Scrubbing of CCI

Record 5: DIAG (Format L1)

If DIAG=.TRUE., a complete set of diagnostics will be written on unit IPRINT.

This ends the control input on unit 5.

3.5.2 Accident Progression Bin Data

The accident progression bins are found on unit IBINNR. Each accident progression bin identifier is a 14-letter word where each letter provides a single bin attribute. The meanings of the attributes and the values assigned to each letter are explained in Table 3.1.

Record 1: NAMBIN Format(2X,A)

Identification of the accident progression bins.

Record 2: NDIM,NBIN (Free format)

NDIM is the number of bin "dimensions" (13 for SEQSOR)

NBIN is the number of bins to follow.

Records 3 to NBIN+2: Format (2X,A)

(BINJ(J),J=1,NBIN)

BINJ is the 13-letter designator for the accident progression bin. Each bin is on a separate record.

This ends the binning input data.

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3.5.3 LHS Sample Data

The LHS sample is given on unit ISAMPL. The input is free format. Each record (or set of records, if a sample member will not fit on a single line) is:

IOBS,NRLHS,(XNDX(J), J=1,NISST) (Free format).

IOBS is the observation number,
NRLHS is the number of pieces of LHS data, and
XNDX(J) is the value selected for issue "J" for the particular sample member. For all the source term issues, XNDX(J) is a real number between 0.0 and 1.0.

3.5.4 Source Term Parameter Data

The distribution for each parameter is given by a set of 10 values. The first 9 are the 0th, 1st, 5th, 25th, 50th, 75th, 95th, 99th, and 100th percentiles of the distribution. These percentiles were chosen because they are approximately equally spaced in a normal distribution, and their logarithms are approximately equally spaced in a lognormal distribution. The 10th number is the "central" value for approximating the STCP. The "central" value is chosen by giving a negative number for XNDX(J). The data are arranged in blocks, in which each block defines a parameter with all its cases. If distinct values for each nuclide group are required, the values for all nine groups can be placed on a single record. All data are free format and spaces may be used between blocks for ease of review.

Block 1 (FCOR)

((FCORL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Each record gives the values of FCOR for nine nuclide groups, for level L, case IC. There are 10 levels (as above), and two cases. Case 1 is low Zr oxidation (high Zr remaining). Case 2 is high Zr oxidation. If all nine nuclide groups are placed on a single record, there are 20 records in block 1.

Block 2 (FVES)

((FVHH(L,ISP),ISP=1,NSP),L=1,10)
((FVHP(L,ISP),ISP=1,NSP),L=1,10)
((FVIP(L,ISP),ISP=1,NSP),L=1,10)
((FVLP(L,ISP),ISP=1,NSP),L=1,10)
((FVV(L,ISP),ISP=1,NSP),L=1,10)
((FVSG(L,ISP),ISP=1,NSP),L=1,10)

FVHH is the distribution for FVES for RCS pressure at the system setpoint. FVHP is the distribution for FVES for high pressure at vessel breach, FVIP for intermediate pressure, FVLP for low pressure, FVV for the interfacing systems LOCA, and FVSG for steam generator tube rupture (SGTR). FVHP and FVIP were combined by the expert panel. The same distributions are used for both, although the "central" values differ.

Block 3 (FISG and FOSG)

((FISG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
((FOSG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

FISG(ISP) is the fraction of a nuclide group (ISP) entering the steam generator in an SGTR. FOSG(ISP) is the fraction of a nuclide group (ISP) leaving the steam generator, that is, released to the atmosphere. Case 1 is for Steam Safety relief

Valves (SRVs) which close when the secondary pressure is reduced to the SRV setpoint. Case 2 is for SRVs which stick and remain open throughout.

Block 4 (VDF)

(VDF(L),L=1,10)

VDF is the decontamination factor to be applied to material released in the interfacing systems LOCA when the break is under water.

Block 5 (FCONV)

((FCONVI(L,ICASE),L=1,10),ICASE=1,5)

Block 5 contains values of FCONV for level L, case ICASE. There are five cases. Case 1 is early leak (dry), case 2 is early leak (wet), case 3 is early rupture, case 4 is late rupture, and case 5 is the interfacing systems LOCA. The same value of FCONV is used for all nuclide groups except noble gases.

Block 6: (FCONC)

((FCONCI(L,ISP,ICASE),ISP=1,NSP),L=1,10),ICASE=1,5)

The cases are the same as for FCONV. However, there is a distinct value of FCONC for each nuclide group.

Block 7 (FCCI)

((CCI(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,4)

This block contains values of FCCI for nuclide group ISP, level L, case IC. There are four cases: low Zr oxidation without water, high Zr oxidation without water, low Zr oxidation with water present, and high Zr oxidation with water present.

Block 8 (Spray DF)

(DFSPR1(L),L=1,10)

(DFSPR2(L),L=1,10)

(DFSPRC(L),L=1,10)

DFSPR1(L) is the value of spray DF at level L to be applied to the RCS release for high pressure sequences with containment failure at vessel breach. DFSPR2 is the DF to be applied to the RCS release for all other sequences. DFSPRC is the DF to be applied to the CCI release for all sequences.

Block 9 (Miscellaneous late sources of iodine)

(LATEIL(L),L=1,10)

Values are for XLATE for level L.

Block 10 (Late revolatilization):

((FLATE(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Block 10 contains values of FLATE for nuclide group ISP, level L, case IC. There are two cases, corresponding to one large opening and two large openings in the RCS after vessel breach.

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Block 11 (FDCH)

((FDCHL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Block 11 contains levels of FDCH for nuclide group ISP, level L, case IC. Case 1 is high pressure and case 2 is intermediate pressure in the RCS at vessel breach.

Block 12 (DF for pool scrubbing)

((VPSL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)

Block 12 contains values of the DF for pool scrubbing of CCI releases to be applied to nuclide group ISP, case IC. There are two cases: case 1 is deep scrubbed (full cavity), and case 2 is shallow scrubbed (accumulator water only).

Block 13 (fractions of core in HPME)

(FPMEL(L),L=1,3)

The APET determines only whether the fraction of core in HPME is low, moderate, high, or none. The actual fractions of core are given by FPMEL. FPMEL(1) is the fraction of core to be used for "high" FPME, FPMEL(2) for "moderate", and FPMEL(3) for "low". FPMEL(4) is internally set to 0.0.

Block 14 (Ice condenser decontamination factor for RCS release)

((DFICVI(L,IC),L=1,10),IC=1,4)

This block contains values of the ice condenser decontamination factor to be applied to RCS releases for all nuclides except noble gases, for level L, case IC.

Block 15 (Ice condenser decontamination factor for CCI release)

((DFICCI(L,IC),L=1,10),IC=1,3)

This ends the parameter distribution data. A listing of the current parameter distribution data for SEQSOR is given in Appendix B.2.

3.6 Sample Problem

Appendix B.2 provides the base data which contains parameter values and the uncertainty distributions. Appendix B.3 provides the other input data files used for the sample problem: the accident progression bins, the LHS sample, and execution option control. Appendix B.4 provides the procedure file used for executing the sample problem.

Ten accident progression bins are used in the sample problem. A brief description of the characteristics of each accident progression bin is shown in Table 3.2.

Table 3.2

Accident Progression Bins for the SEQSOR Sample Problem

Bin	Description and Major Characteristics
1	AHADBCAADDAAAB Interfacing systems LOCA, not scrubbed, no other CF.
2	BHADBCABDCAAAA Interfacing systems LOCA, scrubbed, very late leak (basemat melt-through).
3	CEACACABBBAAAC CF before VB, failure mode is rupture.
4	DACBACDABAAAAB CF at VB, failure mode is catastrophic rupture.
5	DHADDCAADBAAAD Alpha-mode CF at VB, failure mode is rupture.
6	EEADBCAADAAAAC Late CF, failure mode is catastrophic rupture.
7	FHADBBABDCAAAB SGTR, SRV sticks open, very late leak (basemat melt-through)
8	FHDDBCAADBBAAB Very late CF, failure mode is rupture.
9	GDCDFADADDBAAA SGTR, SRV does not stick open, no other CF.
10	GGADBCAADDBAAD No containment failure, no bypass event.

SEQSOR was run with these ten bins using a LHS sample which has two observations. Note that no frequencies are attached to the accident progression bins. The source term results of the ten accident progression bins are shown in Appendix B.5. The output format of SEQSOR is identical to that of SURSOR (see Section 2.6).

4 PBSOR

4.0 PBSOR

The PBSOR code is applicable to most BWRs which have Mark I containment, although some modifications may be required. For example, the reactor building of Peach Bottom has blow-out panels which are assumed to open if the reactor building structure is intact after the containment failure. The release path to the environment in PBSOR is always assumed to be from the reactor building. This may not be applicable to the other BWRs. Also, the interfacing LOCA is not considered in PBSOR because its frequency for Peach Bottom is small as compared to the other accident sequences. For the other BWRs, the interfacing LOCA may be important.

The suppression pool of Peach Bottom provides major decontamination during the in-vessel release phase. After vessel breach, if there is sufficient water supply to the debris, some decontamination is provided by scrubbing the molten core-concrete release with the overlying water.

The listing of PBSOR is provided in Appendix C.1.

4.1 PBSOR Parametric Equation

The basic parametric equation for PBSOR and GGSOR have the following form:

$$\begin{aligned}
 ST_i = & FCOR * FVES_i * (RELF1 + RELF2) * FCONV_i / RBDF_i \\
 & + FCONC_i * VBPUF_i * RELF3 / RBDF_i \\
 & + (1.0 - FCOR_i - VBPUF_i) * FLV * FHPE * FDCH_i * RELF3 * FCONC_i / RBDF_i \\
 & + (1.0 - FCOR_i - VBPUF_i) * FLV * EVSE * FEVSE_i * RELF3 * FCONC_i / RBDF_i \\
 & + (1.0 - FCOR_i - VBPUF_i) * FLV * XCCI * FCCI_i * RELF4 * FCONC_i / RBDF_i \\
 & + FCOR_i * (1 - FVES_i) * FREVO_i * RELF3 * FCONC_i / RBDF_i \quad (i = 2, 3, \text{ or } 4 \text{ only}) \\
 & + [FLT11 * POOLI + FLT12 * CAVWI * RELF5] * RELF6. \quad (i = 2 \text{ only})
 \end{aligned}
 \tag{4.1}$$

where:

RELF1	= FPLBY/MAX(DFCPA _i , DFSPRV _i)	if ECF & WWF or not ECF
	= FPLBY/DFSPRV _i	if ECF & not WWF
RELF2	= (1-FPLBY)/DFVPA _i	if ECF & WWF
	= (1-FPLBY)/MAX(DFSPRV _i , DFVPA _i)	if ECF & not WWF or not ECF
RELF3	= 1/MAX(DFCPA _i , DFSPRC _i)	if EVF & WWF or Late CF
	= 1/DFSPRC _i	if ECF & DWF
RELF4	= 1/MAX(DFCAV _i , DFCPA _i , DFSPRC _i)	if WWF
	= 1/MAX(DFCAV _i , DFSPRC _i)	if not WWF

RELF5	= 1/DFCPA ₂	if WWF
	= 1	if not WWF
RELF6	= FCONC ₂	if no CF
	= 1	if CF
XCCI	= 1-FPHE	if FPHE > 0
	= 1-EVSE	if EVSE > 0
	= 1	ELSE

The first summation term on the right side of Equation 4.1 represents the in-vessel release. The second term describes the puff release at vessel breach. The third term represents the DCH release. The fourth term represents the ex-vessel steam explosion release and is mutually exclusive with the third term (i.e., the experts said if DCH occurred then EVSE should not be considered separately). The fifth term represents the CCI release. The fourth term is the revolatilization release from the reactor coolant system after vessel breach and is for I, Cs, and Te classes only. The last term represents the late iodine release from the suppression pool and reactor cavity/drywell water after the containment failure.

Most of the parameters in the above equation are defined similarly to those for SURSOR and SEQSOR. The definition of each parameter is as follows:

CAVWI	=	fraction of initial iodine core inventory scrubbed by the cavity water during CCI release.
DFSPRC _i	=	scrubbing decontamination factor for sprays acting on species i released into containment after vessel breach.
DFSPRV _i	=	scrubbing decontamination factor for sprays acting on species i released into containment from vessel.
DFCAV _i	=	scrubbing decontamination factor for aerosol species i released into cavity water during CCI release.
DFCPA _i	=	scrubbing decontamination factor for aerosol species i flowing from containment to the suppression pool.
DFVPA _i	=	scrubbing decontamination factor for aerosol species i flowing from the vessel to the suppression pool.
FCCI _i	=	fraction of material released from the melt during molten core-concrete interaction (CCI).
FCONC _i	=	fraction of species i released from containment for CCI and other releases after vessel breach, not including the effects of scrubbing by pools and sprays.
FCONV _i	=	fraction of species i released from containment for material released into containment before vessel breach, not including the effects of scrubbing by pools and sprays.
FCOR _i	=	fraction of initial inventory of species i released

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from the fuel prior to vessel failure.

FDCH _i	=	fraction of radionuclide in the portion of the core involved in direct containment heating that is released to the drywell at vessel breach.
FHPE	=	fraction of core material leaving the vessel that participates in either the direct containment heating or the steam explosion and therefore is not available for molten CCI release later.
FLV	=	fraction of the core material that leaves the vessel after vessel breach.
FPLBY	=	fraction of pool bypass before vessel breach as a result of either LOCA or stuck open SRV tail pipe vacuum breaker.
FREVO _i	=	fraction of the core material that is deposited on the surfaces of the reactor vessel and structural materials that is revaporized and released in the dry well after vessel breach.
FVES _i	=	fraction of material released from the fuel which is released from the vessel.
FLT11	=	fraction of iodine in the suppression pool that is volatilized and released later after vessel breach.
FLT12	=	fraction of iodine in the cavity water that is volatilized and released later after vessel breach.
EVSE	=	fraction of core participating in ex-vessel steam explosion.
POOLI	=	fraction of initial core inventory for iodine scrubbed by the pool.
RBDF _i	=	reactor building decontamination factor for species i.
ST _i	=	fraction of the initial core inventory of species i that is ultimately released to the environment.
VBPUF _i	=	fraction of initial core inventory of species i that is released to the drywell as a puff at the time of vessel breach.

4.2 Uncertainty Distributions of Parameters

As mentioned during the SURSOR and SEQSOR discussions, the values used for the source term estimation in PBSOR are determined using the random numbers generated by Latin Hypercube Sampling and the database of uncertainty distributions of source term parameters provided by the expert panels. Appendix C.2 shows the database used in PBSOR which includes

both the uncertainty distributions and fixed parameter values. The uncertainty distributions are taken from the summary results of the source expert panels. The detailed discussion of source term issues and their elicitation results from the source term panels are provided in Volume 2 of NUREG/CR-4551 [Ha92]. A brief summary of the expert panel elicitation results is discussed for each source term parameter in the following paragraphs.

4.2.1 In-Vessel Release from the Fuel (FCOR)

For Peach Bottom and Grand Gulf, the expert panel for FCOR made a distinction between two cases:

- Case 1: high Zr oxidation
- Case 2: low Zr oxidation

Some experts tend to believe that high Zr oxidation during the in-vessel release phase would increase the release of radionuclides. Experts also distinguish FCOR distributions for different nuclide groups.

4.2.2 Radioactive Material Released from the RCS (FVES)

The expert panel of FVES gave three cases for Peach Bottom and Grand Gulf:

- Case 1: high pressure fast station blackout
- Case 2: low pressure fast station blackout
- Case 3: high pressure ATWS sequence

The experts believe that the reactor vessel pressure during the in-vessel release phase is the most important factor in determining the value of FVES. If the reactor is at low pressure, the value of FVES would be large compared to the cases where reactor pressure is high. Secondly, if the control rod drive hydraulic system is available during this time period, the value of FVES would tend to increase.

The experts made a general distinction among three categories of radionuclide groups as far as the uncertainty distribution of FVES. Noble gases have no retention in the reactor vessel. The volatile iodine and relatively volatile cesium and tellurium tend to have less retention compared to the other species.

4.2.3 Releases from Molten Core Concrete Interaction (FCCI)

The expert panel defined four cases for FCCI during the elicitation based on the amount of Zr in the molten core and whether the reactor cavity is dry (no water in the cavity) or wet (water in the cavity). However, the results of expert elicitation showed that whether or not there is water in the reactor cavity is the only important variable as far as the uncertainty distribution of FCCI.

Experts also made a distinction among different radionuclide groups. The noble gases and the volatile species (I and Cs) would certainly be completely released from the molten core-concrete interaction. The remaining species have their individual uncertainty distributions.

4.2.4 Direct Containment Heating Release (FDCH)

There is only one case for the BWRs given the occurrence of direct containment heating (DCH). If the DCH does not occur, the value of FDCH would be zero for all radionuclide groups. The occurrence of DCH and the amount of core participating in DCH are passed to PBSOR from the accident progression event tree in the accident progression bin.

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From the uncertainty distribution shown in Appendix C.2, it is certain that the noble gases would be completely released from the material participating in DCH. For the volatile species such as iodine and cesium, it is very likely that the release fraction would be much larger than for the non-volatile species.

4.2.5 Ex-Vessel Steam Explosion Release (FEVSE)

The release fraction of each radionuclide group for the ex-vessel steam explosion phenomena is assumed to be the same as that for the direct containment heating case.

4.2.6 Late Iodine Releases from the Suppression Pool and Cavity Water (FLT11 and FLT12)

These two parameters only apply to the iodine radionuclide group. PBSOR keeps track of the amount of iodine scrubbed by the suppression pool and cavity water (if there is water in the cavity) during in-vessel and ex-vessel releases. It has been speculated that iodine trapped by the water may evolve and revolatilize from the water pool and release into the containment.

For FLT11, there are two cases: the suppression pool is either subcooled or saturated. Experts tended to think that the saturated pool would be more likely to have a larger value for iodine revolatilized from the pool than the subcooled pool. For FLT12, there are two cases: flooded reactor cavity (like Grand Gulf TC sequence in Battelle Source Term Code Package calculation, NUREG/CR-4624 [De86]) or wet reactor cavity (like Grand Gulf TBS sequence in NUREG/CR-4624 [De86]). The flooded cavity would be more likely to have a smaller value of FLT12 than the wet cavity case. For Peach Bottom, only the wet cavity case is applicable because of its shallow depth of drywell floor.

4.2.7 Revaporization Release from the RCS after Vessel Breach (FREVO)

Based on the definition of FVES, $FCOR*(1 - FVES)$ is the amount of initial core inventory that is released from the fuel and deposited in the surface and structure materials of reactor vessel. The revaporization release fraction applies to the amount of materials deposited on the surfaces of the reactor vessel and structure materials, i.e., $FCOR*(1 - FVES)$. After the vessel breach, these previously deposited materials may be revaporized and released into the drywell. Only three radionuclide groups are considered: I, Cs, and Te. Three cases are defined for the uncertainty distribution of FREVO:

- Case 1: station blackout and high drywell temperature
- Case 2: station blackout and low drywell temperature
- Case 3: ATWS high pressure sequence and low pressure system available after vessel breach

All members of this expert panel indicated no difference among these cases with the exception of one. That member believed that, in case 3, the water injection from the low pressure systems would cool the reactor vessel enough to prevent the revaporization release. He also stated that if the containment fails late after vessel breach and the drywell temperature becomes high, there could be more revaporization release later.

4.2.8 Reactor Building DF (RBDF)

The reactor building decontamination factor is a value greater than one and used as a divider in the parametric equation.

There are six cases of RBDF according to the expert panel:

1. drywell rupture and suppression pool subcooled
2. drywell rupture and suppression pool saturated
3. shell melt-through and suppression pool subcooled
4. shell melt-through and suppression pool saturated

- 5. drywell head seal leak and suppression pool subcooled
- 6. drywell head seal leak and suppression pool saturated

Except for noble gases, the differences among radionuclide groups are small compared to the differences among different cases.

4.2.9 Release of RCS Material from Containment before VB (FCONV)

There are six cases for Peach Bottom considered by the expert panel:

- Case 1: early leakage and subcooled suppression pool
- Case 2: early leakage and saturated suppression pool
- Case 3: early rupture and subcooled suppression pool
- Case 4: early rupture and saturated suppression pool
- Case 5: late leakage
- Case 6: late rupture

For the noble gases, no containment retention is considered by the experts. Therefore, if containment failure occurs (whether it is early or late), all the noble gases are assumed to be released to the environment. For the remaining groups, most of the experts did not differentiate the release fractions among different radionuclide groups and gave the same distributions in a given case.

4.2.10 Release from Containment after VB (FCONC)

Six cases for Peach Bottom were considered by the expert panel:

- Case 1: early leakage and subcooled suppression pool
- Case 2: early leakage and saturated suppression pool
- Case 3: early rupture and subcooled suppression pool
- Case 4: early rupture and saturated suppression pool
- Case 5: late leakage
- Case 6: late rupture

For the noble gases, no containment retention is considered by the experts. For the remaining groups, most of the experts gave the same distributions in a given case. Only one expert gave different distributions for different radionuclide groups.

There are some accident progression bins which involve wetwell venting either early (before vessel breach) or late (after vessel breach). As far as source term estimation, they are treated the same as the wetwell rupture case.

4.2.11 Suppression Pool DF for In-Vessel Releases (DFVPA)

This issue was not elicited from the expert panel. The uncertainty distribution of DFVPA is taken from the draft report of NUREG/CR-4551, volume 3 (Peach Bottom) [Am87/2].

4.2.12 Suppression Pool DF after Vessel Breach (DFCPA)

This issue was not elicited from the expert panel. The uncertainty distribution of DFCPA is taken from the draft report of NUREG/CR-4551, volume 3 (Peach Bottom) [Am87/2].

4.2.13 Reactor Cavity Water DF for CCI Releases (DFCAV)

This issue was not elicited from the expert panel. The uncertainty distribution of DFCAV is taken from the draft report of NUREG/CR-4551, volume 4 (Grand Gulf) [Am87/3]. There are two cases of DFCAV for Grand Gulf:

Case 1: Reactor cavity is flooded (similar to the TC sequence analyzed in Battelle's STCP calculations, NUREG/CR-4624)

Case 2: Some water in reactor cavity, less than that in Case 1 (similar to the TBS sequence analyzed in Battelle's STCP calculations, NUREG/CR-4624 [De86])

The draft report of NUREG/CR-4551 gave an uncertainty distribution for Case 1. For Case 2, the same probability distributions as Case 1 are used, however, the $DFCAV(\text{Case 2}) = DFCAV(\text{Case 1}) * 0.735$, where 0.735 is the DFCAV ratio of TBS sequence to TC sequence reported in NUREG/CR-4624.

Only case 2 is applicable to Peach Bottom.

4.2.14 Containment Spray DF for In-Vessel Releases (DFSPRV)

This issue was not elicited from the expert panel. The uncertainty distribution of DFSPRV is taken from the draft report of NUREG/CR-4551, Volume 1 (Surry) [Am87/1].

4.2.15 Containment Spray DF for Ex-Vessel Releases (DFSRPC)

This issue was not elicited from the expert panel. The uncertainty distribution of DFSPRV is taken from the draft report of NUREG/CR-4551, Volume 1 (Surry) [Am87/1].

4.3 Parameters with Fixed Values

Other source term parameters which do not have uncertainty distributions are discussed in this section.

4.3.1 Energy Release Parameters (E1 and E2)

Energy release data are taken from the results of Battelle's STCP calculations for Peach Bottom [De86, Le87]. Five accident sequences were analyzed by Battelle's STCP calculations: TC1, TC2, TC3 (these three are different variations of ATWS sequences), TB1 (slow station blackout sequence with late containment failure by overpressure), TB2 (slow station blackout with containment failure at time of vessel breach), and TBUX (fast station blackout with containment failure at time of vessel breach). Two more energy release rate data from the Grand Gulf STCP calculations are used in estimating the effect of containment spray on the energy release rates: TBS and TBR sequences analyzed in [De86]. The ratio of total energy released of TBR to TBS is used to adjust the decrease of energy release due to containment sprays.

These energy data are used to estimate the energy release rate of each accident progression bin.

4.3.2 Warning Time (TW)

Warning time is the time of imminent general site emergency and is input to the consequence code, MACCS, as part of the emergency response parameters. In general, the warning time in PBSOR is assumed to be the time when the reactor water level decreases to two feet above the bottom of the active fuel and is dependent on the plant damage state, determined by the front end analysis.

4.3.3 First Release Time (T1)

The time of first release depends on plant damage state and containment failure time. There are three containment failure times considered by PBSOR: before vessel breach, around the time of vessel breach, and late. Containment failure before vessel breach means containment fails between core damage and vessel breach. Late containment failure means containment fails at least several hours after vessel breach. These data were provided by accident progression analysts.

4.3.4 Duration of First Release (DT1)

For the containment rupture case, the release duration of 3 minutes is used for the case of subcooled suppression pool, based on the results of a recent MELCOR calculation for a Grand Gulf fast station blackout sequence [Di91]. If the suppression pool is saturated, the release duration would be longer because more steam would be released from the containment. Based on Battelle's STCP calculation for the Peach bottom TB1 sequence [De86], the release duration for the containment rupture with saturated pool case is about 15 minutes. For the containment leakage cases, the release duration is assumed to be much longer than in the rupture case. A release duration of two hours is used for the early leakage case and three hours for the late leakage or no containment failure case.

4.3.5 Duration of Second Release (DT2)

For the cases involving containment rupture, the release duration of the second release would be much longer than for the first release, since the containment is already depressurized. A release duration of three hours is assumed for containment rupture cases. If the containment failure mode is leakage, a slightly longer duration of four hours is used for the second release.

For late containment rupture cases, the fraction released during the first release is assumed to be 0.9 based on the results of Battelle's STCP calculation of the Grand Gulf TB1 sequence. For late containment leakage, the fraction of first release is assumed to be the same as that of the second release.

4.3.6 Release Elevation (ELEV)

For all source terms, the release elevation is assumed to be 30 meters above ground level.

4.3.7 Fraction of Core Participating in Direct Containment Heating (FHPE)

There are two levels for FHPE if direct containment heating or steam explosion occurs: high (0.4) or low (0.1). This is shown by the accident progression bin attribute number 4 and is determined in the accident progression event tree analysis.

4.3.8 Fraction of Core Participating in Ex-Vessel Steam Explosion (EVSE)

There are two levels for EVSE if ex-vessel steam explosion occurs: high (0.2) or low (0.05). This is shown by the accident progression bin attribute number 4 and is determined in the accident progression event tree analysis.

4.3.9 Puff Release at Time of Vessel Breach (VBPUF)

This parameter is based on Battelle's STCP calculation of the Peach Bottom TB1 sequence.

4.3.10 Fraction of Suppression Pool Bypass During In-Vessel Release (FPLBY)

There are two levels of suppression pool bypass for Peach Bottom:

- level 1: small bypass (0.39)
- level 2: complete pool bypass (1.0)

This parameter is shown by the accident progression bin attribute number 9 and is determined in the accident progression event tree analysis.

4.4 Accident Progression Bin Definition

As mentioned in the previous sections, the value of a given parameter depends on different conditions of the accident progression (or the "case"). Therefore, in order to assign a value to a given parameter, PBSOR needs to analyze a given accident progression. The characteristics of an accident progression are represented using an accident progression bin. Because of differences among plant designs, each plant has its own definition of accident progression bin attributes. Table 4.1 shows the definition of accident progression bin attributes for Peach Bottom. For more discussion about accident progression bins, please refer to NUREG/CR-4551, Vol. 4 (Peach Bottom) [Pa90].

For Peach Bottom, 10 attributes are used to characterize a particular accident progression. An example of an accident progression bin is: BAAAFBAAAA. The meaning of this accident progression can be inferred using Table 4.1 as follows:

- B - a fast station blackout sequence
- A - high Zr oxidation during the core melt
- A - high reactor vessel pressure at vessel breach and no low pressure water injection recovery after vessel breach
- A - high fraction of core participating in direct containment heating at the time of vessel breach and no ex-vessel steam explosion
- F - containment failure mode of shell melt-through
- B - intermediate containment failure time (i.e., containment failure near vessel breach)
- A - no drywell sprays
- A - dry cavity during molten core-concrete interaction
- A - no suppression pool bypass during in-vessel release
- A - reactor building intact and blow panel open

In order to assign a value to a parameter, PBSOR may use more than one attribute. For example, the expert panel provided four cases for assigning an uncertainty distribution to the parameter FCCI: dry CCI and high Zr content (in molten core), dry CCI and low Zr content, wet CCI and high Zr content, wet CCI and low Zr content. Therefore, PBSOR would use attribute number 2 (Zr oxidation) and attribute number 8 (molten core-concrete interaction) to assign a value to FCCI.

Table 4.1

**PBSOR Accident Progression Bin
Attribute Definition and Corresponding Possible Values**

<u>Attribute Element</u>	<u>Possible Values</u>
1 Accident Sequence	A LOCA B Fast Transients C Fast TC D TC-CV E Fast Station Blackout F Slow Station Blackout G Very Slow Station Blackout
2 Zr Oxidation	A High B Low
3 Vessel Condition at VB	A High Pressure, No Low Pressure Injection (LPI) Recovery after VB B Low Pressure, No LPI Recovery after VB C High Pressure, LPI Recovery after VB D Low Pressure, LPI Recovery after VB E No Vessel Breach
4 Fraction of Core Participating in Direct Containment Heating (DCH) or Steam Explosion (SE)	A High DCH, No SE B Low DCH, No SE C No DCH, High SE D No DCH, Low SE

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		E	No DCH, No SE
5	Containment Failure Mode	A	Drywell Head Seal Leak
		B	Drywell Leak
		C	Wetwell Leak
		D	Drywell Rupture
		E	Shell Melt-Through
		F	Wetwell Rupture
		G	No Containment Failure
6	Containment Failure Time	A	Early
		B	Late
7	Drywell Spray	A	No Spray
		B	Early Spray only
		C	Late Spray only
		D	Early and Late Spray
8	Molten Core-Concrete Interaction	A	Dry Cavity, CCI
		B	Water over Debris, CCI
		C	No CCI Release
9	Suppression Pool Bypass Before Vessel Breach (due to either LOCA or stuck open vacuum breaker)	A	No Pool Bypass
		B	Some Fraction of Bypass
		C	Complete Pool Bypass
10	Reactor Building	A	Reactor Building Intact but Blowout Panel Open
		B	Reactor Building Destroyed

4.5 Program Architecture and Input Data Structure

The majority of the PBSOR computer code consists of a free-format input processor and a means for substituting sampled values created by a sampling type of computer code such as the Latin Hypercube Sampling computer code. PBSOR may be executed in five different modes as defined by combinations of three different flags specified in the user input file: (1) BINNED or DIRECT, (2) SAMPLE, and (3) EXPERT:

- (1) DIRECT -- indicates no sampling and no binning so all input values must be defined through the default data file,
- (2) DIRECT and SAMPLE -- indicates sampling and no binning so all input values must be defined through the default data file and/or through sample value substitution,
- (3) BINNED -- indicates binning and no sampling so all input values must be defined through the default data file and values will be altered using bin definitions,
- (4) BINNED and SAMPLE -- indicates binning and sampling so all input values must be defined through the default data file and/or sample value substitution and values will be altered using bin definitions,
- (5) BINNED, SAMPLE, and EXPERT -- indicates binning and sampling so all input values must be defined through the default data file and interpolation of expert opinion tables using sample vector random numbers (0.0-1.0) and values will be altered using bin definitions.

Three common blocks are defined in PBSOR for the purpose of defining input values and using sample vector substitution:

- (1) /BASVAL/ -- parameter values used to define a single accident sequence. These values may be defined through default data values, bin translation of values in common block /BINNED/, and/or sample value substitution,
- (2) /BINNED/ -- parameter values used to define several cases for each parameter value in common block /BASVAL/. These values may be defined through default data values, sample vector substitution of values, and/or interpolation of expert opinion tables values using sample vector random numbers. Values in common block /BINNED/ are translated to values in common block /BASVAL/ in subroutine BINTRN using an alphabetic accident sequence description,
- (3) /EXPERT/ -- parameter values used to define expert opinion tables. Expert opinion table values are defined through default data values and are interpolated using sample vector random numbers to define variables in common block /BINNED/.

4.5.1 PBSOR Input and Output Files

Appendix C.4 shows the procedure file for executing PBSOR for the sample problem. The input data files needed for executing PBSOR depend on the mode specified by the user. A brief description of each input/output file is as follows:

File Unit Number 5

This input file specifies which execution mode is to be used and assigns file names required for the execution.

File Unit Number 6

This unit contains the normal output listing.

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File Unit Number 9

This output file contains abbreviated output data which is used by the PARTITION code.

All the other input files (i.e., the LHS file, the data base file, the vector position file, and the accident progression bins file are identified by the unit 5) are read by the code during execution by using the FORTRAN OPEN statement.

4.5.2 PBSOR Input Processor

Numeric variable values are set by reading a free format file containing variable names and corresponding numeric values. Variable names and corresponding three-dimensional array dimensions are set through data statements in subroutine DEFINE. The order of the variable names and corresponding array dimensions corresponds exactly to the order of variables in common blocks /BASVAL/, /BINNED/, and /EXPERT/ as if the common blocks are concatenated together in this order. All variables in these common blocks are available to be initialized with either default values or through substitution from a sample vector in a sampling execution. The total number of values in each of these common blocks must also be specified through a data statement in subroutine DEFINE.

Variable names are sorted according to the ASCII collating sequence to facilitate binary searching for variable names. Pointer arrays are set up to facilitate locating variable positions in a single-dimension array corresponding to the ordering of variables in the above named common blocks. Real and integer values may be stored in this array due to the storage locations having a real/integer equivalence. All variables are assumed to be either integer or real and follow FORTRAN conventions for determining type. Integer variable names begin with the letters I-N and real variable names begin with the letters A-H and O-Z. Integer variables may be set only with integer values (no decimal point) and real variables may be set with either integer values (decimal point placed after last digit) or real values (decimal point).

Subroutine SETDEF reads the default file specified in user input with the keyword DEFAULT. This file is read free format with a dollar sign (\$) signifying the beginning of a comment (the rest of the record is not processed). The delimiter between text strings is one or more blank characters. Text strings encountered on the file must be a variable name (e.g., FCOR) or a variable name with an array location (e.g., FCORL(1,2,1)) followed by one or more values to be saved starting at the specified location. A binary search is performed on the collated list of variable names to locate the starting position of the named variable in the single-dimension storage array.

If an array position has been specified as part of the variable name, the array indices are validated. If no array position is specified and the variable name corresponds to an array, the starting position is the first position allocated for this variable. The succeeding text strings are read and converted to integer or real values and are stored in the single-dimension storage array in the order in which they were read. Values are validated with the variables being set according to real or integer type. If neither an integer nor real value is found, the text string is assumed to be a variable name and the search and set process is initiated again. The process of setting default values continues until all text has been processed on the file.

Subroutine VECPOS reads the sample vector position file specified in user input with the keyword VECPOS. This file is read free format in the same manner that the DEFAULT file was read except that only integer values are allowed for any variables. These integer values specify sample vector positions which will contain values to be substituted for the corresponding named variable positions.

Values set through default input or sample vector substitution are stored in a single-dimension array whose values are transferred to the three common blocks /BASVAL/, /BINNED/, and /EXPERT/ by calling subroutine TRANS. Calling arguments for subroutine TRANS are the first variable locations in each of these common blocks.

Figure 4.1 shows a simple flow chart of PBSOR subroutines and operating paths of different options.

Figure 4.1 A Flow Chart of PBSOR Subroutines and Operating Paths of Different Options

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4.6 Sample Problem

A sample problem which uses the execution mode of BINNED, SAMPLE and EXPERT is presented.

Appendix C.2 shows the PBSOR data base which contains the parameter values and uncertainty distributions. Appendix C.3 shows the listing of Unit 5, which defines the execution option and assigns other files needed for executing the sample problem. The accident progression bins for the sample problem are also shown in Appendix C.3 and reproduced in Table 4.2 along with brief descriptions of the accident progression characteristics.

Table 4.2

Accident Progression Bins for the Sample Problem

		Description and Major Characteristics
1	AAAAAAAAABA	LOCA, early drywell head leak
2	BAACCBAAAA	Fast transient, wetwell leak
3	CAAEDCAACA	Fast TC, drywell head rupture
4	DAAAEAAAABA	TC-CV ¹ , drywell rupture
5	EAAAFBAABA	Fast SBO ² , shell melt-through
6	DAAAGAAABB	TC-CV, wetwell venting
7	FAAAHAAABA	Slow SBO, wetwell rupture
8	GAAAHAAAAA	very slow SBO, wetwell rupture

¹ TC-CV: a TC sequence resulting into core vulnerable condition.

² SBO: station black out.

The vector positions of uncertainty parameters and the LHS sample for the sample problem are also described in Appendix C.3. Note that there are a total of 16 uncertainty parameters whereas there are only 13 values. This is because certain parameters are assumed to be completely correlated. For example, FLT11 (late iodine release from the suppression pool) and FLT12 (late iodine release from the cavity water) are assumed to be completely correlated. Therefore, the same LHS value is used for both of them.

The results of the sample problem are shown in Appendix C.5. The format of PBSOR output is identical to that of SURSOR (see Section 2.6). Although there are ten LHS observations in the PBSOR sample problem, only observation number two is executed.

5 GGSOR

5.0 GGSOR Code

The GGSOR code is applicable to most BWR-6s which have a Mark III containment, although some modifications may be required. For example, the interfacing LOCA is not considered in GGSOR, because its frequency for Grand Gulf is small compared to the other accident sequences.

Similarly to Peach Bottom, the suppression pool of Grand Gulf provides a high level of decontamination during the in-vessel release phase. If the drywell is intact after vessel breach, the release from molten core concrete interaction would have to go through the suppression pool through the vent pipes before going into the outer containment. Therefore, for the Mark III containment, the suppression pool still provides scrubbing decontamination even if the outer containment has failed but the drywell is still intact. After the vessel breach, if there is water in the reactor cavity, some decontamination is provided by scrubbing of the molten core-concrete release by the overlying water.

The listing of GGSOR is provided in Appendix D.1.

5.1 GGSOR Parametric Equation

The basic parametric equation of GGSOR is similar to PBSOR and is shown in Equation 4.1.

5.2 Uncertainty Distribution of Parameters

Appendix D.2 shows the data base used in GGSOR which includes both the uncertainty distributions and fixed parameter values. Most of the uncertainty distributions for Grand Gulf are the same as those for Peach Bottom. The discussion of uncertainty distributions for Grand Gulf is as follows.

5.2.1 In-Vessel Release from the Fuel (FCOR)

The distributions are identical to those for Peach Bottom.

5.2.2 Radioactive Material Released from the RCS (FVES)

The distributions are identical to those for Peach Bottom.

5.2.3 Releases from Molten Core Concrete Interaction (FCCI)

The distributions are identical to those for Peach Bottom.

5.2.4 Direct Containment Heating Release (FDCH)

The distributions are identical to those for Peach Bottom.

5.2.5 Ex-Vessel Steam Explosion Release (FEVSE)

The release fraction of each radionuclide group for the ex-vessel steam explosion phenomena is assumed to be the same as that for the direct containment heating.

5.2.6 Late Iodine Releases from the Suppression Pool and Cavity Water (FLT11 and FLT12)

The distributions are identical to those for Peach Bottom.

5.2.7 Revaporization Release from the RCS after Vessel Breach (FREVO)

This release fraction applies to the amount of materials that deposited on the surfaces of the reactor vessel and structure materials. After vessel breach, these previously deposited materials may be revaporized and released into the drywell. Only three radionuclide groups are considered: I, Cs, and Te. There are two cases for the uncertainty distribution of FREVO:

- Case 1: station blackout and high drywell temperature
- Case 2: ATWS high pressure sequence and low pressure system available after vessel breach

5.2.8 Release of RCS Material from Containment before Vessel Breach (FCONV)

There are six cases for Grand Gulf considered by the expert panel:

- Case 1: early leakage and subcooled suppression pool
- Case 2: early leakage and saturated suppression pool
- Case 3: early rupture and subcooled suppression pool
- Case 4: early rupture and saturated suppression pool
- Case 5: late leakage
- Case 6: late rupture

For the noble gases, no containment retention is considered by the experts. Therefore, if containment failure occurs (whether it is early or late), all the noble gases are assumed to be released to the environment. For the remaining groups, most of the experts did not differentiate the release fractions among different element groups and assigned the same distributions in a given case.

5.2.9 Release from Containment after Vessel Breach (FCONC)

There are six cases for Grand Gulf considered by the expert panel:

- Case 1: early leakage and subcooled suppression pool
- Case 2: early leakage and saturated suppression pool
- Case 3: early rupture and subcooled suppression pool
- Case 4: early rupture and saturated suppression pool
- Case 5: late leakage
- Case 6: late rupture

For the noble gases, no containment retention is considered by the experts. For the remaining groups, most of the experts gave the same distributions in a given case. Only one expert gave different distributions for different radionuclide groups.

There are some accident progression bins which involve wetwell venting. As far as source term estimation, they are treated the same as wetwell rupture case.

5.2.10 Suppression Pool DF for In-Vessel Releases (DFVPA)

Because this issue was not elicited from the expert panel, the uncertainty distribution of DFVPA is taken from the draft report of NUREG/CR-4551, Volume 4 (Grand Gulf) [Am87/3].

5.2.11 Suppression Pool DF after Vessel Breach (DFCPA)

Because this issue was not elicited from the expert panel, the uncertainty distribution of DFCPA is taken from the draft report of NUREG/CR-4551, Volume 4 (Grand Gulf) [Am87/3].

5.2.12 Reactor Cavity Water DF for CCI Releases (DFCAV)

Because this issue was not elicited from the expert panel, the uncertainty distribution of DFCAV is taken from the draft report of NUREG/CR-4551, Volume 4 (Grand Gulf). There are two cases of DFCAV for Grand Gulf:

Case 1: reactor cavity is flooded (similar to the TC sequence analyzed in Battelle's STCP calculations, NUREG/CR-4624 [De86])

Case 2: some water in reactor cavity, less than that in Case 1 (similar to the TBS sequence analyzed in Battelle's STCP calculations, NUREG/CR-4624)

The draft report of NUREG/CR-4551 gave an uncertainty distribution for Case 1. For Case 2, the same probability distributions as Case 1 are used; however, the $DFCAV(\text{Case 2}) = DFCAV(\text{Case 1}) \times 0.735$, where 0.735 is the DFCAV ratio of TBS sequence to TC sequence reported in NUREG/CR-4624.

5.2.13 Containment Spray DF for In-Vessel Releases (DFSPRV)

Because this issue was not elicited from the expert panel, the uncertainty distribution of DFSPRV is taken from the draft report of NUREG/CR-4551, Volume 1 (Surry) [Am87/1].

5.2.14 Containment Spray DF for Ex-Vessel Releases (DFSRPC)

Because this issue was not elicited from the expert panel, the uncertainty distribution of DFSRPC is taken from the draft report of NUREG/CR-4551, Volume 1 (Surry) [Am87/1].

5.3 Parameters with Fixed Values

Other GGSOR parameters which do not have uncertainty distributions are also shown in Appendix D.2 and are discussed in the following paragraphs.

5.3.1 Energy Release Parameters (E1 and E2)

Energy release data are taken from the results of Battelle's STCP calculations for Grand Gulf [De86]. Five accident sequences were analyzed by Battelle's STCP calculations: TC, TB1 (slow station blackout sequence with late containment failure by overpressure), TB2 (slow station blackout with containment failure at time of vessel breach), TBS (fast station blackout with containment failure at time of vessel breach), and TBR (the same as TBS, except for the containment sprays initiation at the time of containment failure). Two more energy release rate data from the Grand Gulf STCP calculations are used in estimating the effect of containment spray on the energy release rates: TBS and TBR sequences analyzed in [De86]. The ratio of total energy released of TBR to TBS is used to adjust the energy release due to containment sprays. These energy data are used to estimate the energy release rate for each accident progression bin.

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5.3.2 Warning Time (TW)

Warning time is the time of imminent general site emergency and is input in the consequence code, MACCS, as part of emergency response parameters. In general, the warning time in GGSOR is assumed to be the time when the reactor water level decreases to two feet above the bottom of the active fuel and is dependent on the plant damage state, determined by the front end analysis.

5.3.3 First Release Time (T1)

The time of first release depends on plant damage state and containment failure time. There are three containment failure times considered by GGSOR: before vessel breach, around the time of vessel breach, and late. Containment failure before vessel breach means containment fails between core damage and vessel breach. Late containment failure means the containment fails at least several hours after vessel breach. These data were provided by the accident progression analysts.

5.3.4 Duration of First Release (DT1)

For the containment rupture case, the release duration of 3 minutes is used for the case of subcooled suppression pool, based on results of a recent MELCOR calculation for a Grand Gulf fast station blackout sequence. If the suppression pool is saturated, the release duration would be longer because more steam would be released from the containment. Based on Battelle's STCP calculation for the Peach Bottom TB1 sequence [De86], the release duration for the containment rupture with saturated pool case is about 15 minutes. For the containment leakage cases, the release duration is assumed to be much longer than for the rupture case. A release duration of two hours is used for the early leakage case and three hours for the late leakage or no containment failure case.

5.3.5 Duration of Second Release (DT2)

For the cases involving containment rupture, the release duration of the second release would be much longer than for the first release since the containment is already depressurized. A release duration of three hours is assumed for containment rupture cases. If the containment failure mode is leakage, a slightly longer duration of four hours is used for the second release.

For late containment rupture cases, the fraction released during the first release is assumed to be 0.9, based on the results of Battelle's STCP calculation of the Grand Gulf TB1 sequence. If late containment leakage occurs, the fraction of first release is assumed to be the same as that of the second release.

5.3.6 Second Release Time (T2)

For the cases that the core debris is not temporarily coolable, the second release time T_2 is equal to $T_1 + DT_1$.

For the cases where the core debris is temporarily coolable and water overlies the debris, the onset of core-concrete interaction is delayed after the overlying water is boiled off. In GGSOR, this delay time is assumed to be 3 hours.

5.3.7 Release Elevation (ELEV)

For all source terms, the release elevation for Grand Gulf is assumed to be 32 meters above ground level.

5.3.8 Fraction of Core Participating in Direct Containment Heating (FHPE)

There are two levels for FHPE if direct containment heating or steam explosion occurs: high (0.4) or low (0.1). This is shown by the accident progression bin attribute number 4 and is determined by the accident progression event tree analysis.

5.3.9 Fraction of Core Participating in Ex-Vessel Steam Explosion (EVSE)

There are two levels for EVSE if ex-vessel steam explosion occurs: high (0.2) or low (0.05). This is shown by the accident progression bin attribute number 4 and is determined by the accident progression event tree analysis.

5.3.10 Puff Release at Time of Vessel Breach (VBPUF)

This parameter is based on Battelle's STCP calculation of the Grand Gulf TB1 sequence.

5.3.11 Fraction of Flow Going through SRV Tail Pipe Vacuum Breaker During In- vessel Release (FTLP)

There are two levels for FTLP:

- level 1: vacuum breaker open and high pressure (0.39)
- level 2: vacuum breaker open and low pressure (1.0)

This parameter is determined by the accident progression bin attribute number 9 (vacuum breaker stuck open or not) and bin attribute number 3 (reactor vessel pressure at vessel breach). If the vacuum breaker is not stuck open, the value for FTLP is zero. If the vacuum breaker is stuck open, the value for FTLP depends on the reactor vessel pressure.

5.3.12 Fraction of Flow Going Directly from Drywell to Outer Containment (FPLBY)

This is also called the suppression pool bypass fraction from the drywell to the outer containment. For the Grand Gulf containment, if there is no drywell leakage, the material inside the drywell atmosphere has to go through the suppression pool in order to go into the outer containment. However, if there is a drywell leakage, there would be some fraction of the flow which would go directly from the drywell to the outer containment, bypassing the suppression pool.

The value of FPLBY could change as the accident progresses because of the performance of the drywell. For example, during the early phase (i.e., before vessel breach), the drywell is intact and there is only a nominal leakage from the drywell to the outer containment. Later in the accident, there is a hydrogen burn inside the outer containment, resulting in failure of the outer containment and in larger leakage from the drywell. In GGSOR, there are 8 different cases of pool bypass depending on the timing and the size of the drywell leakage as shown in the accident progression bin definition (Table 5.1).

There are three levels of FPLBY for Grand Gulf:

- level 1: nominal drywell leakage (860 cfm), FPLBY = 0.0564
- level 2: small drywell leakage (8600 cfm), FPLBY = 1.32
- level 3: large drywell leakage, FPLBY = 10⁶

The value of FPLBY defined above needs to be modified using two correction factors: division by the steaming factor WFAC if there is water in the reactor cavity and multiplication by the pressure factor PFAC if the containment fails late (not near the vessel breach). The values for the two correction factors in GGSOR are: WFAC = 3.1 and PFAC = 3.9.

The value for WFAC is based on the results in BMI-2139 for two Grand Gulf accident sequences, TB2 and TBS, which have the same leakage rate (8600 cfm). The TB2 sequence has no water in the reactor cavity, whereas, TBS has water in the reactor cavity. The value of FPLBY for TBS is about a factor of 3.1 smaller than that for TB2.

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The value for PFAC is based on the assumption that the fraction of flow that goes directly from the drywell to the outer containment is proportional to the containment pressure. The containment pressure for the TB1 sequence is about 60 psia before failure, whereas, the containment pressure for the TC sequence is about 15.5 psia. Therefore, $PFAC = 60/15.5 = 3.9$.

After taking into account the two correction factors, if the value for FPLBY is greater than 1.0, it is set to 1.0 in GGSOR.

5.4 Accident Progression Bin Definition

The accident progression bin definition for GGSOR is shown in Table 5.1. For more discussion about the accident progression event tree and accident progression bins for Grand Gulf, please refer to NUREG/CR-4551, Grand Gulf [Bro90].

Table 5.1

GGSOR Accident Progression Bin
Attribute Definition and Corresponding Possible Values

<u>Attribute Element</u>	<u>Possible Values</u>
1 Accident Sequence	A Fast Station Blackout
	B Slow Station Blackout
	C Fast Transients
	D Slow Transients
	E Fast TC
	F Slow TC
2 Zr Oxidation	A High
	B Low
3 Vessel Condition at Vessel Breach (VB)	A High Pressure, No Low Pressure Injection (LPI) after VB
	B Low Pressure, No LPI after VB
	C High Pressure, LPI after VB
	D Low Pressure,

		LPI after VB
		E No Vessel Breach
4	Fraction of Core Participating in Direct Containment Heating (DCH) or Steam Explosion (SE)	A High DCH, No SE B Low DCH, No SE C No DCH, High SE D No DCH, Low SE E No DCH, No SE
5	Pool Bypass Nominal: 860 cfm Small: 8600 cfm Large: Complete Bypass Early: Before VB Intermediate: At VB Late: After VB	A Nominal B Early Nominal, Intermediate Large C Early Nominal, Late Small D Early Nominal, Late Large E Early small, Late Small F Early Small, Intermediate Large G Early Small, Late Large H Early Large, Late Large
6	Containment Failure	A Leak before VB B Rupture before VB C Venting before VB D Leak at VB E Rupture at VB F Late Leak G Late Rupture H Late Venting I No Containment Failure

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7	Containment Spray	A No Spray
B Early Spray only
C Late Spray only
D Early and Late Spray
8	Molten Core Concrete Interaction	A Dry cavity, CCI
B Wet Cavity (water almost dryout after 10 hours) CCI
C Flooded Cavity, CCI
D Delayed CCI Release
E No CCI Release
9	SRV Tail Pipe Vacuum Breaker	A Stuck Open
B Closed

For Grand Gulf, 9 attributes are used to characterize a particular accident progression. An example of an accident progression bin is: BAAAFBAAA. The meaning of this accident progression can be inferred using Table 5.1 as follows:

- B - a slow station blackout sequence
- A - high Zr oxidation during the core melt
- A - high reactor vessel pressure at vessel breach and no low pressure water injection recovery after vessel breach
- A - high fraction of core participating in direct containment heating at the time of vessel breach and no ex-vessel steam explosion
- F - small suppression pool bypass before vessel breach and large suppression bypass after vessel breach
- B - early outer containment rupture (i.e., outer containment rupture before vessel breach)
- A - no drywell spray
- A - dry cavity during molten core concrete interaction
- A - SRV tail pipe vacuum breaker stuck open during in-vessel release

In order to assign a value to a parameter, GGSOR may use more than one attribute. For example, the expert panel provided four cases for assigning an uncertainty distribution to the parameter FCCI: dry CCI and high Zr content (in molten core), dry CCI and low Zr content, wet CCI and high Zr content, wet CCI and low Zr content. Therefore, GGSOR would use attribute number 2 (Zr oxidation) and attribute number 8 (molten core concrete interaction) to assign a value to FCCI.

5.5 GGSOR Program Architecture and Input Data Structure

The program architecture and input data structure for GGSOR are identical to those for PBSOR discussed in Section 4.5.

5.5.1 GGSOR Input and Output Files

Appendix D.4 shows the procedure file for executing GGSOR for the sample problem. The input data files needed for executing GGSOR depend on the mode specified by the user. A brief description of each input/output file are as follows:

File Unit Number 5

This input file specifies which execution mode is to be used and assigns other file names required for execution.

File Unit Number 6

This unit contains the normal output listing.

File Unit Number 9

This output file contains abbreviated output data which is used by the PARTITION code.

All the other input files (i.e., the LHS file, the data base file, the vector position file, and the accident progression bins file are identified by the unit 5) are read by the code during execution by using FORTRAN OPEN statements.

5.5.2 GGSOR Input Processor

The input processor for GGSOR is identical to that for PBSOR discussed in Section 4.5.2. The flow chart of different operating paths shown in Figure 4.1 for PBSOR is also applicable to GGSOR.

5.6 GGSOR Sample Problem

A sample problem which uses the execution mode of BINNED, SAMPLE and EXPERT is presented.

Appendix D.2 shows the GGSOR data base which contains the parameter values and uncertainty distributions. Appendix D.3 shows the listing of Unit 5, which defines the execution option and assigns other files needed for executing the sample problem. The accident progression bins for the sample problem are also shown in Appendix D.3 and reproduced in Table 5.2 along with brief descriptions of the accident progression characteristics.

Table 5.2

Accident Progression Bins for GGSOR Sample Problem

Description and Major Characteristics		
1	AAAAFAAAA	Fast SBO ¹ , DCH ² , early drywell leak, early containment leak
2	AAAAFBAAA	Fast SBO, DCH, early drywell leak, early containment rupture
3	AAAEFBAAA	Fast SBO, no DCH, no EVSE ³ , early drywell leak, early containment rupture
4	AAAAFEAAA	Fast SBO, DCH, early drywell leak, containment rupture at vessel breach
5	BAAAFBAAA	Slow SBO, DCH, early drywell leak, early containment rupture
6	BAAEFBAAA	Slow SBO, no DCH, no EVSE, early drywell leak, early containment rupture
7	BAAAFEAAA	Slow SBO, DCH, early drywell leak, containment rupture at vessel breach
8	FAAAFBAAB	Slow TC, DCH, early drywell leak, early containment rupture
9	FAFEFBAAA	Slow TC, no DCH, no EVSE, early drywell leak, early containment rupture
10	FAAAFEAAA	Slow TC, DCH, early drywell leak, containment rupture at vessel breach

¹ SBO: station black out.

² DCH: direct containment heating

³ EVSE: ex-vessel steam explosion

The vector positions of uncertainty parameters and the LHS sample for the sample problem are also described in Appendix D.3. Note that there are a total of 15 uncertainty parameters whereas there are only 12 values. This is because certain parameters are assumed to be completely correlated. For example, FLT11 (late iodine release from the suppression pool) and FLT12 (late iodine release from the cavity water) are assumed to be completely correlated. Therefore, the same LHS value is used for both of them.

The results of GGSOR sample problem are shown in Appendix D.5. The format of GGSOR output is identical to that of SURSOR (see Section 2.6). Although there are ten LHS observations in the GGSOR sample problem, only observation number two is executed.

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APPENDIX A
SURSOR FILES

APPENDIX A.1 SURSOR Fortran Listing

PROGRAM SURSOR

```

C      CALCULATE SOURCE TERMS FOR SURRY (CENTRAL AND/OR LHS)
C      MAXIMUM NUMBER OF BIN ENTRIES = 5000
C      MAXIMUM NO. OF ST GROUPS = 9
C      MAXIMUM NO. OF ISSUES = 200
C      NISST= TOTAL NO. OF ISSUES IN SAMPLE
C      NISS= TOTAL NO. OF ST ISSUES (MAX=20)
C      NSP= ACTUAL NUMBER OF SOURCE TERM GROUPS
C           UTILIZED IN THE ANALYSIS.
C      IPRINT = UNIT NO. FOR "PRINT" FILE
C      IBINNR = UNIT NO. FOR "BIN" FILE
C      ISAMPL = UNIT NO. FOR "SAMPLE" FILE
C      IRELOUT = UNIT NO. FOR "RELEASE" FILE
C      IWROUT = UNIT NO. FOR "WEIGHTS" FILE
C      ISTDAT = UNIT NO. FOR "SOURCE TERM DATA" FILE
C      DIMENSION ST(9),STE(9),STL(9),XNDX(200)
C      DIMENSION ISSST(20)
C      DATA NSP/9/
C      DATA NTOT/0/
C      CHARACTER BINJ(5000)*20
C      CHARACTER NAMRUN*80,NAMBIN*80
C      CHARACTER BINOUT*20
C      LOGICAL EARLY,I1CALL,I2CALL,DIAG,BYOBS
C      GET THE RUN TITLE
C      READ (5,1000)NAMRUN
C      GET THE I/O UNIT NUMBERS
C      READ(5,*)IPRINT,IBINNR,ISAMPL,IWROUT,IRELOUT,
C      $ISTDAT
C      GET THE ISSUE NUMBERS
C      READ (5,*)NISST,NISS,NSAM
C      READ WHICH ISSUE NO. APPLIES TO EACH ST ISSUE
C      READ(5,*)(ISSST(K),K=1,NISS)
C      IF DIAGNOSTICS ARE REQUIRED, DIAG = .TRUE.
C      IF SOURCE TERMS ARE TO BE READ BY OBSERVATION,
C      BYOBS = .TRUE.
C      READ(5,999)DIAG,BYOBS
C      WRITE THE IDENTIFICATION AND UNIT NUMBERS
C      WRITE(IPRINT,1004)NAMRUN,NSAM,IPRINT,ISAMPL,IBINNR,IRELOUT,
C      $IWROUT,ISTDAT
C      WRITE(IPRINT,1044)NISST,NISS
C      I1CALL=.TRUE.
C      IF(.NOT.BYOBS) THEN
C          READ(IBINNR,1000)NAMBIN
C          READ(IBINNR,*)NDIM,NBIN
C          NTOT=NBIN*NSAM
C          WRITE(IPRINT,1005)NAMBIN,NDIM,NBIN,NTOT
C          READ(IBINNR,1006)(BINJ(J),J=1,NBIN)
C      PUT A HEADER ON THE "RELEASE" OUTPUT FILE
C          WRITE(IRELOUT,2002)NAMRUN,NDIM,NSP,NTOT,NSAM
C      ELSE
C          DO 890 ISAM=1,NSAM
C      PUT A HEADER ON THE "RELEASE" OUTPUT FILE
C          READ(IBINNR,1001)IOBSD,NAMBIN
C          READ(IBINNR,*)NDIM,NBIN
C          NTOT=NTOT+NBIN
C          READ(IBINNR,1006)(BINJ(J),J=1,NBIN)
890      CONTINUE
C          WRITE(IPRINT,1007)NAMBIN,NDIM,NTOT
C          WRITE(IRELOUT,2002)NAMRUN,NDIM,NSP,NTOT,NSAM
C          REWIND IBINNR
C      ENDIF

```

Appendix A.1

```

DO 900 ISAM=1,NSAM
C STEP THROUGH SAMPLE
  READ (ISAMPL,*) IOBSD,NLHS,(XNDX(J),J=1,NISST)
  I2CALL=.TRUE.
C STEP THROUGH MASTER BIN LIST, BY OBSERVATION
  IF (BYOBS) THEN
    READ (IBINNR,1001) IOBSD,NAMBIN
    READ (IBINNR,*) NDIM,NBIN
    READ (IBINNR,1006) (BINJ(J),J=1,NBIN)
  END IF
C CALCULATE SOURCE TERMS
  DO 910 IB=1,NBIN
    CALL SORST(NSP,I1CALL,BINJ(IB),NISS,ISSST,I2CALL,
$      XNDX,ST,STL,EARLY,ISTDAT,DIAG,IPRINT,
$      TW,T1,DT1,E1,T2,DT2,E2,ELEV,ISAM)
C
    I1CALL=.FALSE.
    I2CALL=.FALSE.
C GET EARLY AND LATE EFFECT WEIGHTS
C WEE = EARLY EFFECT OF EARLY RELEASE
C WLE = LATE EFFECT OF EARLY RELEASE
C WEL = EARLY EFFECT OF LATE RELEASE
C WLL = LATE EFFECT OF LATE RELEASE
    DO 770 ISP=1,NSP
      IF (EARLY) THEN
        STE (ISP)=ST (ISP)
        ST (ISP)=STE (ISP)+STL (ISP)
      ELSE
        STE (ISP)=0.
        STL (ISP)=ST (ISP)+STL (ISP)
        ST (ISP)=STL (ISP)
      END IF
770 CONTINUE
      IF (EARLY) THEN
        CALL WEIGHT (NSP,STE,WEE,WLE)
        CALL WEIGHT (NSP,STL,WEL,WLL)
      ELSE
        WEE=0.
        WLE=0.
        CALL WEIGHT (NSP,ST,WEL,WLL)
      END IF
    DO 888 IJ=1,20
      IF (IJ.LE.NDIM) THEN
        BINOUT (IJ:IJ)=BINJ (IB) (IJ:IJ)
      ELSE
        BINOUT (IJ:IJ)='
    END IF
888 CONTINUE
    WRITE (IRELOUT,1775) ISAM,BINOUT,TW,T1,DT1,T2,DT2,ELEV
    WRITE (IRELOUT,17751) E1,(STE (IS),IS=1,NSP)
    WRITE (IRELOUT,17751) E2,(STL (IS),IS=1,NSP)
    WET=WEE+WEL
    WLT=WLE+WLL
C WRITE (IWROUT,1777) ISAM,IB,WEE,WLE,WEL,WLL,WET,HLT
  IF (DIAG) THEN
    WRITE (IPRINT,2010) IB,BINJ (IB),ISAM,(STE (ISP),
$      ISP=1,NSP),(STL (ISP),ISP=1,NSP),
$      (ST (ISP),ISP=1,NSP)
    WRITE (IPRINT,2011),WEE,WLE,WEL,WLL,WET,HLT
  END IF
910 CONTINUE
900 CONTINUE
999 FORMAT (L1,1X,L1)

```



```

1000 FORMAT(A)
1001 FORMAT(I5,A)
1004 FORMAT(5X,'RUN TITLE: ',A80/
$      5X,'SAMPLE SIZE = ',I3/
$      5X,'PRINT FILE ON UNIT ',I2/
$      5X,'INPUT SAMPLE FILE ON UNIT ',I2/
$      5X,'INPUT BIN FILE ON UNIT ',I2/
$      5X,'OUTPUT ST FILE ON UNIT ',I2/
$      5X,'OUTPUT WEIGHTS FILE ON UNIT ',I2/
$      5X,'INPUT PARAMETERS ON UNIT ',I2)
1005 FORMAT(5X,'BIN TITLE: ',A80/5X,'DIMENSIONS: ',I3/
$      5X,'NUMBER OF BINS: ',I4/
$      5X,'TOTAL NUMBER OF SOURCE TERMS: ',I7)
1006 FORMAT(1X,A20)
1007 FORMAT(5X,'BIN TITLE: ',A80/5X,'DIMENSIONS: ',I3/
$      5X,'TOTAL NUMBER OF SOURCE TERMS: ',I7)
1044 FORMAT(5X,'TOTAL NO. OF ISSUES = ',I3/5X,'NO. OF ST ISSUES=',I3)
1775 FORMAT(I4,2X,A20/6(1PE12.3))
1777 FORMAT(2I5,6(1PE11.3))
2002 FORMAT(2X,A80/4I7)
2010 FORMAT(/5X,'OUTPUT FOR BIN ENTRY # ',I4,2X,A20/5X,
$      'SAMPLE MEMBER',I4/5X,'STE = ',9(1PE9.1)/
$      5X,'STL = ',9(1PE9.1)/5X,'STT = ',9(1PE9.1))
2011 FORMAT(5X,' WEE = ',F8.4,' WLE = ',F8.4,' WEL = ',F8.4,
$      ' WLL = ',F8.4/5X,' WET = ',F8.4,' WLT = ',F8.4)
17751 FORMAT(10(1PE12.3))
END

```

```

SUBROUTINE SORST(NSP,I1CALL,BIN,NISS,ISSST,I2CALL,XNDX,ST,
$      STL,EARLY,ISTDAT,DIAG,IPRINT,TW,T1,
$      DT1,E1,T2,DT2,E2,ELEV,ISAM)

```

```

C
C
C      2-ND GENERATION PROGRAM TO CALCULATE SOURCE TERMS FOR SURRY
C
C      THE SOURCE TERM FOR SPECIES GROUP I (I.NE.2 OR 3) IS
C      APPROXIMATED BY:
C      ST(I)=FCOR(I)*(FISG(I)*FOSG(I)+(1-FISG(I))*FVES(I)*FCONV/DFE
C      +FPART*(1-FCOR(I))*FCCI(I)*FCONC(I)/DFL+
C      +(1-FCOR(I))*FPME*FDCH(I)*FCONV+
C      +FLATE(I)*(FCOR(I)*(1-FVES(I))+FREM*(1-FCOR(I)))*FCONRL(I)/DFL(I)
C
C      WHERE:
C      ST(I)=FRACTION OF INITIAL INVENTORY RELEASED TO ENVIRONMENT.
C      FISG(I)=FRACTION OF INITIAL INVENTORY RELEASED INTO STEAM GENERATOR
C      FOSG(I)=FRACTION OF INITIAL INVENTORY RELEASED FROM STEAM GENERATOR
C      FCOR(I)=FRACTION OF INITIAL INVENTORY RELEASED FROM FUEL
C      PRIOR TO VESSEL BREACH.
C      FVES(I)=FRACTION OF FCOR NOT DEPOSITED IN THE VESSEL.
C      FCONV=FRACTION OF MATERIAL RELEASED TO CONTAINMENT PRIOR TO
C      OR AT VESSEL BREACH WHICH WOULD BE RELEASED FROM CONTAINMENT IN
C      THE ABSENCE OF DECONTAMINATION MECHANISMS.
C      DFE=DECONTAMINATION FACOR APPLICABLE TO RCS RELEASE.
C      FPART=FRACTION OF CORE INVOLVED IN CCI
C      FCCI(I)=FRACTION OF INVENTORY REMAINING IN THE MELT
C      RELEASED DURING CORE-CONCRETE INTERACTION (CCI).
C      FCONC(I)=FRACTION OF CCI RELEASE ESCAPING CONTAINMENT.
C      DFL(I)=DECONTAMINATION FACTOR APPLICABLE TO CCI RELEASE.
C      FPME=FRACTION OF CORE INVOLVED IN PRESSURIZED MELT EJECTION.
C      FDCH(I)=FRACTION OF MATERIAL INVOLVED IN PRESSURIZED MELT
C      EJECTION RELEASED FROM CONTAINMENT DUE TO DIRECT HEATING
C      FLATE(I)=FRACTION OF MATERIAL REMAINING IN THE RCS AFTER VESSEL
C      BREACH WHICH IS REVOLATILIZED LATER.
C      FREM=FRACTION OF CORE MATERIAL REMAINING IN VESSEL AFTER BREACH.

```

Appendix A.1

C FCONRL(I)=FRACTION OF LATE REVOLATILIZED MATERIAL WHICH WOULD BE
 C RELEASED FROM CONTAINMENT IN THE ABSENCE OF DECONTAMINATION
 C MECHANISMS.
 C
 C FOR IODINE, AN ADDITIONAL TERM IS ADDED:
 C +XLATE*(RELIV-RELIC)
 C WHERE:
 C XLATE IS THE FRACTION OF IODINE REMAINING IN CONTAINMENT LATE
 C IN THE ACCIDENT WHICH IS CONVERTED TO ORGANIC IODIDES.
 C RELIV=FRACTION OF INITIAL INVENTORY OF IODINE RELEASED TO
 C CONTAINMENT.
 C RELIC = FRACTION OF INITIAL INVENTORY OF IODINE RELEASED FROM
 C CONTAINMENT.
 C
 C NISS=NUMBER OF ST ISSUES
 C ISSUE-1: IN-VESSEL RELEASE FROM FUEL (FCOR)
 C ISSUE-2: RELEASE FROM VESSEL (IN-VESSEL RETENTION) (FVES)
 C ISSUE-3: V-SEQ. DF WITH SUBMERGED RELEASE (VDF)
 C ISSUE-4: RELEASE OF RCS SPECIES FROM CONTAINMENT (FCONV)
 C ISSUE-5: RELEASES FROM MELT IN CCI (FCCI)
 C ISSUE-6: RELEASE OF CCI SPECIES FROM CONTAINMENT (FCONC)
 C ISSUE-7: SPRAY DF'S (SPRDF)
 C ISSUE-8: LATE IODINE RELEASES FROM CONTAINMENT (XLATE)
 C ISSUE 9: LATE REVOLATILIZATION (FLATE)
 C ISSUE-10: RELEASE DUE TO DIRECT HEATING (FDCH)
 C ISSUE-11: STEAM GENERATOR TUBE RUPTURE FISG & FOSG
 C ISSUE-12: POOL SCRUBBING OF CCI
 C
 C ST BINS ARE DEFINED BY AN 11 LETTER WORD, "BIN"
 C 1ST LETTER: CONTAINMENT FAILURE MODE.
 C A=CONT. BYPASS, NOT SUBMERGED
 C B=CONT. BYPASS, SUBMERGED
 C C=CONT. FAILURE BEFORE VESSEL BREACH
 C D=CONT. FAILURE NEAR THE TIME OF VESSEL FAILURE
 C E=LATE OR VERY LATE (SEVERAL HRS AFTER VB) CONTAINMENT FAILURE
 C F=FINAL PERIOD (CA. 24 HRS AFTER VB) CONTAINMENT FAILURE
 C G=NO CONTAINMENT FAILURE
 C
 C 2ND LETTER: SPRAY OPERATION
 C (E=EARLY, UP TO VESSEL BREACH)
 C (I=INTERMEDIATE, VB TO VB+45MIN)
 C (L=LATE, VB+45MIN TO END OF CCI)
 C (V=VERY LATE, AFTER CCI)
 C (-=NON-OPERATION)
 C A=E---
 C B=EI--
 C C=EIL-
 C D=EILV
 C E=--L-
 C F=--LV
 C G=---V
 C H=----
 C
 C 3RD LETTER: CORE-CONCRETE INTERACTION
 C A=PROMPT DRY--FULL UNSCRUBBED CCI
 C B=PROMPT SHALLOW SCRUBBED
 C C=NO CCI
 C D= PROMPT DEEP SCRUBBED
 C E=SHORT DELAYED, THEREAFTER DRY
 C F=LONG DELAYED, THEREAFTER DRY
 C
 C 4TH LETTER: PRESSURE IN RCS AT VB
 C A=AT SYS SETPOINT; T SEQUENCES; OUTFLOW THROUGH CYCLING PORV, 2500 PSIA

B=HIGH PRES; S3 SEQUENCES; VERY SMALL LEAK W/O SG COOLING, 600-2000 PSIA
 C=INTERMEDIATE PRES; S2 SEQUENCES; ACCUMULATORS DISCHARGE, 200-600 PSIA
 D=LOW PRESSURE; A/S1 SEQUENCES; NEAR ATMOSPHERIC PRESSURE, < 200 PSIA

5TH LETTER: MODE OF VESSEL BREACH

A=HPME
 B=POUR
 C=GROSS BOTTOM HEAD FAILURE
 D=ALPHA MODE
 E=ROCKET
 F=NO VESSEL BREACH

6TH LETTER: SGTR

A=OCCURS, SRV CLOSSES
 B=OCCURS, SRV REMAINS OPEN
 C=NONE

7TH LETTER: AMOUNT OF CORE IN CCI

A=LARGE AMOUNT (70-100%) NOMINALLY 85%
 B=MODERATE AMOUNT (30-70%) NOMINALLY 50%
 C=SMALL AMOUNT (0-30%) NOMINALLY 15%
 D=NONE

8TH LETTER: ZR OXIDATION

A=LOW ZR OXIDATION (0-40%) NOMINALLY 25%
 B=HIGH ZR OXIDATION (>40%) NOMINALLY 65%

9TH LETTER: HIGH PRESSURE MELT EJECTION

A=HIGH HPME (75TH PERCENTILE OF IN-VESSEL PANEL)
 B=MODERATE HPME (50TH PERCENTILE OF IN-VESSEL PANEL)
 C=LOW HPME (25TH PERCENTILE OF IN-VESSEL PANEL)
 D=NO HPME

10TH LETTER: CONTAINMENT FAILURE SIZE

A=CATASTROPHIC RUPTURE--GROSS STRUCTURAL FAILURE
 B=RUPTURE--NOMINALLY 7 SQ. FT.
 C=LEAK--NOMINALLY 0.1 SQ. FT., (INCLUDING BMT)
 D=NO FAILURE OR BYPASS

11TH LETTER: HOLES IN RCS

A=ONE LARGE HOLE
 B=TWO LARGE HOLES

PARAMETERS TO BE SET BY ISSUES HAVE 10 LEVELS-- LEVELS 1-9
 DEFINE THE CDF, I.E., THEY ARE MINIMUM, MAXIMUM, AND 7 INTERMEDIATE
 PERCENTILES, (1%, 5%, 25%, 50%, 75%, 95%, 99%) OF CDF.
 LEVEL 10 FOR ANY ISSUE INDICATES THE "CENTRAL" LEVEL, HENCE IF ALL
 LEVELS ARE SET TO 10, THE "CENTRAL" RELEASE WILL BE GIVEN.

THE LEVELS FOR EACH SAMPLE MEMBER ARE SET BY A VECTOR, XNDX, WHERE
 XNDX(I) IS A REAL NUMBER. IF XNDX(I) IS SET TO A VALUE GREATER THAN
 OR EQUAL TO 1.0, THE "MAXIMUM" PERCENTILE VALUES FOR THE GIVEN PARAMETER
 ARE SELECTED. IF XNDX(I) IS SET TO 0.0, THE "MINIMUM" PERCENTILE VALUES
 FOR THE GIVEN PARAMETER ARE SELECTED. IF XNDX(I) IS SPECIFIED AS
 A REAL VALUE BETWEEN 0.0 AND 1.0, EITHER A LINEAR OR A LOGARITHMIC
 INTERPOLATION SCHEME IS INVOKED TO SELECT THE PROPER VALUE FOR A GIVEN
 PARAMETER. TO GET THE "CENTRAL" RELEASE MENTIONED IN THE PREVIOUS
 PARAGRAPH, SPECIFY A NEGATIVE REAL VALUE FOR XNDX(I).

DIMENSION FCORL(10,9,4),FCOR(9),FVHH(10,9),FVHP(10,9),FVIP(10,9),
 \$ FVLP(10,9),FVV(10,9),FVSG(10,9),FVES(9),

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```

$      FCONVI(10,5),VDFL(10),
$CCI(10,9,4),FCCI(9),FCONCI(10,9,5),DFSPR1(10),
$DFSPR2(10),DFSPRC(10),FPMEL(4),FPARTL(4),
$LATEIL(10),FLATE(10,9,4),FLATEX(9),FCONC(9),
$FDCHL(10,9,2),DLATE(9),DFL(9),FCONRLX(9),
$LVL(20),XNDX(200),VPSL(10,9,2),VPS(9),
$XSG(9),ST(9),STL(9),FISG(10,9,2),FOSG(10,9,2),XOSG(9),
C  $FCONRL(9),DST(9),ISSST(20)
$DST(9),ISSST(20)
REAL LATEIL,LVL
LOGICAL ISPR(4),DIAG,EARLY,TEST,I1CALL,I2CALL
CHARACTER*20 BIN
CHARACTER CHH
C  FRACTION OF CORE REMAINING IN VESSEL; THIS MAY EVENTUALLY BE
C  PASSED BY CET.  FOR THE PRESENT, THIS QUANTITY IS FIXED AT 5%.
DATA FREM/.05/
DATA FPARTL /1.,.5,.15,0./
C  FOR THE FIRST CALL TO THIS SUBROUTINE, READ IN ST DATA
IF(.NOT.I1CALL) GOTO 8550
C  BLOCK 1: FCOR=FRACTION OF EACH NUCLIDE RELEASED FROM CORE
C  CASE 1=LOW ZR OXIDATION (HIGH ZR REMAINING)
C  CASE 2=HIGH ZR OXIDATION (LOW ZR REMAINING)
READ(ISTDAT,*)((FCORL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
IF(DIAG)WRITE(IPRINT,2004)((FCORL(L,ISP,IC),ISP=1,NSP),
$  L=1,10),IC=1,2)
2004  FORMAT(/5X,'FCORL: '/(9(1PE10.1)))
C  BLOCK 2: FVES, FRACTION RELEASED FROM VESSEL
C  BASED ON RCS PRESSURE AT TIME OF VESSEL BREACH
C  FVHH: SYSTEM SETPOINT PRESSURE
C  FVHP: HIGH PRESSURE (LUMPED WITH INTERM. BY EXPERTS)
C  FVIP: HIGH OR INTERMEDIATE PRESSURE
C  FVLP: LOW PRESSURE
C  FVV: LARGE INTERFACING SYSTEM LOCA
C
READ(ISTDAT,*)((FVHH(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2010)((FVHH(L,ISP),ISP=1,NSP),
$  L=1,10)
2010  FORMAT(/5X,'FVHH: '/(9(1PE10.1)))
READ(ISTDAT,*)((FVHP(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2011)((FVHP(L,ISP),ISP=1,NSP),
$  L=1,10)
2011  FORMAT(/5X,'FVHP: '/(9(1PE10.1)))
READ(ISTDAT,*)((FVIP(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2012)((FVIP(L,ISP),ISP=1,NSP),
$  L=1,10)
2012  FORMAT(/5X,'FVIP: '/(9(1PE10.1)))
READ(ISTDAT,*)((FVLP(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2014)((FVLP(L,ISP),ISP=1,NSP),
$  L=1,10)
2014  FORMAT(/5X,'FVLP: '/(9(1PE10.1)))
READ(ISTDAT,*)((FVV(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2016)((FVV(L,ISP),ISP=1,NSP),
$  L=1,10)
2016  FORMAT(/5X,'FVV: '/(9(1PE10.1)))
C  FVES FOR SGTR
READ(ISTDAT,*)((FVSG(L,ISP),ISP=1,NSP),L=1,10)
IF(DIAG)WRITE(IPRINT,2018)((FVSG(L,ISP),ISP=1,NSP),
$  L=1,10)
2018  FORMAT(/5X,'FVSG: '/(9(1PE10.1)))
C  BLOCK 3: FISG AND FOSG
C  FISG=FRACTION ENTERING SG IN SGTR
C  FOSG=FRACTION LEAVING STEAM GENERATOR
C  CASE 1: SRV CLOSES.  CASE 2: SRV DOES NOT CLOSE

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READ(ISTDAT,*)((FISG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
  IF(DIAG)THEN
    DO 20201 IC=1,2
      WRITE(IPRINT,2020)IC,((FISG(L,ISP,IC),ISP=1,NSP),
        $      L=1,10)
20201  CONTINUE
    ENDIF
  2020  FORMAT(/5X,'FISG: '/5X,'CASE ',I3/(9(1PE10.1)))
  READ(ISTDAT,*)((FOSG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
  IF(DIAG)THEN
    DO 20221 IC=1,2
      WRITE(IPRINT,2022)IC,((FOSG(L,ISP,IC),ISP=1,NSP),
        $      L=1,10)
20221  CONTINUE
    ENDIF
  2022  FORMAT(/5X,'FOSG: '/5X,'CASE ',I3/(9(1PE10.1)))
C      BLOCK 4: VDF=DF APPLIED TO SCRUBBED V SEQUENCE.
  READ(ISTDAT,*)(VDFL(L),L=1,10)
  IF(DIAG)WRITE(IPRINT,2024)(VDFL(L),L=1,10)
  2024  FORMAT(/5X,'VDF: '/(5(1PE10.1)))
C
C      BLOCK 5: FCONV=FRACTION OF RCS RELEASE LEAVING
C      CONTAINMENT; FIVE CASES
C      CASE 1:  EARLY LEAK, DRY CONTAINMENT
C      CASE 2:  EARLY LEAK, WET CONTAINMENT
C      CASE 3:  EARLY RUPTURE
C      CASE 4:  VERY LATE RUPTURE
C      CASE 5:  V SEQUENCE
C
  READ(ISTDAT,*)((FCONVI(L,ICASE),L=1,10),ICASE=1,5)
  IF(DIAG)THEN
    DO 2222 ICASE=1,5
      WRITE(IPRINT,2025)ICASE,(FCONVI(L,ICASE),L=1,10)
2222  CONTINUE
    END IF
  2025  FORMAT(5X,'FCONV--CASE ',I3/(10(1PE10.1)))
C
C      BLOCK 6: FCONC=FRACTION OF CCI RELEASE LEAVING
C      CONTAINMENT; FIVE CASES
C      CASE 1:  EARLY LEAK (BEFORE CCI), DRY CONTAINMENT
C      CASE 2:  EARLY LEAK (BEFORE CCI), WET CONTAINMENT
C      CASE 3:  EARLY RUPTURE (BEFORE CCI)
C      CASE 4:  VERY LATE RUPTURE (AFTER CCI)
C      CASE 5:  V-SEQUENCE
C
  READ(ISTDAT,*)((FCONCI(L,ISP,ICASE),ISP=1,NSP),L=1,10),
  $  ICASE=1,5)
  IF(DIAG)THEN
    DO 2223 ICASE=1,5
      WRITE(IPRINT,2026)ICASE,((FCONCI(L,ISP,ICASE),
        $      ISP=1,NSP),L=1,10)
2223  CONTINUE
    END IF
  2026  FORMAT(5X,'FCONC--CASE ',I3/(9(1PE10.1)))
C      BLOCK 7: CCI=FRACTION OF MATERIAL REMAINING IN DEBRIS
C      RELEASED IN CCI
C      CASE 1:  LOW ZR OXIDATION (HIGH ZR REMAINING), NO WATER
C      CASE 2:  HIGH ZR OXIDATION (LOW ZR REMAINING), NO WATER
C      CASE 3:  LOW ZR OXIDATION, WATER PRESENT
C      CASE 4:  HIGH ZR OXIDATION, WATER PRESENT
  READ(ISTDAT,*)((CCI(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,4)
  IF(DIAG)WRITE(IPRINT,2028)((CCI(L,ISP,IC),ISP=1,NSP),
  $  L=1,10),IC=1,4)

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2028      FORMAT(/5X,'CCI: '/(9(1PE10.1)))
C        BLOCK 8:  SPRAY DF-S
C        DFSPR1=SPRAY DF FOR HIGH PRESSURE, EARLY
C        CONTAINMENT RUPTURE, FOR RCS RELEASE.
C        CURRENTLY ONE VALUE FOR ALL NUCLIDE GROUPS (EXCEPT NG).
      READ(ISTDAT,*)(DFSPR1(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2034)(DFSPR1(L),L=1,10)
2034      FORMAT(/5X,'DFSPR1: '/(10(1PE10.1)))
C        DFSPR2=SPRAY DF FOR ALL OTHER CASES, FOR RCS RELEASE.
      READ(ISTDAT,*)(DFSPR2(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2036)(DFSPR2(L),L=1,10)
2036      FORMAT(/5X,'DFSPR2: '/(10(1PE10.1)))
C        DFSPRC=SPRAY DF FOR CCI RELEASE
      READ(ISTDAT,*)(DFSPRC(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2038)(DFSPRC(L),L=1,10)
2038      FORMAT(/5X,'DFSPRC: '/(10(1PE10.1)))
C        BLOCK 9:  FRACTION OF IODINE REMAINING IN CONTAINMENT
C        WHICH IS CONVERTED TO VOLATILE FORMS
      READ(ISTDAT,*)(LATEIL(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2044)(LATEIL(L),L=1,10)
2044      FORMAT(/5X,'LATEIL: '/(10(1PE10.1)))
C        BLOCK 10:  FRACTION OF MATERIAL REMAINING IN RCS WHICH IS
C        REVOLATILIZED LATE IN THE ACCIDENT.
C        CASE 1: ONE HOLE IN RCS
C        CASE 2: TWO HOLES IN RCS
      READ(ISTDAT,*)((FLATE(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
      IF(DIAG)WRITE(IPRINT,2046)((FLATE(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,2)
2046      FORMAT(/5X,'FLATE: '/(9(1PE10.1)))
C        BLOCK 11:  FOR DIRECT HEATING
C        FDCH=FRACTION OF FPME RELEASED FROM CONTAINMENT (FOR EARLY CF
C        ONLY)
      READ(ISTDAT,*)((FDCHL(L,ISP,1),ISP=1,NSP),L=1,10)
      IF(DIAG)WRITE(IPRINT,2051)((FDCHL(L,ISP,1),ISP=1,NSP),L=1,10)
2051      FORMAT(/5X,'FDCHL: HI PRESSURE '/(9(1PE10.1)))
      READ(ISTDAT,*)((FDCHL(L,ISP,2),ISP=1,NSP),L=1,10)
      IF(DIAG)WRITE(IPRINT,2052)((FDCHL(L,ISP,2),ISP=1,NSP),L=1,10)
2052      FORMAT(/5X,'FDCHL: INT PRESSURE '/(9(1PE10.1)))
C        BLOCK 12:  DF FOR POOL SCRUBBING.
C        CASE 1: ACCUMULATOR WATER ONLY
C        CASE 2: FULL CAVITY
      READ(ISTDAT,*)((VPSL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
      IF(DIAG)WRITE(IPRINT,2056)((VPSL(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,2)
2056      FORMAT(/5X,'VPSL: '/(9(1PE10.1)))
C        BLOCK 13:  FRACTIONS OF CORE IN HPME (HIGH, MODERATE, LOW)
      READ(ISTDAT,*)(FPMEL(L),L=1,3)
      FPMEL(4)=0.0
      IF(DIAG)WRITE(IPRINT,20566)(FPMEL(L),L=1,3)
20566      FORMAT(5X,'FRACTION OF CORE IN HPME: '/5X,'HIGH      ',F8.3/
$      5X,'MODERATE ',F8.3/5X,'LOW      ',F8.3)
C        THIS IS THE END OF THE DATA INPUT.
8550 CONTINUE
      IF(I2CALL) THEN
        DO 10 ISS=1,NISS
          ISSUE=ISSST(ISS)
          LVL(ISS)=XNDX(ISSUE)
10        CONTINUE
      END IF
      CHH=BIN(1:1)
      EARLY=.FALSE.
      IF(CHH.LE.'D'.OR.BIN(6:6).LT.'C')EARLY=.TRUE.
      IF(DIAG)WRITE(IPRINT,1009)BIN,ISAM,(LVL(ISS),ISS=1,NISS)

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1009 FORMAT(///5X,'DIAGNOSTIC OUTPUT FOR BIN ',A20,
$ ' SAMPLE MEMBER ',I4/
$ 5X,'ST LEVELS = ',4(5F6.3,3X))
C MAIN CALCULATION
C
C SET UP SPRAY INDICES
C "TRUE" INDICATES SPRAY IS OPERATING DURING THE FOLLOWING TIME
C PERIODS.
C PERIOD 1: UP TO VESSEL BREACH (EARLY)
C PERIOD 2: VESSEL BREACH TO START OF CCI (INTERMEDIATE)
C PERIOD 3: DURING CCI (LATE)
C PERIOD 4: AFTER CCI (VERY LATE)
CALL SPRAY(BIN,ISPR)
IF(DIAG)WRITE(IPRINT,1010)(ISPR(L),L=1,4)
1010 FORMAT(5X,'"SPRAY" CALLED; ISPR = ',4L1)
C RELEASE CHARACTERISTICS
CALL RELCHAR(BIN,TW,T1,DT1,E1,T2,DT2,E2,ELEV,ISPR)
DTW=T1-TW
IF(DIAG)WRITE(IPRINT,2145)TW,DTW,T1,DT1,E1,T2,DT2,E2,ELEV
2145 FORMAT(5X,'"RELCHAR" CALLED; RELEASE CHARACTERISTICS: '/
$ 9X,'TW',7X,'DTW',6X,'T1',7X,'DT1',6X,'E1',7X,'T2',
$ 7X,'DT2',6X,'E2',7X,'ELEV'/5X,9(1PE9.1)/5X,
$ 'TIMES IN SEC.--REL. RATES IN WATTS--ELEV. IN METERS')
C IN VESSEL RELEASE FOR EACH GROUP (FCOR)
CALL CORER(BIN,NSP,FCOR,FCORL,LVL(1))
IF(DIAG)WRITE(IPRINT,1014)LVL(1),(FCOR(IS),IS=1,NSP)
1014 FORMAT(5X,'"CORER" CALLED'/5X,'LVL(1)=' ,F6.3,/5X,'FCOR = ',9(1PE
$9.1))
C IN-VESSEL RETENTION
CALL VESREL(BIN,FVES,FVHH,FVHP,FVIP,FVLP,FVV,
$ FVSG,NSP,LVL(2))
IF(DIAG)WRITE(IPRINT,1016)LVL(2),(FVES(IS),IS=1,NSP)
1016 FORMAT(5X,'"VESREL" CALLED'/5X,'LVL(2)=' ,F6.3,/5X,'FVES = ',9(1P
$E9.1))
C CALCULATE ALL FISSION PRODUCT RELEASES THROUGH RUPTURED STEAM
C GENERATOR TUBE, (FOR SGTR ONLY)
DO 195 ISP=1,NSP
XSG(ISP)=0.
XOSG(ISP)=0.
IF(BIN(6:6).EQ.'C')GOTO 195
ICASE=1
IF(BIN(6:6).EQ.'B')ICASE=2
XSG(ISP)=XINTERPLSC(LVL(11),FISG,ISP,ICASE,ILOG)
XOSG(ISP)=XINTERPLSC(LVL(11),FOSG,ISP,ICASE,ILOG)
195 CONTINUE
IF(DIAG)WRITE(IPRINT,2078)LVL(11),(XSG(ISP),ISP=1,NSP)
2078 FORMAT(5X,'LVL(11)=' ,F6.3,/5X,'RELEASE TO SG-S:' ,9(1PE9.1))
IF(DIAG)WRITE(IPRINT,20781)(XOSG(ISP),ISP=1,NSP)
20781 FORMAT(5X,'RELEASE FROM SG-S:' /5X,9(1PE9.1))
ILOG=1
VDF=1.0
IF(CHH.EQ.'B')VDF=XINTERPL(LVL(3),VDFL,ILOG)
IF(DIAG)WRITE(IPRINT,20791)LVL(3),VDF
20791 FORMAT(5X,'LVL(3)=' ,F6.3,/5X,'VDF = ',1PE10.1)
C RELEASE OF MATERIAL FROM CONTAINMENT(FCONV AND FCONC)
CALL FCONVC(BIN,ISPR,FCONVI,FCONV,FCONCI,
$ FCONC,LVL(4),LVL(6),NSP)
IF(DIAG)WRITE(IPRINT,1018)LVL(4),LVL(6),FCONV,(FCONC(IS),IS=1,NS
$P)
1018 FORMAT(5X,'"FCONVC" CALLED'/5X,'LVL(4)=' ,F6.3,/5X,'LVL(6)=' ,F6.3
$,/5X,'FCONV = ',1PE10.1/5X,'FCONC = ',9(1PE10.1))
C CCI RELEASE
CALL CCIREL(BIN,NSP,CCI,FCCI,LVL(5))

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      IF(DIAG)WRITE(IPRINT,1020)LVL(5),(FCCI(IS),IS=1,NSP)
1020  FORMAT(5X'"CCIREL" CALLED'/5X,'LVL(5)=' ,F6.3,/5X,'FCCI = ',9(1PE
      $9.1))
C     DCH RELEASE
      IDCH=ICHAR(BIN(9:9))-64
      FPME=FPMEL(IDCH)*(1.-FREM)
      IF(DIAG)WRITE(IPRINT,20777)FPME
20777 FORMAT(5X,'FRACTION OF CORE IN HPME = ',F8.4)
C     FRACTION OF CORE PARTICIPATING IN CCI
      ICCI=ICHAR(BIN(7:7))-64
C     MATERIAL REMAINING IN VESSEL, AND MATERIAL INVOLVED IN HIGH
C     PRESSURE MELT EJECTION, CANNOT PARTICIPATE IN CCI
      FPART=FPARTL(ICCI)*(1.-FREM-FPME)
      IF(DIAG)WRITE(IPRINT,10200)FPART
10200 FORMAT(5X,'FRACTION OF CORE IN CCI = ',F8.3)
C     EFFECTS OF SPRAYS
      CALL SPRDF(BIN,ISPR,DFSPR1,DFSPR2,DFSPV,DFSPRC,DFSPC,
      $LVL(7))
      IF(DIAG)WRITE(IPRINT,1022)LVL(7),DFSPV,DFSPC
1022  FORMAT(5X,'"SPRDF" CALLED;'/5X,'LVL(7) = ',F6.3,/5X,'DFSPV = ',
      $F7.1,' DFSPC = ',F7.1)
C     POOL SCRUBBING DF
C     FIND CASE (SHALLOW OR DEEP)
      ICASE=3
      ILOG=1
      IF(BIN(3:3).EQ.'B')ICASE=1
      IF(BIN(3:3).EQ.'D')ICASE=2
      DO 185 ISP=1,NSP
          IF(ICASE.EQ.3)THEN
              VPS(ISP)=1.
          ELSE
              VPS(ISP)=XINTERPLSC(LVL(12),VPSL,ISP,ICASE,ILOG)
          END IF
185    CONTINUE
      IF(DIAG)WRITE(IPRINT,2077)LVL(12),(VPS(ISP),ISF=1,NSP)
2077  FORMAT(5X,'LVL(12)=' ,F6.3,/5X,'DF(PPOOL SCRUB):',9F7.1)
C     FIND OVERALL DF
      ILOG=1
      DFE=1.0
      DO 22620 ISP=1,NSP
          DFL(ISP)=1.0
22620  CONTINUE
C     FOR V-SEQUENCE WITH WATER:
      IF(CHH.EQ.'B')THEN
          DFE=VDF
          DO 22621 ISP=2,NSP
              DFL(ISP)=AMAX1(VDF,VPS(ISP))
22621  CONTINUE
          ELSE
C     FOR ALL OTHERS:
C     OVERALL DF IS SET EQUAL TO THE LARGEST FOR ALL OPERATIVE
C     MECHANISMS. FOR EARLY CF (BEFORE CCI) DFL CANNOT BE GREATER
C     THAN WHAT THE SPRAY DF WOULD BE, IF SPRAYS WERE OPERATING.
          DFE=DFSPV
          ILOG=1
          DO 22622 ISP=2,NSP
              DFL(ISP)=AMAX1(VPS(ISP),DFSPC)
              IF((BIN(1:1).EQ.'D'.OR.BIN(1:1).EQ.'C')
              $      .AND.DFL(ISP).GT.1.)DFL(ISP)=
              $      AMIN1(DFL(ISP),XINTERPL(LVL(7),DFSPRC,ILOG))
22622  CONTINUE
          END IF
C     DO NOT ALLOW OVERALL DF-S TO EXCEED 10,000.

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      DFE=AMIN1(DFE,1.E4)
      DO 11211 ISP=2,NSP
        DFL(ISP)=AMIN1(DFL(ISP),1.E4)
11211  CONTINUE
        IF(DIAG)WRITE(IPRINT,1026)DFE,(DFL(ISP),ISP=1,NSP)
1026   FORMAT(5X,'DFE = ',F7.1/5X,'DFL: '/4X,(9(1PE10.1)))
        CALL DHEAT(BIN,FDCHL,LVL(10),NSP,DST,FCOR,DIAG,IPRINT,
$       FPME,ISPR)
        IF(DIAG)WRITE(IPRINT,17775)LVL(10),(DST(ISP),ISP=1,NSP)
17775  FORMAT(/5X,'LVL(10)=',F6.3,/, 'DCH RELEASE TO CONTAINMENT: ',/5X,9(
$1PE10.1))
        DI2=DST(2)
C       EARLY RUPTURE OR LARGE LEAK, NO EFFECT OF SPRAYS ON DCH RELEASE.
        DO 176 ISP=2,NSP
          DST(ISP)=DST(ISP)*FCONV
176    CONTINUE
          IF(BIN(1:1).EQ.'G')DST(1)=.005*DST(1)
          IF(DIAG)WRITE(IPRINT,17776)(DST(ISP),ISP=1,NSP)
17776  FORMAT(5X,'DCH RELEASE FROM CONTAINMENT: '/9(1PE10.1))
C       CALCULATE SOURCE TERMS
        FCNG=1.
        IF(BIN(1:1).EQ.'G')FCNG=.005
        ST(1)=FCOR(1)*(XSG(1)*XOSG(1)+(1.-XSG(1))*FVES(1)*FCNG)+DST(1)
        STL(1)=FPART*(1.-FCOR(1))*FCCI(1)*FCNG
        GRCS=ST(1)
        GCCI=STL(1)
        DO 200 ISP=2,NSP
          ST(ISP)=FCOR(ISP)*(XSG(ISP)*XOSG(ISP)+(1.-XSG(ISP))*
$       FVES(ISP)*FCONV/DFE)+DST(ISP)
          STL(ISP)=(1.-FCOR(ISP))*FPART*FCCI(ISP)*FCONC(ISP)/
$       DFL(ISP)
200    CONTINUE
C       "LATE" RELEASES OF GROUPS 1-3 ARE TRANSFERRED TO EARLY
C       RELEASES, IF CCI IS PROMPT AND CONTAINMENT FAILURE IS EARLY
C       IF SGTR OCCURS NOBLE GAS RELEASE IS TERMED EARLY
        IF((BIN(1:1).GT.'D'.OR.BIN(3:3).EQ.'F').AND.BIN(6:6).EQ.'C')
$       GOTO 2333
        DO 230 ISP=1,3
          ST(ISP)=ST(ISP)+STL(ISP)
          STL(ISP)=0.
230    CONTINUE
C       LATE REVOLATILIZATION FROM THE RCS. RELEASE FRACTIONS FROM
C       CONTAINMENT ARE SET EQUAL TO THOSE FOR "LATE" (CCI) Te.
2333   ILOG=0
        FCONRLX(1)=1.
        FLATEX(1)=1.
C       NOBLE GASES RELEASED IN VESSEL, NOT YET RELEASED TO CONTAINMENT
        SGQ1=FCNG
        IF(BIN(6:6).EQ.'B')SGQ1=1.
        DL1=FCOR(1)*(XSG(1)*(1.-XOSG(1))*SGQ1+(1.-XSG(1))*
$       (1.-FVES(1))*FCNG)
C       NOBLE GASES NOT YET RELEASED, FROM MATERIAL REMAINING IN RCS
        DL2=(1.-FCOR(1))*FREM*FCNG
C       NOBLE GASES IN MATERIAL LEAVING VESSEL BUT NOT IN CCI
        DL3=(1.-FCOR(1))*(1.-FPART-FREM-FPME)*FCNG
C       REVOLATILIZED NOBLE GASES
        DLATE(1)=(DL1+DL2+DL3)
        GTOT=GRCS+GCCI+DLATE(1)
        IF(DIAG)WRITE(IPRINT,7763)GRCS,GCCI,DL1,DL2,DL3,GTOT
7763  FORMAT(/5X,'NOBLE GASES: '/5X,'FROM RCS: ',1PE12.3/
$       5X,'FROM CCI: ',1PE12.3/5X,'LATE RCS: ',1PE12.3/
$       5X,'LATE REM: ',1PE12.3/5X,'LATE NCC: ',1PE12.3/
$       5X,'TOTAL      ',1PE12.3)

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C      NO REVOLATILIZATION IF NO VESSEL BREACH
      IF(BIN(5:5).EQ.'F') THEN
        DO 99570 ISP=1,NSP
          DLATE(ISP)=0.
99570    CONTINUE
        ELSE
          ICASE = ICHAR(BIN(11:11))-64
          DO 9957 ISP=2,NSP
            DFLX=DFSPC
            IF(.NOT.ISPR(4))DFLX=1.
            FCONRLX(ISP)=FCONC(4)
            FLATEX(ISP)=XINTERPLSC(LVL(9),FLATE,ISP,ICASE,ILOG)
            SGQ=0.
            IF(BIN(6:6).EQ.'B')SGQ=FCOR(ISP)*XSG(ISP)
$      *(1.-XOSG(ISP))
            DLATE(ISP)=FLATEX(ISP)*(FCOR(ISP)*(1.-XSG(ISP))*
$      (1.-FVES(ISP))+FREM*(1.-FCOR(ISP)))*FCONRLX(ISP)/DFLX
$      +FLATEX(ISP)*SGQ
            STL(ISP)=STL(ISP)+DLATE(ISP)
9957    CONTINUE
          END IF
          STL(1)=STL(1)+DLATE(1)
          IF(DIAG)WRITE(IPRINT,1050)LVL(9),(FLATEX(ISP),ISP=1,NSP),
$      (DLATE(ISP),ISP=1,NSP)
1050    FORMAT(5X,'LATE REVOLATILIZATION: ',/5X,'LVL(9)=',F6.3,/5X,
$      'FLATE = ',9(1PE10.1)/5X,'DLATE = ',9(1PE10.1))
C      MISCELLANEOUS LATE SOURCES OF IODINE
      XLATE=XINTERPL(LVL(8),LATEIL,ILOG)
      CALL CLATEI2(FCOR(2),FVES(2),FCCI(2),
$      FLATEX(2),XLATE,DIAG,IPRINT,BIN,FPART,
$      ST(2),STL(2),DI2,DLATE(2),XSG(2),XOSG(2),LVL(8))
C      IF EARLY RELEASE OVERLAPS LATE RELEASE, A FRACTION OF THE EARLY
C      RELEASE IS PUT INTO THE LATE RELEASE.
      IF(T1+DT1.GT.T2) THEN
        OVERLAP=(T1+DT1-T2)/(T1+DT1)
        DT1=AMAX1(T2-T1,0.)
        DO 7772 ISP=1,NSP
          FRACT=OVERLAP*ST(ISP)
          ST(ISP)=ST(ISP)-FRACT
          STL(ISP)=STL(ISP)+FRACT
7772    CONTINUE
        ENDIF
C      MASS BALANCE OF CORE MATERIAL
      IF(DIAG)THEN
        FM1=FREM
        FM2=FPME
        FM3=FPART
        FM4=(1.-FREM-FPME)-FPART
        SUM=FM1+FM2+FM3+FM4
        WRITE(IPRINT,1058),FM1,FM2,FM3,FM4,SUM
1058    FORMAT(/5X,'CORE DISTRIBUTION: '/
$      10X,'IN RCS          ',F7.3/
$      10X,'HPME           ',F7.3/
$      10X,'CCI            ',F7.3/
$      10X,'OTHER          ',F7.3/
$      10X,'              -----'/
$      10X,'TOTAL          ',F7.3)
        WRITE(IPRINT,1032)(ST(IS),IS=1,NSP),
$      (STL(IS),IS=1,NSP)
1032    FORMAT(5X,'SOURCE TERMS: '/5X,'RCS: ',9(1PE9.1)/
$      5X,'CCI: ',9(1PE9.1))
        END IF
C      TEST THAT RELEASES FOR ALL SPECIES DO NOT EXCEED 1.0

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TEST=.FALSE.
DO 300 ISP=1,NSP
  IF(ST(ISP)+STL(ISP)-1..GT.1.E-3)THEN
    TEST=.TRUE.
    BAD=ST(ISP)+STL(ISP)
    WRITE (IPRINT,5000)BIN,ISP,BAD
  END IF
300 CONTINUE
  IF(TEST)STOP9999
5000 FORMAT('  BIN ',A20,' GROUP ',I1,
$' ERROR IN SOURCE TERM; TOTAL RELEASE = ',E15.7)
C NOBLE GAS RELEASE SHOULD EQUAL 1.0, EXCEPT FOR BASEMAT MELTTHROUGH
C OR NO CONTAINMENT FAILURE.
  RNG=ST(1)+STL(1)
  IF(CHH.LT.'G'.AND.ABS(1.-RNG).GE.1.E-2.AND.BIN(5:5).NE.'F')THEN
    WRITE(IPRINT,5010)BIN,RNG
    STOP 9998
  END IF
5010 FORMAT('  BIN ',A20,' GROUP 1 ',
$ ' TOTAL RELEASE = ',E15.7,' SHOULD BE 1.0')
  RETURN
  END
  SUBROUTINE RELCHAR ( BIN, TW,T1,DT1,E1, T2,DT2,E2, ELEV,ISPR )
C
C Original by WBM, Autumn 1988
C Revised by RJB, 11 Feb 1989
C
  LOGICAL ISPR(4)
  CHARACTER*20 BIN
  CHARACTER CHH1, CHH3, CHH6, CHH10
C
C THIS SUBROUTINE COMPUTES THE RELEASE CHARACTERISTICS --
C WARNING TIME, RELEASE TIMES, AND ENERGY OF THE RELEASE
C ALL TIMES ARE IN SECONDS
C TW = WARNING TIME -- USUALLY THE TIME OF CORE COLLAPSE, BUT
C THE TIME THE CORE UNCOVERED (TAF) FOR V OR CF BEFORE CM
C NOTE: TW IS NOT THE WARNING INTERVAL, BUT TIME SINCE THE
C START OF THE ACCIDENT
C
C T1 = TIME OF START OF THE FIRST OR EARLY RELEASE
C ( T1 IS THE SAME AS T2, IF THERE IS NO EARLY RELEASE)
C DTW = WARNING INTERVAL = T1 - TW
C DT1 = DURATION OF THE EARLY RELEASE
C E1 = ENERGY RELEASE RATE OF THE EARLY RELEASE ( WATTS )
C
C T2 = TIME OF START OF THE SECOND OR LATE RELEASE.
C DT2 = DURATION OF THE LATE RELEASE
C E2 = ENERGY RELEASE RATE OF THE LATE RELEASE ( WATTS )
C
C ELEV = ELEVATION OF THE RELEASE ( METERS )
C
C GET THE LETTER FOR FOUR CHARACTERISTICS OF THE BIN:
C CHARACTERISTIC 1 - CF TIME
C CHARACTERISTIC 3 - CCI
C CHARACTERISTIC 6 - SGTR
C CHARACTERISTIC 10 - CF SIZE
C
C CHH1 = BIN(1:1)
C CHH3 = BIN(3:3)
C CHH6 = BIN(6:6)
C CHH10 = BIN(10:10)
C
C SET THE DEFAULT CORE UNCOVERY TIME TO 300 MINUTES = 5 HOURS
C TCU = 18000.

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Appendix A.1

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C
C SET DEFAULT RELEASE DURATIONS --
C     CHH10 = A FOR CATASTROPHIC RUPTURE ( 10 SECONDS )
C     CHH10 = B FOR RUPTURE ( 3.3 MINUTES )
C     CHH10 = C FOR LEAK OR BASEMAT MELT-THRU ( 3 HOURS )
C     CHH10 = D FOR NO CF OR BYPASS ONLY ( 24 HOURS )
C     IF ( CHH10 .EQ. 'A' ) THEN
C         DT1 = 10.
C         DT2 = 10.
C     ELSEIF ( CHH10 .EQ. 'B' ) THEN
C         DT1 = 200.
C         DT2 = 200.
C     ELSEIF ( CHH10 .EQ. 'C' ) THEN
C
C         DT1 = 10800.
C         DT2 = 10800.
C     ELSEIF ( CHH10 .EQ. 'D' ) THEN
C         DT1 = 86400.
C         DT2 = 86400.
C     ENDIF
C
C SET DEFAULT ENERGIES AND ELEVATION
C     E1 = 0.
C     E2 = 0.
C     ELEV = 10.
C
C FIRST CONSIDER THE SGTRS
C     IF ( CHH6 .NE. 'C' ) GO TO 70
C
C NEXT CONSIDER THE V's, AND THEN SORT ON CF TIME
C     IF ( CHH1 .LE. 'B' ) GO TO 10
C     IF ( CHH1 .LE. 'D' ) GO TO 30
C     IF ( CHH1 .EQ. 'E' ) GO TO 40
C     IF ( CHH1 .EQ. 'F' ) GO TO 50
C     IF ( CHH1 .EQ. 'G' ) GO TO 60
C
C V-SEQUENCE -- CHH1 = A FOR V-DRY, CHH1 = B FOR V-WET
10  TCU = 1250.
    TW = TCU
    T1 = 2400. + TCU
    DT1 = 1800.
    E1 = 3.7E6
    IF ( CHH1 .EQ. 'B' ) E1 = E1 / 2.
    T2 = 9000. + TCU
    DT2 = 21600.
    E2 = 1.7E5
    ELEV = 0.
    RETURN
C
C CF AT OR BEFORE VB -- CHH1 = C FOR CF BEFORE VB, = D FOR CF AT VB
30  TW = 4300. + TCU
    T1 = 10000. + TCU
    E1 = 5.6E9 / DT1
    IF ( ISPR(1) .OR. ISPR(2) ) E1 = E1 / 10.
    DT2 = 21600.
    E2 = 1.6E6
    IF ( ISPR(3) ) E2 = E2 / 10.
C
C DETERMINE IF CCI WILL BE PROMPT OR DELAYED --
C     CHH3 = A FOR PROMPT - DRY           CHH3 = B FOR PROMPT - SHALLOW
C     CHH3 = C FOR NO CCI                 CHH3 = D FOR PROMPT - DEEP
C     CHH3 = E FOR SHORT DELAY - DRY      CHH3 = F FOR LONG DELAY - DRY

```

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C
  IF ( CHH3 .EQ. 'C' ) GO TO 34
C  PROMPT CCI -- CHH3 = A, B, OR D
  IF ( CHH3 .LE. 'D' ) T2 = 11000. + TCU
C  SHORT DELAYED CCI -- CHH3 = E
  IF ( CHH3 .EQ. 'E' ) T2 = 16000. + TCU

C  LONG DELAYED CCI -- CHH3 = F
  IF ( CHH3 .EQ. 'F' ) T2 = 28000. + TCU
  RETURN

C
C  NO CCI -- CHH3 = C
34  T2 = 1.E6
  DT2 = 1.E6
  RETURN

C
C  LATE OR VERY LATE FAILURE -- CHH1 = E
40  TW = 4300. + TCU
  T1 = 29000. + TCU
  DT1 = 0.
  T2 = 29000. + TCU
  E2 = 7.E9 / DT2
  IF ( ISPR(3) ) E2 = E2 / 10.
  RETURN

C
C  FAILURE IN THE FINAL PERIOD ( AFTER 24 HOURS ) -- CHH1 = F
50  TW = 4300. + TCU
  T1 = 29000. + TCU
  DT1 = 0.
  T2 = 86400. + T1
  E2 = 7.E8 / DT2
  IF ( ISPR(4) ) E2 = E2 / 10.
  RETURN

C
C  NO CONTAINMENT FAILURE -- CHH1 = G
60  TW = 4300. + TCU
  T1 = 29000. + TCU
  DT1 = 0.
  T2 = T1
  DT2 = 86400.
  ELEV = 0.
  RETURN

C
C  STEAM GENERATOR TUBE RUPTURES -- SGTRs
70  E1 = 1.0E6
C  USE THE DEFAULT VALUES FOR DT2 UNLESS THERE IS NO CF,
  THEN USE 6 HOURS
  IF ( CHH10 .EQ. 'D' ) DT2 = 21600.
C  SGTRs -- SEPARATE THE "H" SGTRs FROM THE "G" SGTRs
  IF ( CHH6 .EQ. 'A' ) GO TO 80

C
C  SGTRs WITH THE SECONDARY SRVs STUCK OPEN -- HINY-NXY
C  TW = 10 HOURS, T1 = 14.2 HOURS, DT1 = 1 HOUR
  TW = 36000.
  T1 = 51000.
  DT1 = 3600.
  GO TO 83

C
C  SGTRs WITH THE SECONDARY SRVs RECLOSING -- GLYY-YaY
C  TW = 3.5 HOURS, T1 = 5.5 HOURS, DT1 = 1 HOUR
80  TW = 12600.

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Appendix A.1

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      T1 = 19800.
      DT1 = 3600.
C
C NOW SORT OUT THE CCI RELEASES
83   IF ( CHH3 .EQ. 'C' ) GO TO 88
C   PROMPT CCI -- CHH3 = A, B, OR D -- ADD 16.7 MINUTES
      IF ( CHH3 .LE. 'D' ) T2 = T1 + 1000.
C   SHORT DELAYED CCI -- CHH3 = E -- ADD 1.67 HOURS
      IF ( CHH3 .EQ. 'E' ) T2 = T1 + 6000.
C   LONG DELAYED CCI -- CHH3 = F -- ADD 5.0 HOURS
      IF ( CHH3 .EQ. 'F' ) T2 = T1 + 18000.
      RETURN
C
C NO CCI -- CHH3 = C.
88   T2 = 1.0E6
      DT2 = 1.0E6
      RETURN
      END

      SUBROUTINE CORER(BIN,NSP,FCOR,FCORL,LVL)
      REAL LVL
      CHARACTER*20 BIN
C   RELEASE OF RADIONUCLIDES FROM THE CORE.
      DIMENSION FCOR(9),FCORL(10,9,4)
      IC=ICHAR(BIN(8:8))-64
      ILOG=1
      DO 10 ISP=1,NSP
        FCOR(ISP)=XINTERPLSC(LVL,FCORL,ISP,IC,ILOG)
10     CONTINUE
      RETURN
      END
      SUBROUTINE CCIREL(BIN,NSP,CCI,FCCI,LVL)
      DIMENSION CCI(10,9,4),FCCI(9)
      REAL LVL
      CHARACTER*20 BIN
C   DEGREE OF ZR OXIDATION
      IC=ICHAR(BIN(8:8))-64
C   IS WATER PRESENT?
      IF(BIN(3:3).EQ.'B'.OR.BIN(3:3).EQ.'D') IC=IC+2
      ILOG=1
      FCCI(1)=1.0
C   CALCULATE RELEASE DURING CORE-CONCRETE INTERACTION.
      IF(BIN(3:3).EQ.'C') GOTO 20
C   NON-COOLABLE BED; CCI OCCURS.
      DO 10 ISP=2,NSP
        FCCI(ISP)=XINTERPLSC(LVL,CCI,ISP,IC,ILOG)
10     CONTINUE
      RETURN
C   PERMANENTLY COOLABLE DEBRIS BED; NO CCI OCCURS.
20     DO 30 ISP=2,NSP
        FCCI(ISP)=0.
30     CONTINUE
      RETURN
      END
      SUBROUTINE SPRAY (BIN,ISPR)
      LOGICAL ISPR(4)
      CHARACTER*20 BIN
      CHARACTER CHSP
C   SETS UP THE "ISPR" MATRIX.
C   ISPR(1) = .TRUE. : SPRAYS BEFORE VESSEL BREACH.
C   ISPR(2) = .TRUE. : SPRAYS AFTER VESSEL BREACH BUT BEFORE CCI
C   ISPR(3) = .TRUE. : SPRAYS DURING CCI.
C   ISPR(4) = .TRUE. : SPRAYS AFTER CCI.
C

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```

CHSP=BIN(2:2)
DO 10 ISP=1,4
  ISPR(ISP)=.FALSE.
10 CONTINUE
  IF(CHSP.LE.'D') ISPR(1)=.TRUE.
  IF(CHSP.GE.'B'.AND.CHSP.LE.'D') ISPR(2)=.TRUE.
  IF(CHSP.GE.'C'.AND.CHSP.LE.'F') ISPR(3)=.TRUE.
  IF(CHSP.EQ.'D'.OR.CHSP.EQ.'F'.OR.CHSP.EQ.'G') ISPR(4)=.TRUE.
  RETURN
END
SUBROUTINE CLATEI2(FCOR,FVES,FCCI,FLATE,XLATE,
$  DIAG,IPRINT,BIN,FPART,ST,STL,DI2,DLATE,XISG,XOSG,LVL)
LOGICAL DIAG
REAL LVL
CHARACTER*20 BIN
CHARACTER CHH
CHH=BIN(1:1)
C CONTRIBUTION OF MISCELLANEOUS LATE SOURCES OF IODINE,
C INCLUDING (BUT NOT LIMITED TO) ORGANIC IODIDES.
C RELRCS = FRACTION RELEASED FROM THE RCS AND CCI.
C CONTI2 = FRACTION REMAINING IN CONTAINMENT.
C RELI = FRACTION RELEASED TO THE ENVIRONMENT, FROM
CONTAINMENT.
C
C REVOLATILIZATION AND I FROM SG'S IS NOT INCLUDED
C
DSG=FCOR*XISG*XOSG
RELI=ST+STL-DLATE-DSG
FRCS=FVES*(1.-XISG)
RELRCS=FCOR*FRCS+(1.-FCOR)*FPART*FCCI+DI2
CONTI2=RELRCS-RELI
C IF 50% OR MORE HAS ALREADY BEEN RELEASED, REDUCE ADDED
C AMOUNT.
ADDI2=CONTI2*XLATE
IF(RELI.GT.0.5) ADDI2=ADDI2*2.*(1.-AMAX1(0.5,RELI))
IF(CHH.EQ.'G') ADDI2=ADDI2*.005
STL=STL+ADDI2
1000 IF(DIAG)WRITE(IPRINT,1000)LVL,XLATE,RELRCS,RELI,CONTI2,ADDI2
$ FORMAT(/5X,'LVL(8)=' ,F6.3,/5X,'XLATE = ' ,F8.4/
$ 5X,'REL. TO CONT. = ' ,1PE10.1,'REL. FROM CONT. = ' ,
$ 1PE10.1,' REM. IN CONT. = ' ,1PE10.1/5X,
$ 'ADDED IODINE = ' ,1PE10.1)
RETURN
END
SUBROUTINE VESREL(BIN,FVES,FVHH,FVHP,
$ FVIP,FVLP,FVV,FVSG,NSP,LVL)
DIMENSION FVES(9),FVHH(10,9),FVHP(10,9),FVIP(10,9),FVLP(10,9),
$ FVV(10,9),FVSG(10,9)
REAL LVL
CHARACTER CHH
CHARACTER*20 BIN
CHH=BIN(1:1)
ILOG=1
C RELEASE OF RADIONUCLIDES FROM THE VESSEL
C
C V-SEQUENCE HAS SPECIAL TREATMENT
C
IF(CHH.LE.'B')GOTO 100
IF(BIN(6:6).LE.'B')GOTO 200
IGO=ICHAR(BIN(4:4))-64
DO 10 ISP=1,NSP
  GOTO (11,12,13,14),IGO

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11          FVES (ISP)=XINTERPLS (LVL,FVHH,ISP,ILOG)
12          GOTO 10
13          FVES (ISP)=XINTERPLS (LVL,FVHP,ISP,ILOG)
14          GOTO10
15          FVES (ISP)=XINTERPLS (LVL,FVIP,ISP,ILOG)
16          GOTO10
17          FVES (ISP)=XINTERPLS (LVL,FVLP,ISP,ILOG)
18          CONTINUE
19  C      IF NO VESSEL BREACH, REDUCE RELEASE (EXCEPT NG) BY 2.0
20          IF (BIN(5:5).EQ. 'F') THEN
21              DO 17 ISP=2,NSP
22                  FVES (ISP)=FVES (ISP)/2.
23              CONTINUE
24          END IF
25          RETURN
26 100      DO 40 ISP=1,NSP
27          FVES (ISP)=XINTERPLS (LVL,FVV,ISP,ILOG)
28 40      CONTINUE
29          RETURN
30 200      DO 50 ISP=1,NSP
31          IF (BIN(6:6).EQ. 'A') THEN
32              FVES (ISP)=XINTERPLS (LVL,FVSG,ISP,ILOG)
33          ELSE
34              FVES (ISP)=XINTERPLS (LVL,FVV,ISP,ILOG)
35          END IF
36 50      CONTINUE
37          RETURN
38          END
39          SUBROUTINE FCONVC (BIN,ISPR,FCONVI,FCONV,FCONCI,
40              $      FCONC,LVL4,LVL6,NSP)
41              DIMENSION FCONVI (10,5)
42              DIMENSION FCONCI (10,9,5),FCONC (9)
43              REAL LVL4,LVL6
44              CHARACTER*20 BIN
45              LOGICAL ISPR (4)
46              CHARACTER CHH1,CHH10
47              CHH1=BIN (1:1)
48              CHH10=BIN (10:10)
49              ILOG=1
50  C      RELEASE OF MATERIAL FROM CONTAINMENT.
51  C      FCONV: RELEASE OF MATERIAL FROM RCS
52  C      FCONC: RELEASE OF MATERIAL FROM CCI
53  C
54  C      CASE 1 = EARLY SMALL LEAK, DRY CONTAINMENT.
55  C      CASE 2 = EARLY SMALL LEAK, WET CONTAINMENT.
56  C      CASE 3 = EARLY RUPTURE OR LARGE LEAK.
57  C      CASE 4 = LATE RUPTURE OR LARGE LEAK
58  C      CASE 5 = V-SEQUENCE
59  C
60          IF (CHH1.LE. 'B') GOTO 100
61          IF (CHH1.EQ. 'C') GOTO 110
62          IF (CHH1.EQ. 'D') IJ1=1
63          IF (CHH1.EQ. 'E') IJ1=2
64          IF (CHH1.EQ. 'F') IJ1=3
65          IJ2=ICHAR (CHH10)-64
66          IF (IJ1.EQ.4.OR.IJ2.EQ.4) GOTO 120
67          IGO=(IJ1-1)*3+IJ2
68          GOTO (10,20,30,40,40,60,80,80,80),IGO
69  C      CATASTROPHIC RUPTURE AT VESSEL BREACH; USE LARGE FCONV & FCONC
70 10      FM=FCONVI (5,3)
71          FI=XINTERPLC (LVL4,FCONVI,3,ILOG)
72  C      USE 95-TH PERCENTILE OF CASE 3 AS MEDIAN
73          FX=FCONVI (7,3)

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```

IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
  FCONV=1.
ELSE
  YI=FI/(1.-FI)
  YM=FM/(1.-FM)
  YS=FX/(1.-FX)
  PHI=YS/YM
  FCONV=PHI*YI/(1.+PHI*YI)
END IF
DO 11 ISP=2,NSP
  FM=FCONCI(5,ISP,3)
  FI=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
  FX=FCONCI(7,ISP,3)
  IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
    FCONC(ISP)=1.
  ELSE
    YI=FI/(1.-FI)
    YM=FM/(1.-FM)
    YS=FX/(1.-FX)
    PHI=YS/YM
    FCONC(ISP)=PHI*YI/(1.+PHI*YI)
  END IF
11 CONTINUE
FCONC(1)=1.
RETURN
C LARGE BREAK AT VESSEL BREACH
20 ICASV=3
  ICASC=3
  GOTO 150
C SMALL LEAK AT VESSEL BREACH
30 ICASV=1
  IF(ISPR(1)) ICASV=2
  ICASC=1
  IF(ISPR(1).OR.ISPR(2).OR.ISPR(3)) ICASC=2
  GOTO 150
C CATASTROPHIC RUPTURE OR RUPTURE LATE
40 IF(ISPR(2).OR.ISPR(3)) THEN
  FACTV=XINTERPLC(LVL4,FCONVI,4,ILOG)/FCONVI(5,4)
  FCONV=.01*FACTV
  ICASC=4
C FOR DELAYED CCI, A LATE CF IS THE SAME AS EARLY CF
  IF(BIN(3:3).EQ.'F') ICASC=3
  DO 41 ISP=2,NSP
    FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,ICASC,ILOG)
41 CONTINUE
  FCONC(1)=1.
  RETURN
ELSE
  ICASV=4
  ICASC=4
  IF(BIN(3:3).EQ.'F') ICASC=3
  GOTO 150
END IF
C LATE LEAK
60 IF(ISPR(2).OR.ISPR(3)) GOTO 65
C NO SPRAYS AFTER VB
  FACTV=XINTERPLC(LVL4,FCONVI,1,ILOG)/FCONVI(5,1)
  FCONV=5.E-3*FACTV
  FCONC(1)=1.
  DO 61 ISP=2,NSP
C IF CCI IS LONG DELAYED, "LATE" LEAK IS SAME AS EARLY
C USE EARLY FOR TE AND RU
  IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6) THEN

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        FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,1,ILOG)
    ELSE
        FACTC=XINTERPLSC(LVL6,FCONCI,ISP,1,ILOG)/FCONCI(5,ISP,1)
        FCONC(ISP)=1.E-2*FACTC
    END IF
61    CONTINUE
    RETURN
C    SPRAYS OPERATE AFTER VB; REMOVE RCS RELEASE
65    FACTV=XINTERPLC(LVL4,FCONVI,2,ILOG)/FCONVI(5,2)
    FCONV=.001*FACTV
    DO 67 ISP=2,NSP
        IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6)THEN
            FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)
        ELSE
            FACTC=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)/FCONCI(5,ISP,2)
            IF(ISPR(3))THEN
                FCONC(ISP)=.005*FACTC
            ELSE
                FCONC(ISP)=1.E-2*FACTC
                IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6)
                    $    FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)
            END IF
        END IF
67    CONTINUE
    FCONC(1)=1.
    RETURN
C    VERY LATE (24 HRS) RUPTURE OR LEAK
80    FCONV=1.E-6
    DO 85 ISP=2,NSP
        FACTC=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)/FCONCI(5,ISP,3)
        FCONC(ISP)=1.E-4*FACTC
85    CONTINUE
    FCONC(1)=1.
    RETURN
C    V SEQUENCE (CASE 4)
100    ICASV=5
    ICASC=5
    IF(BIN(10:10).EQ.'C')ICASC=2
    IF(BIN(10:10).LE.'B')ICASC=3
    GOTO 150
C    CONTAINMENT FAILURE BEFORE VESSEL BREACH OR ISOLATION FAILURE
110    IF(CHH10.LE.'B')THEN
C    CATASTROPHIC RUPTURE OR RUPTURE BEFORE VESSEL BREACH
        FM=FCONVI(5,3)
        FI=XINTERPLC(LVL4,FCONVI,3,ILOG)
C    ORDINARY RUPTURE USES 75-TH PERCENTILE AS MEDIAN
        FX=FCONVI(6,3)
C    CATASTROPHIC RUPTURE USES 99-TH PERCENTILE
        IF(CHH10.EQ.'A')FX=FCONVI(8,3)
        IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
            FCONV=1.
        ELSE
            YI=FI/(1.-FI)
            YM=FM/(1.-FM)
            YS=FX/(1.-FX)
            PHI=YS/YM
            FCONV=PHI*YI/(1.+PHI*YI)
        END IF
    DO 111 ISP=2,NSP
        IF(CHH10.EQ.'A')THEN
            FM=FCONCI(5,ISP,3)
            FI=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
            FX=FCONCI(8,ISP,3)

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```

      IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
        FCONC(ISP)=1.
      ELSE
        YI=FI/(1.-FI)
        YM=FM/(1.-FM)
        YS=FX/(1.-FX)
        PHI=YS/YM
        FCONC(ISP)=PHI*YI/(1.+PHI*YI)
      END IF
    ELSE
      FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
    END IF
111  CONTINUE
      FCONC(1)=1.
      RETURN
C    LEAK OR SMALL ISOLATION FAILURE BEFORE VESSEL BREACH
C    USE AVERAGE OF CASES 1 OR 2 AND 3
    ELSE
      IIFC=1
      IF(ISPR(1))IIFC=2
      F1=XINTERPLC(LVL4,FCONVI,IIFC,ILOG)
      F2=XINTERPLC(LVL4,FCONVI,3,ILOG)
      FCONV=(F1+F2)/2.
      DO 114 IS=2,NSP
        FCONC(IS)=XINTERPLSC(LVL6,FCONCI,IS,IIFC,ILOG)
114  CONTINUE
      FCONC(1)=1.
    END IF
    RETURN
C    NO FAILURE
120  FCONV=1.E-6
      FCONC(1)=.005
      DO 121 ISP=2,NSP
        FCONC(ISP)=1.E-6
121  CONTINUE
      RETURN
C    CALCULATE FCONV AND FCONC FROM GIVEN CASE
150  FCONV=XINTERPLC(LVL4,FCONVI,ICASV,ILOG)
      DO 151 ISP=2,NSP
        FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,ICASC,ILOG)
151  CONTINUE
      FCONC(1)=1.
      RETURN
END
$  SUBROUTINE SPRDF(BIN,ISPR,DFSPR1,DFSPR2,DFSPV,DFSPRC,DFSPC,
    LVL)
    DIMENSION DFSPR1(10),DFSPR2(10),DFSPRC(10)
    LOGICAL ISPR(4)
    REAL LVL
    CHARACTER*20 BIN
    CHARACTER CHH1,CHH10
    CHH1=BIN(1:1)
    CHH10=BIN(10:10)
    ILOG=1
C    DF FOR SPRAYS.
C    DFSPV IS THE DF FOR VESSEL RELEASE.  DFSPC IS
C    THE DF FOR CCI RELEASE.  NO CREDIT FOR SPRAYS (EARLY OR LATE)
C    FOR V-SEQUENCE OR LARGE CF BEFORE MELT.
C    DEFAULT IS NO SPRAYS.
      DFSPV=1.
      DFSPC=1.
      IF(CHH1.LE.'B'.OR.(CHH1.EQ.'C'.AND.CHH10.LE.'B'))RETURN
C    EARLY FAILURE

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        IF(CHH1.GT.'D')GOTO 100
        IF(ISPR(3))DFSPC=XINTERPL(LVL,DFSPRC,ILOG)
        IF(BIN(4:4).LE.'B'.AND.CHH10.LE.'B')THEN
            IF(ISPR(1))DFSPV=XINTERPL(LVL,DFSPR1,ILOG)
        ELSE
            IF(ISPR(1))DFSPV=XINTERPL(LVL,DFSPR2,ILOG)
        END IF
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
        DFSPC=AMIN1(DFSPC,1.E4)
        DFSPV=AMIN1(DFSPV,1.E4)
        RETURN
100    IF(CHH1.GT.'E')GOTO 110
        IF(ISPR(1).OR.ISPR(2).OR.ISPR(3))DFSPV=
$      10.*XINTERPL(LVL,DFSPR2,ILOG)
        IF(ISPR(3))DFSPC=XINTERPL(LVL,DFSPRC,ILOG)
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
        DFSPC=AMIN1(DFSPC,1.E4)
        DFSPV=AMIN1(DFSPV,1.E4)
        RETURN
110    IF(ISPR(1).OR.ISPR(2).OR.ISPR(3).OR.ISPR(4))
$      DFSPV=10.*XINTERPL(LVL,DFSPR2,ILOG)
        IF(ISPR(3).OR.ISPR(4))DFSPC=10.*XINTERPL(LVL,DFSPRC,ILOG)
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
        DFSPC=AMIN1(DFSPC,1.E4)
        DFSPV=AMIN1(DFSPV,1.E4)
        RETURN
        END
        SUBROUTINE DHEAT(BIN,FDCHL,LDCH,NSP,DST,FCOR,DIAG,IPRINT,FPME,ISPR)
C
C      MODEL DEVELOPED BY D. A. POWERS
C      DCH RELEASE OF NUCLIDE "I": (ADDITION TO ST "I")
C      DST(I)=(1.-FCOR(I))*FPME*FDCH(I)
C      FPME=FRACTION OF CORE PARTICIPATING IN PRESSURIZED MELT EJECTION
C      FPME ASSUMED NOT TO PARTICIPATE IN CCI
C      FDCH(I)=FRACTION OF EJECTED MELT RELEASED TO CONTAINMENT
        DIMENSION FDCHL(10,9,2),DST(9),FCOR(9),FDCH(9)
        LOGICAL DIAG,ISPR(4)
        REAL LDCH
        CHARACTER*20 BIN
C      CONTRIBUTION DUE TO AEROSOLIZATION IS ONLY CALCULATED FOR
C      CONTAINMENT FAILURE AT VESSEL BREACH.
C      NOT CALCULATED FOR LOW PRESSURE SEQUENCES
        DO 1 ISP=1,NSP
            DST(ISP)=0.
1        CONTINUE
            IF(FPME.EQ.0..OR.BIN(4:4).GT.'C')RETURN
C          CASE 1: HIGH PRESSURE
C          CASE 2: INTERMEDIATE PRESSURE
            IC=1
            IF(BIN(4:4).GT.'B')IC=2
C          CONTAINMENT FAILURE LATE: DO NOT CALCULATE DCH RELEASE
C          EARLY LEAK AND SPRAYS OPERATE: DO NOT CALCULATE DCH RELEASE
            IF((BIN(1:1).EQ.'D'.OR.BIN(1:1).EQ.'C')
$          .AND.(BIN(10:10).LE.'B'.OR.BIN(10:10).
$          EQ.'C'.AND..NOT.ISPR(1))) GOTO 5
            IF(DIAG)WRITE(IPRINT,950)
950    FORMAT(5X,'DCH RELEASE NOT CALCULATED')
            DST(1)=(1.-FCOR(1))*FPME
            RETURN
5        ILOG=1
        DO 10 ISP=1,NSP
            FDCH(ISP)=XINTERPLSC(LDCH,FDCHL,ISP,IC,ILOG)
            DST(ISP)=(1.-FCOR(ISP))*FPME*FDCH(ISP)

```

```

10      CONTINUE
1000    IF (DIAG)WRITE(IPRINT,1000)(FDCH(ISP),ISP=1,NSP)
      FORMAT(5X,'FDCH = ',9(1PE8.1))
      RETURN
      END
      SUBROUTINE WEIGHT (NSP,ST,WE,WL)
      DIMENSION ST(9),WFE(9),WFL(9)
      DATA (WFE(I),I=1,9)/.08,1.,.12,.78,.8,2.13,8.31,8.,.55/
      DATA (WFL(I),I=1,9)/.0011,.1,1.,.104,.7,1.19,2.62,5.4,.2/
      WE=0.
      WL=0.
      DO 10 ISP=1,NSP
        WE=WE+ST(ISP)*WFE(ISP)
        WL=WL+ST(ISP)*WFL(ISP)
10      CONTINUE
      RETURN
      END
      REAL FUNCTION XINTERPL(LEVEL,PARAM,ILOG)
      DIMENSION PARAM(10),CDF(9),PARAMX(10)
      REAL LEVEL
      DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
      IF(LEVEL.LT.0.)THEN
        XINTERPL=PARAM(10)
        RETURN
      ELSE IF(LEVEL.GE.1.)THEN
        XINTERPL=PARAM(9)
        RETURN
      ELSE IF(LEVEL.EQ.0.)THEN
        XINTERPL=PARAM(1)
        RETURN
      ELSE
        IF(ILOG.EQ.0)THEN
          DO 2 L=1,9
            PARAMX(L)=PARAM(L)
2          CONTINUE
          ELSE
            DO 4 L=1,9
              PARAMX(L)=LOG(PARAM(L))
4            CONTINUE
          END IF
          DO 6 L=2,9
            IF(CDF(L).LE.LEVEL)GOTO 6
            FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
            GOTO 8
6          CONTINUE
          L=9
          FR=1.
8          XINTERPL=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
          IF(ILOG.GT.0)XINTERPL=EXP(XINTERPL)
          RETURN
        END IF
      END
      REAL FUNCTION XINTERPLS(LEVEL,PARAM,ISP,ILOG)
      DIMENSION PARAM(10,9),PARAMX(10),CDF(9)
      REAL LEVEL
      DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
      IF(LEVEL.LT.0.)THEN
        XINTERPLS=PARAM(10,ISP)
        RETURN
      ELSE IF(LEVEL.GE.1.)THEN
        XINTERPLS=PARAM(9,ISP)
        RETURN
      ELSE IF(LEVEL.EQ.0.)THEN

```

2 of 4

Appendix A.1

```

        XINTERPLS=PARAM(1,ISP)
        RETURN
    ELSE
        IF(ILOG.EQ.0)THEN
            DO 2 L=1,9
                PARAMX(L)=PARAM(L,ISP)
2            CONTINUE
            ELSE
                DO 4 L=1,9
                    PARAMX(L)=LOG(PARAM(L,ISP))
4                CONTINUE
                END IF
                DO 6 L=2,9
                    IF(CDF(L).LE.LEVEL)GOTO 6
                    FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
                    GOTO 8
6                CONTINUE
                L=9
                FR=1.
8                XINTERPLS=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
                IF(ILOG.GT.0)XINTERPLS=EXP(XINTERPLS)
                RETURN
            END IF
        END
    REAL FUNCTION XINTERPLSC(LEVEL,PARAM,ISP,ICASE,ILOG)
    DIMENSION PARAM(10,9,5),PARAMX(9),CDF(9)
    REAL LEVEL
    DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
    IF(LEVEL.LT.0.)THEN
        XINTERPLSC=PARAM(10,ISP,ICASE)
        RETURN
    ELSE IF(LEVEL.GE.1.)THEN
        XINTERPLSC=PARAM(9,ISP,ICASE)
        RETURN
    ELSE IF (LEVEL.EQ.0.) THEN
        XINTERPLSC=PARAM(1,ISP,ICASE)
        RETURN
    ELSE
        IF(ILOG.EQ.0)THEN
            DO 2 L=1,9
                PARAMX(L)=PARAM(L,ISP,ICASE)
2            CONTINUE
            ELSE
                DO 4 L=1,9
                    PARAMX(L)=LOG(PARAM(L,ISP,ICASE))
4                CONTINUE
                END IF
                DO 6 L=2,9
                    IF(CDF(L).LE.LEVEL)GOTO 6
                    FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
                    GOTO 8
6                CONTINUE
                L=9
                FR=1.
8                XINTERPLSC=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
                IF(ILOG.GT.0)XINTERPLSC=EXP(XINTERPLSC)
                RETURN
            END IF
        END
    REAL FUNCTION XINTERPLC(LEVEL,PARAM,ICASE,ILOG)
    DIMENSION PARAM(10,4),PARAMX(9),CDF(9)
    REAL LEVEL
    DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./

```



```

IF (LEVEL.LT.0.) THEN
  XINTERPLC=PARAM(10, ICASE)
  RETURN
ELSE IF (LEVEL.GE.1.) THEN
  XINTERPLC=PARAM(9, ICASE)
  RETURN
ELSE IF (LEVEL.EQ.0.) THEN
  XINTERPLC=PARAM(1, ICASE)
  RETURN
ELSE
  IF (ILOG.EQ.0) THEN
    DO 2 L=1,9
      PARAMX(L)=PARAM(L, ICASE)
2     CONTINUE
    ELSE
      DO 4 L=1,9
        PARAMX(L)=LOG(PARAM(L, ICASE))
4     CONTINUE
    END IF
    DO 6 L=2,9
      IF (CDF(L).LE.LEVEL) GOTO 6
      FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
      GOTO 8
6     CONTINUE
      L=9
      FR=1.
8     XINTERPLC=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
      IF (ILOG.GT.0) XINTERPLC=EXP(XINTERPLC)
    RETURN
  END IF
END

```

APPENDIX A.2 SURSOR Data Base

8.0E-02	2.0E-02	1.0E-02	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09
9.9E-02	3.3E-02	2.4E-02	2.3E-03	3.0E-05	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.1E-04
1.8E-01	8.4E-02	6.7E-02	1.3E-02	1.5E-04	1.0E-09	1.0E-09	1.0E-09	1.0E-09	2.2E-04
8.0E-01	3.7E-01	3.0E-01	7.6E-02	7.6E-04	5.0E-05	2.0E-05	2.0E-05	2.0E-05	1.7E-03
9.0E-01	6.9E-01	5.9E-01	2.0E-01	4.0E-03	2.0E-03	1.0E-04	1.5E-04	6.4E-03	
1.0E+00	9.1E-01	8.3E-01	4.6E-01	1.3E-02	1.2E-02	9.5E-04	2.5E-03	2.7E-02	
1.0E+00	1.0E+00	1.0E+00	8.9E-01	5.2E-01	5.8E-02	2.1E-02	8.5E-02	5.2E-01	
1.0E+00	1.0E+00	1.0E+00	9.8E-01	1.0E+00	1.4E-01	1.0E-01	5.1E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.7E-01	1.1E-01	1.0E+00	1.0E+00	
1.0E+00	9.9E-01	9.9E-01	2.7E-01	1.3E-01	1.0E-06	1.0E-07	1.0E-07	1.3E-01	
9.9E-02	9.9E-02	3.5E-02	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.6E-01	1.4E-01	8.1E-02	3.0E-03	1.0E-09	1.0E-09	1.0E-09	1.0E-09	2.2E-04	
4.2E-01	2.8E-01	1.7E-01	1.8E-02	2.5E-04	1.0E-09	1.0E-09	1.0E-09	1.2E-03	
8.0E-01	5.6E-01	4.2E-01	9.7E-02	2.1E-03	5.0E-05	2.0E-05	2.0E-05	4.2E-03	
9.2E-01	7.5E-01	8.2E-01	3.3E-01	6.4E-03	4.6E-03	1.0E-04	1.5E-04	8.6E-03	
1.0E+00	9.6E-01	8.9E-01	5.9E-01	1.8E-02	2.0E-02	1.2E-03	3.0E-03	3.0E-02	
1.0E+00	1.0E+00	1.0E+00	9.1E-01	5.1E-01	8.1E-02	2.1E-02	8.5E-02	5.2E-01	
1.0E+00	1.0E+00	1.0E+00	9.9E-01	1.0E+00	1.4E-01	1.0E-01	5.1E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.9E-01	1.1E-01	1.0E+00	1.0E+00	
1.0E+00	9.9E-01	9.9E-01	8.4E-01	1.3E-01	1.0E-06	1.0E-07	1.0E-07	1.3E-01	FCOR*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	9.3E-03	5.1E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	
1.0E+00	8.6E-02	4.2E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	
1.0E+00	3.5E-01	3.5E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	
1.0E+00	7.7E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	
1.0E+00	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	2.4E-01	2.0E-01	1.5E-01	1.1E-01	1.0E-01	1.0E-01	1.0E-01	1.1E-01	FVHH*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	9.3E-03	5.1E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	
1.0E+00	8.6E-02	4.2E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	
1.0E+00	3.5E-01	3.5E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	
1.0E+00	7.7E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	
1.0E+00	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	2.8E-01	2.8E-01	9.0E-02	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	FVHP*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	
1.0E+00	1.1E-02	9.0E-03	8.0E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	
1.0E+00	2.0E-01	1.3E-01	1.2E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	
1.0E+00	4.1E-01	2.9E-01	2.5E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	
1.0E+00	6.1E-01	5.9E-01	4.3E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	
1.0E+00	8.9E-01	8.9E-01	8.9E-01	8.7E-01	8.7E-01	8.7E-01	8.7E-01	8.7E-01	
1.0E+00	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	5.0E-01	5.0E-01	2.0E-02	3.4E-01	3.4E-01	3.4E-01	3.4E-01	3.4E-01	FVIP*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	2.5E-02	1.1E-02	5.9E-03	5.9E-03	5.9E-03	5.9E-03	5.9E-03	5.9E-03	
1.0E+00	1.2E-01	7.2E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	
1.0E+00	3.1E-01	2.0E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	
1.0E+00	5.2E-01	4.0E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	
1.0E+00	8.7E-01	8.7E-01	6.7E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01	
1.0E+00	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	8.7E-01	8.7E-01	8.3E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	FVLP*
1.0E+00	6.5E-02	6.2E-02	5.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	
1.0E+00	7.9E-02	1.4E-01	5.3E-02	8.5E-02	8.5E-02	8.5E-02	8.5E-02	8.5E-02	

1.0E+00 1.6E-01 1.5E-01 6.4E-02 1.0E-01 1.0E-01 1.0E-01 1.0E-01 1.0E-01
 1.0E+00 4.1E-01 4.0E-01 1.1E-01 1.7E-01 1.7E-01 1.7E-01 1.7E-01 1.7E-01
 1.0E+00 6.1E-01 6.0E-01 2.5E-01 3.5E-01 3.5E-01 3.5E-01 3.5E-01 3.5E-01
 1.0E+00 7.9E-01 7.8E-01 5.5E-01 6.7E-01 6.7E-01 6.7E-01 6.7E-01 6.7E-01
 1.0E+00 9.8E-01 9.7E-01 9.3E-01 9.6E-01 9.6E-01 9.6E-01 9.6E-01 9.6E-01
 1.0E+00 9.9E-01 9.9E-01 9.8E-01 9.9E-01 9.9E-01 9.9E-01 9.9E-01 9.9E-01
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 2.0E-01 2.0E-01 1.0E-01 1.0E-01 1.0E-01 1.0E-01 1.0E-01 1.0E-01 FVW*

1.0E+00 9.0E-03 8.9E-03 7.1E-02 1.0E-02 7.5E-03 1.0E-02 1.0E-02 1.0E-01
 1.0E+00 1.1E-02 2.2E-02 7.3E-02 2.2E-02 7.9E-03 1.1E-02 1.1E-02 1.1E-02
 1.0E+00 2.4E-02 2.4E-02 8.8E-02 1.3E-02 9.4E-03 1.3E-02 1.3E-02 1.3E-02
 1.0E+00 8.3E-02 8.3E-02 1.5E-01 2.3E-02 1.7E-02 2.3E-02 2.3E-02 2.3E-02
 1.0E+00 1.7E-01 1.7E-01 3.2E-01 5.8E-02 4.4E-02 5.8E-02 5.8E-02 5.8E-02
 1.0E+00 3.3E-01 3.3E-01 6.3E-01 1.9E-01 1.5E-01 1.9E-01 1.9E-01 1.9E-01
 1.0E+00 8.7E-01 8.2E-01 9.5E-01 7.3E-01 6.7E-01 7.3E-01 7.3E-01 7.3E-01
 1.0E+00 9.3E-01 9.3E-01 9.9E-01 9.2E-01 8.9E-01 9.2E-01 9.2E-01 9.2E-01
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.7E-01 1.7E-01 3.2E-01 5.8E-02 4.4E-02 5.8E-02 5.8E-02 5.8E-02 FVSG*

1.5E-01 6.6E-02 6.4E-02 2.6E-01 1.4E-01 1.5E-01 1.5E-01 1.5E-01 1.4E-01
 1.7E-01 7.3E-02 9.9E-02 2.6E-01 1.5E-01 1.5E-01 1.5E-01 1.5E-01 1.5E-01
 2.5E-01 1.1E-01 1.0E-01 2.9E-01 1.6E-01 1.7E-01 1.7E-01 1.7E-01 1.6E-01
 4.4E-01 2.0E-01 2.0E-01 3.8E-01 2.2E-01 2.2E-01 2.2E-01 2.2E-01 2.2E-01
 5.8E-01 2.9E-01 2.8E-01 5.6E-01 3.3E-01 3.4E-01 3.4E-01 3.4E-01 3.3E-01
 7.2E-01 4.1E-01 3.9E-01 8.5E-01 5.3E-01 5.4E-01 5.4E-01 5.4E-01 5.3E-01
 9.5E-01 8.5E-01 7.7E-01 1.0E+00 9.0E-01 9.0E-01 9.0E-01 9.0E-01 9.0E-01
 9.8E-01 9.2E-01 9.2E-01 1.0E+00 9.7E-01 9.8E-01 9.8E-01 9.8E-01 9.8E-01
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 5.9E-01 2.9E-01 2.8E-01 5.6E-01 3.3E-01 3.4E-01 3.4E-01 3.4E-01 3.3E-01

1.0E+00 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
 1.0E+00 4.9E-07 4.9E-07 5.2E-07 5.2E-07 5.2E-07 5.2E-07 5.2E-07 5.2E-07
 1.0E+00 2.8E-05 2.8E-07 3.8E-05 3.8E-05 3.8E-05 3.8E-05 3.8E-05 3.8E-05
 1.0E+00 7.3E-02 6.2E-02 4.0E-02 3.0E-02 3.0E-02 3.0E-02 3.0E-02 3.0E-02
 1.0E+00 2.7E-01 2.6E-01 1.7E-01 2.4E-01 2.4E-01 2.4E-01 2.4E-01 2.4E-01
 1.0E+00 5.6E-01 5.5E-01 4.3E-01 5.5E-01 5.5E-01 5.5E-01 5.5E-01 5.5E-01
 1.0E+00 8.0E-01 7.8E-01 7.7E-01 7.6E-01 7.6E-01 7.6E-01 7.6E-01 7.6E-01
 1.0E+00 9.6E-01 9.5E-01 9.4E-01 9.1E-01 9.1E-01 9.1E-01 9.1E-01 9.1E-01
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 2.7E-01 2.6E-01 1.7E-01 2.4E-01 2.4E-01 2.4E-01 2.4E-01 2.4E-01 F1SG*

1.8E-01 1.2E-01 1.2E-01 2.3E-01 2.3E-01 2.3E-01 2.3E-01 2.3E-01 2.3E-01
 2.0E-01 1.3E-01 1.9E-01 2.3E-01 2.4E-01 2.3E-01 2.4E-01 2.4E-01 2.4E-01
 2.9E-01 2.0E-01 2.0E-01 2.6E-01 2.6E-01 2.5E-01 2.5E-01 2.6E-01 2.6E-01
 5.0E-01 3.7E-01 3.8E-01 3.4E-01 3.5E-01 3.4E-01 3.5E-01 3.5E-01 3.5E-01
 6.7E-01 5.3E-01 5.4E-01 5.0E-01 5.2E-01 5.3E-01 5.3E-01 5.3E-01 5.3E-01
 8.4E-01 7.4E-01 7.6E-01 7.2E-01 8.4E-01 8.3E-01 8.4E-01 8.4E-01 8.4E-01
 1.0E+00 1.0E+00 1.0E+00 9.2E-01 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.0E+00 1.0E+00 9.4E-01 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.0E+00 1.0E+00 9.4E-01 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 6.7E-01 5.3E-01 5.4E-01 5.0E-01 5.2E-01 5.3E-01 5.3E-01 5.3E-01 5.3E-01

1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
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 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00
 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 FOSG*

5.1E+03 4.5E+03 4.1E+03 1.3E+02 6.2E+00 3.0E+00 1.8E+00 1.7E+00 1.6E+00 5.0E+00 VDF*

1.0E-03 2.0E-03 6.0E-03 5.8E-02 1.4E-01 3.6E-01 6.9E-01 7.8E-01 8.0E-01 1.0E-01
 1.0E-03 2.0E-03 7.0E-03 8.6E-02 1.8E-01 4.2E-01 7.1E-01 7.9E-01 8.9E-01 1.0E-01
 1.8E-02 8.0E-02 2.1E-01 4.2E-01 5.8E-01 7.6E-01 8.9E-01 9.6E-01 9.8E-01 8.0E-01
 3.0E-05 7.0E-05 2.0E-04 2.0E-03 2.2E-02 6.8E-02 2.1E-01 2.9E-01 4.5E-01 1.0E-01
 1.3E-02 5.9E-02 1.6E-01 3.4E-01 5.0E-01 7.0E-01 8.6E-01 9.5E-01 9.7E-01 8.0E-01 FCONV*

1.0E+00 1.0E-03 1.0E-03 1.0E-03 1.0E-03 1.0E-03 1.0E-03 1.0E-03 1.0E-03
 1.0E+00 2.0E-03 2.0E-04 4.0E-03 4.0E-03 4.0E-03 4.0E-03 4.0E-03 4.0E-03

Appendix A.2

1.0E+00	6.0E-03	6.0E-03	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02
1.0E+00	5.8E-02	5.8E-02	6.5E-02	6.5E-02	6.5E-02	6.5E-02	6.5E-02	6.5E-02	6.5E-02
1.0E+00	1.5E-01	1.5E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01
1.0E+00	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01
1.0E+00	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01	6.7E-01
1.0E+00	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01
1.0E+00	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01
1.0E+00	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
1.0E+00	1.0E-03	1.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03
1.0E+00	2.0E-03	2.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
1.0E+00	7.0E-03	7.0E-03	1.7E-02	1.7E-02	1.7E-02	1.7E-02	1.7E-02	1.7E-02	1.7E-02
1.0E+00	8.6E-02	8.6E-02	9.6E-02	9.6E-02	9.6E-02	9.6E-02	9.6E-02	9.6E-02	9.6E-02
1.0E+00	1.9E-01	1.9E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01
1.0E+00	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01
1.0E+00	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01
1.0E+00	7.9E-01	7.9E-01	7.9E-01	7.9E-01	7.9E-01	7.9E-01	7.9E-01	7.9E-01	7.9E-01
1.0E+00	8.9E-01	8.9E-01	8.9E-01	8.9E-01	8.9E-01	8.9E-01	8.9E-01	8.9E-01	8.9E-01
1.0E+00	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
1.0E+00	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03
1.0E+00	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02
1.0E+00	1.7E-01	1.7E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
1.0E+00	4.3E-01	4.3E-01	3.9E-01	3.9E-01	3.9E-01	3.9E-01	3.9E-01	3.9E-01	3.9E-01
1.0E+00	6.3E-01	6.3E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01
1.0E+00	7.7E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01
1.0E+00	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01
1.0E+00	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01
1.0E+00	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01
1.0E+00	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
1.0E+00	1.0E-09	1.0E-09	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
1.0E+00	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
1.0E+00	2.0E-03	2.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03
1.0E+00	1.2E-02	1.2E-02	3.0E-02	1.8E-02	3.0E-02	1.8E-02	1.8E-02	1.8E-02	1.8E-02
1.0E+00	4.5E-02	4.5E-02	8.5E-02	6.3E-02	8.5E-02	6.3E-02	6.3E-02	6.3E-02	6.3E-02
1.0E+00	1.0E-01	1.0E-01	1.9E-01	1.2E-01	1.9E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01
1.0E+00	2.1E-01	2.1E-01	4.8E-01	2.6E-01	4.8E-01	2.6E-01	2.6E-01	2.6E-01	2.6E-01
1.0E+00	2.9E-01	2.9E-01	7.3E-01	3.4E-01	7.3E-01	3.4E-01	3.4E-01	3.4E-01	3.4E-01
1.0E+00	4.9E-01	4.9E-01	9.0E-01	5.5E-01	9.0E-01	5.5E-01	5.5E-01	5.5E-01	5.5E-01
1.0E+00	1.0E-01	1.0E-01	3.7E-01	1.6E-01	3.7E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01
1.0E+00	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03
1.0E+00	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02
1.0E+00	1.1E-01	1.1E-01	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02
1.0E+00	3.1E-01	3.1E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01
1.0E+00	5.0E-01	5.0E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01
1.0E+00	6.6E-01	6.6E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01
1.0E+00	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01
1.0E+00	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01
1.0E+00	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01
1.0E+00	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	CONC*
1.0E+00	1.0E+00	1.0E+00	5.8E-03	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09
1.0E+00	1.0E+00	1.0E+00	1.3E-02	1.0E-05	1.0E-09	1.0E-09	1.0E-09	1.0E-09	6.0E-05
1.0E+00	1.0E+00	1.0E+00	6.0E-02	2.7E-04	1.2E-09	1.0E-05	1.0E-05	3.6E-04	
1.0E+00	1.0E+00	1.0E+00	2.9E-01	1.6E-03	2.4E-09	2.2E-04	2.3E-04	2.0E-03	
1.0E+00	1.0E+00	1.0E+00	5.5E-01	3.4E-02	5.6E-09	7.1E-04	9.7E-04	2.5E-02	
1.0E+00	1.0E+00	1.0E+00	6.5E-01	1.9E-01	5.0E-06	1.5E-02	1.6E-02	1.4E-01	
1.0E+00	1.0E+00	1.0E+00	9.6E-01	7.7E-01	7.3E-03	9.2E-02	9.6E-02	6.7E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	9.0E-01	9.7E-02	1.7E-01	1.7E-01	8.7E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.5E-01	2.2E-01	2.2E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	3.3E-01	1.1E-01	1.0E-05	5.4E-04	5.4E-04	1.1E-01	
1.0E+00	1.0E+00	1.0E+00	3.9E-03	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	1.0E+00	1.0E+00	8.9E-03	1.0E-05	1.0E-09	1.0E-09	1.0E-09	3.0E-05	
1.0E+00	1.0E+00	1.0E+00	4.0E-02	1.8E-04	1.2E-09	1.0E-05	1.0E-09	2.7E-04	
1.0E+00	1.0E+00	1.0E+00	1.8E-01	1.5E-03	2.4E-09	2.2E-04	2.2E-04	1.3E-03	
1.0E+00	1.0E+00	1.0E+00	4.9E-01	1.7E-02	5.6E-09	6.3E-04	7.2E-04	1.2E-02	
1.0E+00	1.0E+00	1.0E+00	6.6E-01	1.4E-01	5.0E-06	7.8E-03	8.1E-03	8.0E-02	
1.0E+00	1.0E+00	1.0E+00	9.1E-01	5.9E-01	7.3E-03	8.8E-02	8.8E-02	4.8E-01	
1.0E+00	1.0E+00	1.0E+00	9.7E-01	8.6E-01	9.7E-02	1.7E-01	1.7E-01	8.4E-01	
1.0E+00	1.0E+00	1.0E+00	9.9E-01	1.0E+00	2.5E-01	2.2E-01	2.2E-01	1.0E+00	

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1.0E+00 1.0E+00 1.0E+00 3.3E-01 1.1E-01 1.0E-05 5.4E-04 5.4E-04 1.1E-01

1.0E+00 1.0E+00 1.0E+00 1.4E-03 1.0E-09 1.0E-09 1.0E-09 1.0E-09 1.0E-09
1.0E+00 1.0E+00 1.0E+00 4.7E-03 1.0E-05 1.0E-09 1.0E-09 1.0E-09 3.0E-05
1.0E+00 1.0E+00 1.0E+00 2.7E-02 1.7E-04 1.1E-09 1.0E-05 1.0E-09 2.7E-04
1.0E+00 1.0E+00 1.0E+00 1.7E-01 1.5E-03 1.3E-09 1.6E-04 2.2E-04 1.3E-03
1.0E+00 1.0E+00 1.0E+00 4.2E-01 1.7E-02 1.7E-09 4.6E-04 7.5E-04 1.2E-02
1.0E+00 1.0E+00 1.0E+00 6.1E-01 1.4E-01 1.0E-06 7.6E-03 8.6E-03 8.3E-02
1.0E+00 1.0E+00 1.0E+00 9.3E-01 6.4E-01 2.5E-03 8.4E-02 8.8E-02 5.3E-01
1.0E+00 1.0E+00 1.0E+00 9.9E-01 8.7E-01 5.8E-02 1.6E-01 1.7E-01 8.6E-01
1.0E+00 1.0E+00 1.0E+00 9.9E-01 1.0E+00 1.5E-01 2.2E-01 2.2E-01 1.0E+00
1.0E+00 1.0E+00 1.0E+00 3.3E-01 1.1E-01 1.0E-05 5.4E-04 5.4E-04 1.1E-01

1.0E+00 1.0E+00 1.0E+00 9.6E-04 1.0E-09 1.0E-09 1.0E-09 1.0E-09 1.0E-09
1.0E+00 1.0E+00 1.0E+00 3.2E-03 1.0E-09 1.0E-09 1.0E-09 1.0E-09 1.0E-05
1.0E+00 1.0E+00 1.0E+00 1.9E-02 1.0E-04 1.1E-09 1.0E-09 1.0E-09 2.1E-04
1.0E+00 1.0E+00 1.0E+00 1.5E-01 1.5E-03 1.3E-09 1.1E-04 2.0E-04 9.7E-04
1.0E+00 1.0E+00 1.0E+00 3.9E-01 1.5E-02 1.7E-09 4.3E-04 5.1E-04 9.3E-03
1.0E+00 1.0E+00 1.0E+00 6.0E-01 1.3E-01 1.0E-06 7.3E-03 7.9E-03 6.8E-02
1.0E+00 1.0E+00 1.0E+00 8.8E-01 4.6E-01 2.5E-03 8.4E-02 8.4E-02 3.7E-01
1.0E+00 1.0E+00 1.0E+00 9.6E-01 8.5E-01 5.8E-02 1.6E-01 1.6E-01 8.3E-01
1.0E+00 1.0E+00 1.0E+00 9.7E-01 1.0E+00 1.5E-01 2.3E-01 2.3E-01 1.0E+00
1.0E+00 1.0E+00 1.0E+00 3.3E-01 1.1E-01 1.0E-05 5.4E-04 5.4E-04 1.1E-01 FCCI*

2.8E+00 2.6E+00 2.2E+00 2.0E+00 1.8E+00 1.7E+00 1.6E+00 1.4E+00 1.0E+00 2.6E+00 DFSPR1*

2.8E+03 2.6E+03 1.8E+3 7.4E+01 4.0E+01 9.4E+00 3.0E+00 2.4E+00 2.3E+00 4.5E+01 DFSPR2*

3.2E+03 2.9E+03 2.0E+03 2.8E+02 2.8E+01 1.4E+01 7.7E+00 6.8E+00 6.7E+00 3.0E+01 DFSPRC*

0.0E+00 1.0E-03 5.0E-03 1.0E-02 5.0E-02 8.0E-02 1.0E-01 1.0E-01 1.0E-01 6.0E-03 LATEIL*

1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.1E-02 1.0E-03 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 4.5E-02 2.3E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E-01 7.2E-02 2.4E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 4.4E-01 1.7E-01 2.1E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 8.0E-01 2.5E-01 4.1E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E+00 7.5E-01 8.0E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 3.6E-02 2.7E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.3E-01 9.5E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 3.0E-01 2.7E-01 7.7E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 7.2E-01 7.0E-01 6.3E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 9.2E-01 9.1E-01 8.9E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E+00 1.0E+00 1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 FLATE*

1.0E+00 6.7E-01 6.7E-01 2.3E-03 5.2E-05 5.0E-05 5.2E-05 5.2E-05 5.2E-05
1.0E+00 6.7E-01 6.7E-01 3.4E-03 7.0E-05 7.3E-05 7.0E-05 7.0E-05 7.0E-05
1.0E+00 6.8E-01 6.8E-01 1.7E-02 2.3E-04 3.3E-04 2.3E-04 2.3E-04 2.3E-04
1.0E+00 7.5E-01 7.5E-01 6.8E-02 1.3E-03 7.7E-03 1.3E-03 1.3E-03 1.3E-03
1.0E+00 9.2E-01 9.2E-01 2.0E-01 6.0E-03 2.2E-02 6.0E-03 6.0E-03 9.0E-03
1.0E+00 9.7E-01 9.7E-01 2.8E-01 2.5E-02 8.2E-02 1.8E-02 1.8E-02 4.3E-02
1.0E+00 1.0E+00 1.0E+00 3.6E-01 2.3E-01 2.1E-01 6.3E-02 6.3E-02 2.9E-01
1.0E+00 1.0E+00 1.0E+00 4.0E-01 3.9E-01 3.6E-01 1.3E-01 1.6E-01 3.9E-01
1.0E+00 1.0E+00 1.0E+00 4.0E-01 4.4E-01 4.2E-01 1.6E-01 2.0E-01 4.2E-01
1.0E+00 9.2E-01 9.2E-01 2.0E-01 6.0E-03 2.2E-02 6.0E-03 6.0E-03 9.0E-03 FDCHL-HP*

1.0E+00 6.7E-01 6.7E-01 2.3E-03 5.5E-05 5.2E-05 5.5E-05 5.5E-05 5.5E-05
1.0E+00 6.7E-01 6.7E-01 3.4E-03 7.0E-05 7.3E-05 7.0E-05 7.0E-05 7.0E-05
1.0E+00 6.8E-01 6.8E-01 1.7E-02 1.8E-04 2.8E-04 1.8E-04 1.8E-04 1.8E-04
1.0E+00 7.5E-01 7.5E-01 6.7E-02 7.7E-04 7.1E-03 7.7E-04 7.7E-04 7.7E-04
1.0E+00 9.2E-01 9.2E-01 2.0E-01 4.7E-03 2.0E-02 4.7E-03 4.7E-03 7.7E-03
1.0E+00 9.7E-01 9.7E-01 2.8E-01 2.1E-02 7.8E-02 1.5E-02 1.5E-02 3.9E-02
1.0E+00 1.0E+00 1.0E+00 3.5E-01 2.2E-01 2.0E-01 5.0E-02 5.0E-02 2.8E-01
1.0E+00 1.0E+00 1.0E+00 3.8E-01 3.7E-01 3.4E-01 1.1E-01 1.4E-01 3.7E-01

```

Appendix A.2

1.0E+00 1.0E+00 1.0E+00 3.8E-01 4.2E-01 3.9E-01 1.3E-01 1.8E-01 4.0E-01
 1.0E+00 9.2E-01 9.2E-01 2.0E-01 4.7E-03 2.0E-02 4.7E-03 4.7E-03 7.7E-03 FDCHL-IP*

1.0E+00 1.3E+02 1.3E+02 4.1E+01 1.3E+02 4.1E+01 1.3E+02 1.3E+02 1.3E+02
 1.0E+00 1.2E+02 1.2E+02 3.7E+01 1.2E+02 3.7E+01 1.2E+02 1.2E+02 1.2E+02
 1.0E+00 8.4E+01 8.4E+01 2.4E+01 8.4E+01 2.4E+01 8.4E+01 8.4E+01 8.4E+01
 1.0E+00 1.8E+01 1.8E+01 5.0E+00 1.8E+01 5.0E+00 1.8E+01 1.8E+01 1.8E+01
 1.0E+00 5.5E+00 5.5E+00 2.1E+00 5.5E+00 2.1E+00 5.5E+00 5.5E+00 5.5E+00
 1.0E+00 2.7E+00 2.7E+00 1.6E+00 2.7E+00 1.6E+00 2.7E+00 2.7E+00 2.7E+00
 1.0E+00 1.6E+00 1.6E+00 1.4E+00 1.6E+00 1.4E+00 1.6E+00 1.6E+00 1.6E+00
 1.0E+00 1.4E+00 1.4E+00 1.4E+00 1.4E+00 1.4E+00 1.4E+00 1.4E+00 1.4E+00
 1.0E+00 1.4E+00 1.4E+00 1.3E+00 1.4E+00 1.3E+00 1.4E+00 1.4E+00 1.4E+00
 1.0E+00 5.0E+00 5.0E+00 2.0E+00 5.0E+00 2.0E+00 5.0E+00 5.0E+00 5.0E+00

1.0E+00 1.8E+04 1.8E+04 1.6E+03 1.8E+04 1.6E+03 1.8E+04 1.8E+04 1.8E+04
 1.0E+00 1.5E+04 1.5E+04 1.3E+03 1.5E+04 1.3E+03 1.5E+04 1.5E+04 1.5E+04
 1.0E+00 6.8E+03 6.8E+03 7.5E+02 6.8E+03 7.5E+02 6.8E+03 6.8E+03 6.8E+03
 1.0E+00 2.9E+02 2.9E+02 6.8E+01 2.9E+02 6.8E+01 2.9E+02 2.9E+02 2.9E+02
 1.0E+00 3.0E+01 3.0E+01 1.5E+01 3.0E+01 1.5E+01 3.0E+01 3.0E+01 3.0E+01
 1.0E+00 8.5E+00 8.5E+00 3.7E+00 8.5E+00 3.7E+00 8.5E+00 8.5E+00 8.5E+00
 1.0E+00 3.3E+00 3.3E+00 1.4E+00 3.3E+00 1.4E+00 3.3E+00 3.3E+00 3.3E+00
 1.0E+00 3.0E+00 3.0E+00 1.4E+00 3.0E+00 1.4E+00 3.0E+00 3.0E+00 3.0E+00
 1.0E+00 2.6E+00 2.6E+00 1.3E+00 2.6E+00 1.3E+00 2.6E+00 2.6E+00 2.6E+00
 1.0E+00 2.5E+01 2.5E+01 1.3E+01 2.5E+01 1.3E+01 2.5E+01 2.5E+01 2.5E+01 VPSL*

.398 .265 .195 FPME*

APPENDIX A.3 Other Input File for SORSOR Sample Problem

Sorsor Execution Title, Options, and Input Files Identification
(unit number 5)

SORSOR LHS SAMPLE RUN, 28 NOV 89, FULLY SAMPLED ST'S
1 2 3 7 6 9
161 12 2
130 131 132 133 134 135 136 137 138 139 140 141
T T

Appendix A.3

Sursor Accident Progression Bins for Sample Problem (Unit number 2)

1 SURRY LHS SAMPLE PROBLEM SOURCE TERM BINS
11 10

AHADEBCAADD
BHADEBCAADD
DHADDCBBDB
DDCAACDAABA
EHADEBCAADB
FDDDEBCAADCB
FHADBBAADCA
FDDDBAABDCB
GHACABABBDA
GDCDFADBDDA

2 SURRY LHS SAMPLE PROBLEM SOURCE TERM BINS
11 10

AHADEBCAADD
BHADEBCAADD
DHADDCBBDB
DDCAACDAABA
EHADEBCAADB
FDDDEBCAADCB
FHADBBAADCA
FDDDBAABDCB
GHACABABBDA
GDCDFADBDDA

Sursor LHS Data for Sample Problem
(unit number 3)

1	161	2.6464909E-03	1.5145850E-02	1.6329153E-02
1.8267676E-02	9.2905843E-09	0.1002005	5.9022959E-03	0.2533823
1.0236209E-05	3.4734127E-04	4.3731341E-03	2.0558487E-03	8.0410820E-03
4.0376128E-04	1.0609056E-03	9.3565956E-02	0.1002134	2.4600293E-02
7.2113721E-04	3.2821239E-04	3.033520	3.246469	0.7913142
5.1577576E-03	7.6430273E-04	5.7131372E-04	0.2616454	0.8236757
0.1974065	1.4806448E-02	0.9784908	0.9510265	0.7304379
4.1100387E-02	3.2425292E-02	0.1943589	0.9302723	5.7396587E-02
0.6927519	0.1273516	0.2052047	0.8924389	7.9718642E-02
6.6582469E-04	1.9651478E-04	2.2599599E-05	2.0353582E-03	4.5650836E-02
3.7687793E-03	3.2799211E-03	1.4430959E-03	0.4115240	5.4397445E-02
0.2882318	3.0173641E-02	0.2390520	1.9724544E-05	1.3176416E-04
3.2104000E-03	3.6385711E-04	1.0257899E-04	2.5439437E-02	6.5624766E-02
7.0629581E-03	1.5231004E-02	2.5160152E-05	1.2897967E-03	3.0829858E-02
1.8583702E-02	0.9605544	0.6180661	1.000000	0.0000000E+00
1.000000	0.0000000E+00	1.000000	0.0000000E+00	9.1238588E-05
3.2354157E-02	2.1788812E-05	0.0000000E+00	1.000000	0.0000000E+00
0.0000000E+00	1.000000	0.8563893	0.5279256	0.3172168
0.2181379	0.2914964	0.2002352	0.2324810	0.2315367
0.2852790	0.2019113	0.2211023	6.0445140E-03	6.0445140E-04
1.000000	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00
0.0000000E+00	0.0000000E+00	1.000000	48.45979	65.74821
60.87212	38.00063	91.85649	76.11291	46.14946
76.10318	64.84780	39.80193	56.83210	47.42916
31.45190	74.57883	60.02295	37.81403	65.99749
53.21755	34.57309	115.9840	0.7077845	1.052334
0.1002862	0.5072251	0.5504767	1.1020542E-02	0.1135454
0.5683360	0.9413391	0.1346145	6.9190152E-02	0.7527201
8.2908653E-02	0.2607284	0.4053752	0.6063320	0.7864740
0.4263850	0.8464900	0.7502650	0.9229660	0.7988780
0.6505650	0.8319270	0.7132400	0.9755810	0.8077960
1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
0.0000000E+00	0.0000000E+00	0.0000000E+00		
2	161	1.6249366E-03	8.7424908E-03	2.4723208E-02
3.1048495E-02	5.4616628E-08	8.3732449E-02	1.2419117E-03	0.2065430
2.7272345E-06	1.7257995E-04	4.1575748E-02	1.6266359E-03	1.0283048E-03
4.6598965E-05	1.0517711E-03	3.6049444E-02	0.1644935	3.9860856E-02
1.2235802E-04	1.4422744E-03	8.486111	8.475259	1.292450
6.0542654E-03	1.0504378E-05	3.3522755E-04	0.5531761	0.9649771
0.2754248	2.0551510E-02	0.9919400	0.9029126	0.7208879
1.3261837E-02	8.3316371E-02	9.8487228E-02	0.9288949	2.4737820E-02
0.7854388	0.1219989	0.3616140	0.8897179	5.0050020E-02
5.1816395E-03	6.3874928E-04	4.7917507E-05	1.5532604E-03	5.8435686E-02
2.1984815E-03	4.4186995E-03	2.1884770E-03	0.3224178	3.7019849E-02
0.1167579	4.6947677E-02	8.9498751E-02	1.3147960E-04	2.1207280E-04
5.0408589E-03	1.2607171E-04	8.1883074E-05	3.9170310E-03	0.1928475
1.4494730E-03	8.9601979E-02	5.9576287E-06	2.5787386E-03	5.57004420E-03
1.2305353E-03	0.7015558	0.9234272	1.000000	0.0000000E+00
1.000000	0.0000000E+00	1.000000	0.0000000E+00	1.9070240E-02
0.9999280	8.1655504E-05	0.0000000E+00	1.000000	1.000000
0.0000000E+00	0.0000000E+00	0.9921780	0.9772158	0.9585319
0.4639153	0.5641564	0.3617328	0.4435208	0.5667539
0.5967962	0.5079128	0.2069573	1.4746060E-05	1.4746059E-06
0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00
1.000000	0.0000000E+00	1.000000	9.148561	36.20157
28.67328	19.85789	55.73864	44.28530	27.48083
46.88707	35.10102	22.05704	33.39161	23.94483
17.85279	47.52784	34.67199	22.61643	38.81199
33.12344	21.73158	141.1491	0.9644870	0.4880276
0.2290654	0.1977736	0.5658842	0.1173497	0.7618060

Appendix A.3

0.5309821	0.5512744	7.6606043E-02	3.0579995E-02	0.7188875
0.2641788	6.8597391E-02	0.6801000	0.6138290	0.7903370
0.4377480	0.8564630	0.7689800	0.9269310	0.8094980
0.6592670	0.8390620	0.7189680	0.9776120	0.8113140
1.0000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
0.0000000E+00	0.0000000E+00	0.0000000E+00		

APPENDIX A.4 SURSOR Procedure File

\$ SET DEFAULT [LNSMITH.SURSOR_TEXT]	
\$ ASSIGN SUR_MSG_LHS_SAMPLE.OUT	FOR001
\$ ASSIGN SUR_BIN_LHS.DAT	FOR002
\$ ASSIGN SUR_LHS_HCUBE.DAT	FOR003
\$ ASSIGN SUR_SETUP_LHS_SAMPLE.DAT	FOR005
\$ ASSIGN SUR_RELEASE_LHS_SAMPLE.OUT	FOR006
\$ ASSIGN SUR_ST.DAT	FOR009
\$ RUN SURSOR.EXE	

APPENDIX A.5 SURSOR Sample Problem Output

SURSOR LHS SAMPLE RUN, 28 NOV 89, FULLY SAMPLED ST'S

11	9	20	2							
1 AHADBCAADDA										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00					
3.700E+06	9.951E-01	3.121E-01	3.703E-01	1.221E-02	3.357E-04	1.709E-04	8.658E-06	1.320E-05	5.412E-04	
1.700E+05	4.863E-03	2.342E-02	1.340E-02	3.361E-01	3.935E-02	2.599E-08	1.187E-03	1.515E-03	2.888E-02	
1 BHADBCAADDA										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00					
1.850E+06	9.951E-01	6.952E-05	8.249E-05	2.720E-06	7.478E-08	3.806E-08	1.928E-09	2.940E-09	1.206E-07	
1.700E+05	4.863E-03	2.513E-02	1.340E-02	3.817E-03	8.766E-06	5.790E-12	2.644E-07	3.375E-07	6.433E-06	
1 DHADDCBBDDB										
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01					
2.800E+07	9.592E-01	2.124E-01	1.723E-01	3.344E-02	6.469E-04	4.708E-04	1.054E-05	1.605E-05	8.747E-04	
1.600E+06	4.083E-02	8.766E-02	1.041E-01	1.591E-01	1.207E-02	1.434E-08	5.035E-04	5.605E-04	8.026E-03	
1 DDCAACDAABA										
2.230E+04	2.800E+04	2.000E+02	1.000E+06	1.000E+06	1.000E+01					
2.800E+06	9.395E-01	3.066E-02	3.240E-02	2.715E-03	5.104E-05	6.536E-05	3.080E-05	3.108E-05	6.376E-05	
1.600E+05	6.048E-02	7.673E-04	4.116E-05	6.091E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
1 EHADBCAADBB										
2.230E+04	4.700E+04	0.000E+00	4.700E+04	2.000E+02	1.000E+01					
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
3.500E+07	1.000E+00	1.061E-01	1.211E-01	2.071E-01	1.295E-02	3.438E-07	3.904E-04	4.985E-04	9.501E-03	
1 FDDDBCAADCB										
2.230E+04	4.700E+04	0.000E+00	1.334E+05	1.080E+04	1.000E+01					
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
6.481E+03	1.000E+00	3.784E-03	7.492E-09	5.935E-09	4.638E-10	1.694E-13	1.524E-11	2.249E-11	3.117E-10	
1 FHADBBAADCA										
3.600E+04	5.100E+04	1.000E+03	5.200E+04	1.080E+04	1.000E+01					
1.000E+06	9.477E-01	5.399E-02	4.005E-02	8.893E-03	1.538E-04	7.826E-05	3.965E-06	6.045E-06	2.479E-04	
0.000E+00	5.225E-02	6.538E-03	2.005E-03	5.066E-04	1.495E-05	3.913E-06	4.172E-07	5.817E-07	1.772E-05	
1 FDDDBAABDCB										
1.260E+04	1.980E+04	1.000E+03	2.080E+04	1.080E+04	1.000E+01					
1.000E+06	7.053E-01	5.159E-02	5.750E-02	4.012E-02	4.706E-04	3.344E-04	7.692E-06	1.171E-05	6.371E-04	
0.000E+00	2.947E-01	8.362E-03	7.188E-03	5.015E-03	5.883E-05	4.180E-05	9.616E-07	1.464E-06	7.964E-05	
1 GHACABABDDA										
3.600E+04	5.100E+04	1.000E+03	5.200E+04	2.160E+04	1.000E+01					
1.000E+06	8.787E-01	5.860E-02	5.519E-02	1.457E-02	2.450E-04	1.783E-04	3.992E-06	6.077E-06	3.313E-04	
0.000E+00	4.395E-02	2.947E-03	2.759E-03	7.286E-04	1.227E-05	8.916E-06	2.005E-07	3.048E-07	1.658E-05	
1 GDCDFADBDDB										
1.260E+04	1.980E+04	3.600E+03	1.000E+06	1.000E+06	1.000E+01					
1.000E+06	2.112E-01	5.803E-02	6.469E-02	4.513E-02	5.295E-04	3.762E-04	8.654E-06	1.317E-05	7.168E-04	
0.000E+00	0.000E+00	3.203E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	

APPENDIX A.5 SURSOR Sample Problem Output (Continued)

SURSOR LHS SAMPLE RUN, 28 NOV 89, FULLY SAMPLED ST'S

2 AHADBCAADDA										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00					
3.700E+06	9.771E-01	4.928E-01	4.932E-01	1.045E-02	1.464E-04	8.723E-07	4.433E-07	4.433E-07	2.933E-04	
1.700E+05	2.290E-02	7.001E-03	3.717E-03	2.560E-01	2.007E-02	6.203E-09	4.945E-04	6.551E-04	1.475E-02	
2 BHADBCAADDA										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00					
1.850E+06	9.771E-01	3.842E-04	3.846E-04	8.148E-06	1.142E-07	6.802E-10	3.456E-10	3.456E-10	2.287E-07	
1.700E+05	2.290E-02	8.507E-03	3.717E-03	1.052E-03	1.565E-05	4.836E-12	3.856E-07	5.108E-07	1.150E-05	
2 DHADDCBBDBB										
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01					
2.800E+07	8.300E-01	3.796E-01	3.333E-01	1.906E-02	3.601E-04	8.861E-07	4.502E-07	4.502E-07	9.052E-04	
1.600E+06	1.700E-01	3.833E-02	3.162E-02	1.462E-01	6.596E-03	3.888E-09	2.574E-04	2.907E-04	4.528E-03	
2 DDCAACDAABA										
2.230E+04	2.800E+04	2.000E+02	1.000E+06	1.000E+06	1.000E+01					
2.800E+06	7.151E-01	1.758E-01	1.807E-01	2.074E-02	4.191E-04	2.370E-03	4.113E-04	4.113E-04	4.365E-04	
1.600E+05	2.849E-01	2.247E-04	6.140E-06	8.023E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
2 EHADBCAADBB										
2.230E+04	4.700E+04	0.000E+00	4.700E+04	2.000E+02	1.000E+01					
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
3.500E+07	1.000E+00	5.495E-02	5.094E-02	5.281E-02	2.887E-03	8.519E-08	7.082E-05	9.382E-05	2.140E-03	
2 FDDDBCAADCB										
2.230E+04	4.700E+04	0.000E+00	1.334E+05	1.080E+04	1.000E+01					
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
6.481E+03	1.000E+00	2.633E-03	8.274E-09	4.232E-09	2.201E-10	1.529E-16	6.494E-12	1.012E-11	1.520E-10	
2 FHADBBAADCA										
3.600E+04	5.100E+04	1.000E+03	5.200E+04	1.080E+04	1.000E+01					
1.000E+06	9.306E-01	1.701E-03	1.189E-03	1.714E-04	1.338E-06	7.974E-09	4.052E-09	4.052E-09	2.681E-06	
0.000E+00	6.943E-02	2.760E-03	6.022E-05	6.206E-05	4.261E-06	4.000E-10	1.035E-07	1.371E-07	3.217E-06	
2 FDDDBAABDCB										
1.260E+04	1.980E+04	1.000E+03	2.080E+04	1.080E+04	1.000E+01					
1.000E+06	7.634E-01	1.061E-02	6.984E-03	4.432E-03	4.758E-05	1.189E-07	6.063E-08	6.275E-08	1.196E-04	
0.000E+00	2.366E-01	3.129E-03	8.729E-04	5.540E-04	5.948E-06	1.486E-08	7.585E-09	7.851E-09	1.495E-05	
2 GHACABABDDA										
3.600E+04	5.100E+04	1.000E+03	5.200E+04	2.160E+04	1.000E+01					
1.000E+06	6.454E-01	3.033E-03	1.822E-03	2.234E-04	3.240E-06	7.974E-09	4.052E-09	4.052E-09	8.146E-06	
0.000E+00	3.235E-02	1.620E-04	9.109E-05	1.150E-05	1.774E-07	3.987E-10	8.034E-10	8.812E-10	4.179E-07	
2 GDCDFABDDA										
1.260E+04	1.980E+04	3.600E+03	1.000E+06	1.000E+06	1.000E+01					
1.000E+06	5.849E-02	1.194E-02	7.856E-03	4.986E-03	5.353E-05	1.338E-07	6.821E-08	7.060E-08	1.346E-04	
0.000E+00	0.000E+00	1.275E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	

APPENDIX B
SEQSOR FILES

APPENDIX B.1 SEQSOR Fortran Listing

PROGRAM SEQSOR

```

C      CALCULATE SOURCE TERMS FOR SEQUOYAH (CENTRAL AND/OR LHS)
C      MAXIMUM NUMBER OF BIN ENTRIES = 5000
C      MAXIMUM NO. OF ST GROUPS = 9
C      MAXIMUM NO. OF ISSUES = 300
C      NISST= TOTAL NO. OF ISSUES IN SAMPLE
C      NISS= TOTAL NO. OF ST ISSUES (MAX=20)
C      NSP= ACTUAL NUMBER OF SOURCE TERM GROUPS
C           UTILIZED IN THE ANALYSIS.
C      IPRINT = UNIT NO. FOR "PRINT" FILE
C      IBINNR = UNIT NO. FOR "BIN" FILE
C      ISAMPL = UNIT NO. FOR "SAMPLE" FILE
C      IRELOUT = UNIT NO. FOR "RELEASE" FILE
C      IWROUT = UNIT NO. FOR "WEIGHTS" FILE
C      ISTDAT = UNIT NO. FOR "SOURCE TERM DATA" FILE
      DIMENSION ST(9),STE(9),STL(9),XNDX(300)
      DIMENSION ISSST(20)
      DATA NSP/9/
      DATA NTOT/0/
      CHARACTER BINJ(5000)*20
      CHARACTER NAMRUN*80,NAMBIN*80
      CHARACTER BINOUT*20
      LOGICAL EARLY,I1CALL,I2CALL,DIAG,BYOBS
C      GET THE RUN TITLE
      READ (5,1000)NAMRUN
C      GET THE I/O UNIT NUMBERS
      READ(5,*)IPRINT,IBINNR,ISAMPL,IWROUT,IRELOUT,
      $ ISTDAT
C      GET THE ISSUE NUMBERS
      READ (5,*)NISST,NISS,NSAM
C      READ WHICH ISSUE NO. APPLIES TO EACH ST ISSUE
      READ(5,*)(ISSST(K),K=1,NISS)
C      IF DIAGNOSTICS ARE REQUIRED, DIAG = .TRUE.
C      IF SOURCE TERMS ARE TO BE READ BY OBSERVATION,
C      BYOBS = .TRUE.
      READ(5,999)DIAG,BYOBS
C      WRITE THE IDENTIFICATION AND UNIT NUMBERS
      WRITE(IPRINT,1004)NAMRUN,NSAM,IPRINT,ISAMPL,IBINNR,IRELOUT,
      $ IWROUT,ISTDAT
      WRITE(IPRINT,1044)NISST,NISS
      I1CALL=.TRUE.
      IF(.NOT.BYOBS) THEN
        READ(IBINNR,1000)NAMBIN
        READ(IBINNR,*)NDIM,NBIN
        NTOT=NBIN*NSAM
        WRITE(IPRINT,1005)NAMBIN,NDIM,NBIN,NTOT
        READ(IBINNR,1006)(BINJ(J),J=1,NBIN)
C      PUT A HEADER ON THE "RELEASE" OUTPUT FILE
        WRITE(IRELOUT,2002)NAMRUN,NDIM,NSP,NTOT,NSAM
      ELSE
        DO 890 ISAM=1,NSAM
C      PUT A HEADER ON THE "RELEASE" OUTPUT FILE
        READ(IBINNR,1001)IOBSD,NAMBIN
        READ(IBINNR,*)NDIM,NBIN
        NTOT=NTOT+NBIN
        READ(IBINNR,1006)(BINJ(J),J=1,NBIN)
890      CONTINUE
        WRITE(IPRINT,1007)NAMBIN,NDIM,NTOT
        WRITE(IRELOUT,2002)NAMRUN,NDIM,NSP,NTOT,NSAM
        REWIND IBINNR
      ENDIF

```

Appendix B.1

```

DO 900 ISAM=1,NSAM
C STEP THROUGH SAMPLE
    READ (ISAMPL,*) IOBSD,NLHS,(XNDX(J),J=1,NISST)
    I2CALL=.TRUE.
C STEP THROUGH MASTER BIN LIST, BY OBSERVATION
    IF (BYOBS) THEN
        READ (IBINNR,1001) IOBSD,NAMBIN
        READ (IBINNR,*) NDIM,NBIN
        READ (IBINNR,1006) (BINJ(J),J=1,NBIN)
    END IF
C CALCULATE SOURCE TERMS
    DO 910 IB=1,NBIN
        CALL SORST(NSP,I1CALL,BINJ(IB),NISS,ISSST,I2CALL,
$          XNDX,ST,STL,EARLY,ISTDAT,DIAG,IPRINT,
$          TW,T1,DT1,E1,T2,DT2,E2,ELEV,ISAM)
C
        I1CALL=.FALSE.
        I2CALL=.FALSE.
C GET EARLY AND LATE EFFECT WEIGHTS
C WEE = EARLY EFFECT OF EARLY RELEASE
C WLE = LATE EFFECT OF EARLY RELEASE
C WEL = EARLY EFFECT OF LATE RELEASE
C WLL = LATE EFFECT OF LATE RELEASE
        DO 770 ISP=1,NSP
            IF (EARLY) THEN
                STE (ISP)=ST (ISP)
                ST (ISP)=STE (ISP)+STL (ISP)
            ELSE
                STE (ISP)=0.
                STL (ISP)=ST (ISP)+STL (ISP)
                ST (ISP)=STL (ISP)
            END IF
770 CONTINUE
            IF (EARLY) THEN
                CALL WEIGHT (NSP,STE,WEE,WLE)
                CALL WEIGHT (NSP,STL,WEL,WLL)
            ELSE
                WEE=0.
                WLE=0.
                CALL WEIGHT (NSP,ST,WEL,WLL)
            END IF
            DO 888 IJ=1,20
                IF (IJ.LE.NDIM) THEN
                    BINOUT (IJ:IJ)=BINJ (IB) (IJ:IJ)
                ELSE
                    BINOUT (IJ:IJ)=' '
                END IF
888 CONTINUE
                WRITE (IRELOUT,1775) ISAM,BINOUT,TW,T1,DT1,T2,DT2,ELEV
                WRITE (IRELOUT,17751) E1,(STE (IS),IS=1,NSP)
                WRITE (IRELOUT,17751) E2,(STL (IS),IS=1,NSP)
                WET=WEE+WEL
                WLT=WLE+WLL
C WRITE (IWROUT,1777) ISAM,IB,WEE,WLE,WEL,WLL,WET,WT
                IF (DIAG) THEN
                    WRITE (IPRINT,2010) IB,BINJ (IB),ISAM,(STE (ISP),
$                      ISP=1,NSP),(STL (ISP),ISP=1,NSP),
$                      (ST (ISP),ISP=1,NSP)
                    WRITE (IPRINT,2011),WEE,WLE,WEL,WLL,WET,WT
                END IF
910 CONTINUE
900 CONTINUE
999 FORMAT (L1,1X,L1)

```


[illegible]

2-ND GENERATION PROGRAM TO CALCULATE SOURCE TERMS FOR SEQUOYAH

```

ST(I)=FCOR(I)*(FISG(I)*FOSG(I)+(1-FISG(I))*FVES(I)*((1.-FBYPV)/
/DFICV+FBYPV)*FCONV/DFE
+FPART*(1-FCOR(I))*FCCI(I)*((1.-FBYPC)/DIFCC+FBYPC)*FCONC(I)/DFL
+(1-FCOR(I))*FPMF*FDCH(I)*FCONV*((1.-FBYPV)/DFICDH+FBYPV)+
+FLATE(I)*(FCOR(I)*(1-FVES(I))+FREM*(1-FCOR(I))*FCONRL(I)/DFL(I)
WHERE:
ST(I)=FRACTION OF INITIAL INVENTORY RELEASED TO ENVIRONMENT.
FISG(I)=FRACTION OF INITIAL INVENTORY RELEASED INTO STEAM GENERATOR
FOSG(I)=FRACTION OF INITIAL INVENTORY RELEASED FROM STEAM GENERATOR
FCOR(I)=FRACTION OF INITIAL INVENTORY RELEASED FROM FUEL PRIOR TO
BREACH.
FVES(I)=FRACTION OF FCOR NOT DEPOSITED IN THE VESSEL.
FCONV=FRACTION OF MATERIAL RELEASED TO CONTAINMENT PRIOR TO
OR AT VESSEL BREACH WHICH WOULD BE RELEASED FROM CONTAINMENT IN
THE ABSENCE OF DECONTAMINATION MECHANISMS.
FBYPV=EFFECTIVE BYPASS FRACTION OF ICE CONDENSER UP TO THE TIME OF
VESSEL BREACH
DFICV=DECONTAMINATION FACTOR FOR ICE CONDENSER UP TO THE TIME OF
VESSEL BREACH
DFE=DECONTAMINATION FACTOR APPLICABLE TO RCS RELEASE.
FPART=FRACTION OF CORE INVOLVED IN CCI
FCCI(I)=FRACTION OF INVENTORY REMAINING IN THE MELT
RELEASED DURING CORE-CONCRETE INTERACTION (CCI).
FCONC(I)=FRACTION OF CCI RELEASE ESCAPING CONTAINMENT.

```

Appendix B.1

C FBYPC=EFFECTIVE BYPASS FRACTION FOR ICE CONDENSER DURING CCI RELEA
 C DFICC=DECONTAMINATION FACTOR FOR ICE CONDENSER DURING CCI RELEASE
 C DFL(I)=DECONTAMINATION FACTOR APPLICABLE TO CCI RELEASE.
 C FPME=FRACTION OF CORE INVOLVED IN PRESSURIZED MELT EJECTION.
 C FDCH(I)=FRACTION OF MATERIAL INVOLVED IN PRESSURIZED MELT
 C EJECTION RELEASED FROM CONTAINMENT DUE TO DIRECT HEATING
 C DFICDH=DECONTAMINATION FACTOR FOR ICE CONDENSER APPLICABLE TO
 C DCH RELEASE
 C FLATE(I)=FRACTION OF MATERIAL REMAINING IN THE RCS AFTER VESSEL
 C BREACH WHICH IS REVOLATILIZED LATER.
 C FREM=FRACTION OF CORE MATERIAL REMAINING IN VESSEL AFTER BREACH.
 C FCONRL(I)=FRACTION OF LATE REVOLATILIZED MATERIAL WHICH WOULD BE
 C RELEASED FROM CONTAINMENT IN THE ABSENCE OF DECONTAMINATION
 C MECHANISMS.
 C
 C FOR IODINE, AN ADDITIONAL TERM IS ADDED:
 C +XLATE*(RELIV-RELIC)
 C WHERE:
 C XLATE IS THE FRACTION OF IODINE REMAINING IN CONTAINMENT LATE
 C IN THE ACCIDENT WHICH IS CONVERTED TO ORGANIC IODIDES.
 C RELIV=FRACTION OF INITIAL INVENTORY OF IODINE RELEASED TO
 C CONTAINMENT.
 C RELIC = FRACTION OF INITIAL INVENTORY OF IODINE RELEASED FROM
 C CONTAINMENT.
 C
 C NISS=NUMBER OF ST ISSUES
 C ISSUE-1: IN-VESSEL RELEASE FROM FUEL (FCOR)
 C ISSUE-2: RELEASE FROM VESSEL (IN-VESSEL RETENTION) (FVES)
 C ISSUE-3: V-SEQ. DF WITH SUBMERGED RELEASE (VDF)
 C ISSUE-4: RELEASE OF RCS SPECIES FROM CONTAINMENT (FCONV)
 C ISSUE-5: RELEASES FROM MELT IN CCI (FCCI)
 C ISSUE-6: RELEASE OF CCI SPECIES FROM CONTAINMENT (FCONC)
 C ISSUE-7: SPRAY DF'S (SPRDF)
 C ISSUE-8: LATE IODINE RELEASES FROM CONTAINMENT (XLATE)
 C ISSUE 9: LATE REVOLATILIZATION (FLATE)
 C ISSUE-10: RELEASE DUE TO DIRECT HEATING (FDCH)
 C ISSUE-11: DECONTAMINATION FACTOR FOR ICE CONDENSER
 C ISSUE-12: STEAM GENERATOR TUBE RUPTURE FISG & FOSG
 C ISSUE-13: POOL SCRUBBING OF CCI
 C
 C ST BINS ARE DEFINED BY A 14 LETTER WORD, "BIN"
 C 1ST LETTER: CONTAINMENT FAILURE MODE.
 C A=CONT. BYPASS, NOT SUBMERGED
 C B=CONT. BYPASS, SUBMERGED
 C C=CONT. FAILURE BEFORE VESSEL BREACH
 C D=CONT. FAILURE NEAR THE TIME OF VESSEL FAILURE
 C E=LATE (CA. 6 HRS AFTER VB) CONTAINMENT FAILURE
 C F=VERY LATE (CA. 24 HRS AFTER VB) CONTAINMENT FAILURE
 C G=NO CONTAINMENT FAILURE
 C
 C 2ND LETTER: SPRAY OPERATION
 C (E=EARLY, UP TO VESSEL BREACH)
 C (I=INTERMEDIATE, VB TO VB+45MIN)
 C (L=LATE, VB+45MIN TO END OF CCI)
 C (V=VERY LATE, AFTER CCI)
 C (--=NON-OPERATION)
 C A=E---
 C B=EI--
 C C=EIL-
 C D=EILV
 C E---L-
 C F---LV
 C G----V

C H=-----
 C
 C 3RD LETTER: CORE-CONCRETE INTERACTION
 C A=PROMPT DRY--FULL UNSCRUBBED CCI
 C B=PROMPT SHALLOW SCRUBBED
 C C=NO CCI
 C D= PROMPT DEEP SCRUBBED
 C E=SHORT DELAYED, THEREAFTER DRY
 C F=LONG DELAYED, THEREAFTER DRY
 C
 C 4TH LETTER: PRESSURE IN RCS AT VB
 C A=AT SYSTEM SETPOINT; T SEQUENCES; OUTFLOW THROUGH CYCLING PORV
 C B=HIGH PRESSURE; S3 SEQUENCES; VERY SMALL LEAK W/O SG COOLING
 C C=INTERMEDIATE PRESSURE; S2 SEQUENCES; ACCUMULATORS DISCHARGE
 C D=LOW PRESSURE; A/S1 SEQUENCES; NEAR ATMOSPHERIC PRESSURE
 C
 C 5TH LETTER: MODE OF VESSEL BREACH
 C A=HPME
 C B=POUR
 C C=GROSS BOTTOM HEAD FAILURE
 C D=ALPHA MODE
 C E=ROCKET
 C F=NO VESSEL BREACH
 C
 C 6TH LETTER: SGTR
 C A=OCCURS (EITHER S2 OR S3), SRV CLOSSES
 C B=OCCURS, SRV REMAINS OPEN
 C C=NONE
 C
 C 7TH LETTER: AMOUNT OF CORE IN CCI
 C A=LARGE AMOUNT (70-100%) NOMINALLY 85%
 C B=MODERATE AMOUNT (30-70%) NOMINALLY 50%
 C C=SMALL AMOUNT(0-30%) NOMINALLY 15%
 C D=NONE
 C
 C 8TH LETTER: ZR OXIDATION
 C A=LOW ZR OXIDATION (0-40%) NOMINALLY 25%
 C B=HIGH ZR OXIDATION (>40%) NOMINALLY 65%
 C
 C 9TH LETTER: HIGH PRESSURE MELT EJECTION
 C A=HIGH HPME (75TH PERCENTILE OF IN-VESSEL PANEL)
 C B=MODERATE HPME (50TH PERCENTILE OF IN-VESSEL PANEL)
 C C=LOW HPME (25TH PERCENTILE OF IN-VESSEL PANEL)
 C D=NO HPME
 C
 C 10TH LETTER: CONTAINMENT FAILURE SIZE
 C A=CATASTROPHIC RUPTURE--GROSS STRUCTURAL FAILURE
 C B=RUPTURE--NOMINALLY 7 SQ. FT.
 C C=LEAK--NOMINALLY 0.1 SQ. FT.
 C D=NO FAILURE
 C
 C 11TH LETTER: HOLES IN RCS
 C A=ONE LARGE HOLE
 C B=TWO LARGE HOLES
 C
 C 12TH LETTER: ICE CONDENSER FUNCTION BEFORE VESSEL BREACH
 C A=NO BYPASS; IC FUNCTIONS AS DESIGNED
 C B=PARTIALLY BYPASSED
 C C=COMPLETELY BYPASSED OR ICE MELTED
 C
 C 13TH LETTER: ICE CONDENSER FUNCTION DURING CCI
 C A=NO BYPASS; IC FUNCTIONS AS DESIGNED
 C B=PARTIAL BYPASS

Appendix B.1

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C      C=COMPLETELY BYPASSED OR ICE MELTED
C
C      14TH LETTER: AIR RETURN FANS
C      A=EARLY; FANS OPERATE ONLY UP TO VESSEL BREACH
C      B=EARLY AND LATE; FANS OPERATE BEFORE AND AFTER VESSEL BREACH
C      C=LATE ONLY; FANS OPERATE ONLY AFTER VESSEL BREACH
C      D=NEVER; AIR RETURN FANS NEVER OPERATE
C
C
C      PARAMETERS TO BE SET BY ISSUES HAVE 10 LEVELS-- LEVELS 1-9
C      DEFINE THE CDF, I.E., THEY ARE MINIMUM, MAXIMUM, AND 7 INTERMEDIATE
C      PERCENTILES, (1%, 5%, 25%, 50%, 75%, 95%, 99%) OF CDF.
C      LEVEL 10 FOR ANY ISSUE INDICATES THE "CENTRAL" LEVEL, HENCE IF ALL
C      LEVELS ARE SET TO 10, THE "CENTRAL" RELEASE WILL BE GIVEN.
C
C      THE LEVELS FOR EACH SAMPLE MEMBER ARE SET BY A VECTOR, XNDX, WHERE
C      XNDX(I) IS A REAL NUMBER. IF XNDX(I) IS SET TO A VALUE GREATER THAN
C      OR EQUAL TO 1.0, THE "MAXIMUM" PERCENTILE VALUES FOR THE GIVEN PARAMETER
C
C      ARE SELECTED. IF XNDX(I) IS SET TO 0.0, THE "MINIMUM" PERCENTILE VALUES
C      FOR THE GIVEN PARAMETER ARE SELECTED. IF XNDX(I) IS SPECIFIED AS
C      A REAL VALUE BETWEEN 0.0 AND 1.0, EITHER A LINEAR OR A LOGARITHMIC
C      INTERPOLATION SCHEME IS INVOKED TO SELECT THE PROPER VALUE FOR A GIVEN
C      PARAMETER. TO GET THE "CENTRAL" RELEASE MENTIONED IN THE PREVIOUS
C      PARAGRAPH, SPECIFY A NEGATIVE REAL VALUE FOR XNDX(I).
C
C      DIMENSION FCORL(10,9,4),FCOR(9),FVHH(10,9),FVHP(10,9),FVIP(10,9),
$      FVLP(10,9),FVV(10,9),FVSG(10,9),FVES(9),
$      FCONVI(10,6),VDFL(10),DFICVI(10,5),DFICCI(10,5),
$      SCCI(10,9,4),FCCI(9),FCONCI(10,9,6),DFSPR1(10),
$      DFSPR2(10),DFSPRC(10),FPMEL(4),FPARTL(4),
$      SLATEIL(10),FLATE(10,9,4),FLATEX(9),FCONC(9),
$      FDCHL(10,9,2),DLATE(9),DFL(9),FCONRLX(9),
$      LVL(20),XNDX(300),VPSL(10,9,2),VPS(9),
$      XSXG(9),ST(9),STL(9),FISG(10,9,2),FOSG(10,9,2),XOSG(9),
C      $FCONRL(9),DST(9),ISSST(20)
$      SDST(9),ISSST(20)
      REAL LATEIL,LVL
      LOGICAL ISPR(4),IFAN(2),DIAG,EARLY,TEST,I1CALL,I2CALL
      CHARACTER*20 BIN
      CHARACTER CHH
C      FRACTION OF CORE REMAINING IN VESSEL; THIS MAY EVENTUALLY BE
C      PASSED BY CET. FOR THE PRESENT, THIS QUANTITY IS FIXED AT 5%.
      DATA FREM/.05/
      DATA FPARTL /1.,.5,.15,0./
C      FOR THE FIRST CALL TO THIS SUBROUTINE, READ IN ST DATA
      IF(.NOT.I1CALL) GOTO 8550
C      BLOCK 1: FCOR=FRACTION OF EACH NUCLIDE RELEASED FROM CORE
C      CASE 1=LOW ZR OXIDATION (HIGH ZR REMAINING)
C      CASE 2=HIGH ZR OXIDATION (LOW ZR REMAINING)
      READ(ISTDAT,*)((FCORL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
      IF(DIAG)WRITE(IPRINT,2004)((FCORL(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,2)
2004      FORMAT(/5X,'FCORL: '/(9(1PE10.1)))
C      BLOCK 2: FVES, FRACTION RELEASED FROM VESSEL
C      BASED ON RCS PRESSURE AT TIME OF VESSEL BREACH
C      FVHH: SYSTEM SETPOINT PRESSURE
C      FVHP: HIGH PRESSURE (LUMPED WITH INTERM. BY EXPERTS)
C      FVIP: HIGH OR INTERMEDIATE PRESSURE
C      FVLP: LOW PRESSURE
C      FVV: LARGE INTERFACING SYSTEM LOCA
C
      READ(ISTDAT,*)((FVHH(L,ISP),ISP=1,NSP),L=1,10)

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                IF(DIAG)WRITE(IPRINT,2010)((FVHH(L,ISP),ISP=1,NSP),
$           L=1,10)
2010      FORMAT(/5X,'FVHH: '/(9(1PE10.1)))
        READ(ISTDAT,*)((FVHP(L,ISP),ISP=1,NSP),L=1,10)
        IF(DIAG)WRITE(IPRINT,2011)((FVHP(L,ISP),ISP=1,NSP),
$           L=1,10)
2011      FORMAT(/5X,'FVHP: '/(9(1PE10.1)))
        READ(ISTDAT,*)((FVIP(L,ISP),ISP=1,NSP),L=1,10)
        IF(DIAG)WRITE(IPRINT,2012)((FVIP(L,ISP),ISP=1,NSP),
$           L=1,10)
2012      FORMAT(/5X,'FVIP: '/(9(1PE10.1)))
        READ(ISTDAT,*)((FVLP(L,ISP),ISP=1,NSP),L=1,10)
        IF(DIAG)WRITE(IPRINT,2014)((FVLP(L,ISP),ISP=1,NSP),
$           L=1,10)
2014      FORMAT(/5X,'FVLP: '/(9(1PE10.1)))
        READ(ISTDAT,*)((FVV(L,ISP),ISP=1,NSP),L=1,10)
        IF(DIAG)WRITE(IPRINT,2016)((FVV(L,ISP),ISP=1,NSP),
$           L=1,10)
2016      FORMAT(/5X,'FVV: '/(9(1PE10.1)))
C        FVES FOR SGTR
        READ(ISTDAT,*)((FVSG(L,ISP),ISP=1,NSP),L=1,10)
        IF(DIAG)WRITE(IPRINT,2018)((FVSG(L,ISP),ISP=1,NSP),
$           L=1,10)
2018      FORMAT(/5X,'FVSG: '/(9(1PE10.1)))
C        BLOCK 3: FISG AND FOSG
C        FISG=FRACTION ENTERING SG IN SGTR
C        FOSG=FRACTION LEAVING STEAM GENERATOR
C        CASE 1: SRV CLOSES. CASE 2: SRV DOES NOT CLOSE
        READ(ISTDAT,*)((FISG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
        IF(DIAG)THEN
            DO 20201 IC=1,2
                WRITE(IPRINT,2020)IC,((FISG(L,ISP,IC),ISP=1,NSP),
$                   L=1,10)
20201      CONTINUE
            ENDIF
        2020      FORMAT(/5X,'FISG: '/5X,'CASE ',I3/(9(1PE10.1)))
        READ(ISTDAT,*)((FOSG(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
        IF(DIAG)THEN
            DO 20221 IC=1,2
                WRITE(IPRINT,2022)IC,((FOSG(L,ISP,IC),ISP=1,NSP),
$                   L=1,10)
20221      CONTINUE
            ENDIF
        2022      FORMAT(/5X,'FOSG: '/5X,'CASE ',I3/(9(1PE10.1)))
C        BLOCK 4: VDF=DF APPLIED TO SCRUBBED V SEQUENCE.
        READ(ISTDAT,*)((VDFL(L),L=1,10)
        IF(DIAG)WRITE(IPRINT,2024)(VDFL(L),L=1,10)
2024      FORMAT(/5X,'VDF: '/(5(1PE10.1)))
C
C        BLOCK 5: FCONV=FRACTION OF RCS RELEASE LEAVING
C        CONTAINMENT; SIX CASES
C        CASE 1: EARLY LEAK, DRY CONTAINMENT
C        CASE 2: EARLY LEAK, WET CONTAINMENT
C        CASE 3: EARLY RUPTURE, UPPER COMPARTMENT
C        CASE 4: EARLY RUPTURE, LOWER COMPARTMENT
C        CASE 5: LATE RUPTURE
C        CASE 6: V SEQUENCE
C
        READ(ISTDAT,*)((FCONVI(L,ICASE),L=1,10),ICASE=1,6)
        IF(DIAG)THEN
            DO 2222 ICASE=1,6
                WRITE(IPRINT,2025)ICASE,(FCONVI(L,ICASE),L=1,10)
2222      CONTINUE

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Appendix B.1

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END IF
2025  FORMAT(5X,'FCONV--CASE ',I3/(10(1PE10.1)))
C
C      BLOCK 6: FCONC=FRACTION OF CCI RELEASE LEAVING
C      CONTAINMENT; FIVE CASES
C      CASE 1:  EARLY LEAK (BEFORE CCI), DRY CONTAINMENT
C      CASE 2:  EARLY LEAK (BEFORE CCI), WET CONTAINMENT
C      CASE 3:  EARLY RUPTURE (BEFORE CCI), UPPER COMP.
C      CASE 4:  EARLY RUPTURE (BEFORE CCI), UPPER COMP.
C      CASE 5:  LATE RUPTURE (AFTER CCI)
C      CASE 6:  V-SEQUENCE
C
      READ(ISTDAT,*)((FCONCI(L,ISP,ICASE),ISP=1,NSP),L=1,10),
$      ICASE=1,6)
      IF(DIAG)THEN
        DO 2223 ICASE=1,6
          WRITE(IPRINT,2026)ICASE,((FCONCI(L,ISP,ICASE),
$      ISP=1,NSP),L=1,10)
2223  CONTINUE
      END IF
2026  FORMAT(5X,'FCONC--CASE ',I3/(9(1PE10.1)))
C
C      BLOCK 7: CCI=FRACTION OF MATERIAL REMAINING IN DEBRIS
C      RELEASED IN CCI
C      CASE 1:  LOW ZR OXIDATION (HIGH ZR REMAINING), NO WATER
C      CASE 2:  HIGH ZR OXIDATION (LOW ZR REMAINING), NO WATER
C      CASE 3:  LOW ZR OXIDATION, WATER PRESENT
C      CASE 4:  HIGH ZR OXIDATION, WATER PRESENT
      READ(ISTDAT,*)((CCI(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,4)
      IF(DIAG)WRITE(IPRINT,2028)((CCI(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,4)
2028  FORMAT(/5X,'CCI: '/(9(1PE10.1)))
C
C      BLOCK 8:  SPRAY DF-S
C      DFSPR1=SPRAY DF FOR HIGH PRESSURE, EARLY
C      CONTAINMENT RUPTURE, FOR RCS RELEASE.
C      CURRENTLY ONE VALUE FOR ALL NUCLIDE GROUPS (EXCEPT NG).
      READ(ISTDAT,*)(DFSPR1(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2034)(DFSPR1(L),L=1,10)
2034  FORMAT(/5X,'DFSPR1: '/(10(1PE10.1)))
C      DFSPR2=SPRAY DF FOR ALL OTHER CASES, FOR RCS RELEASE.
      READ(ISTDAT,*)(DFSPR2(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2036)(DFSPR2(L),L=1,10)
2036  FORMAT(/5X,'DFSPR2: '/(10(1PE10.1)))
C      DFSPRC=SPRAY DF FOR CCI RELEASE
      READ(ISTDAT,*)(DFSPRC(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2038)(DFSPRC(L),L=1,10)
2038  FORMAT(/5X,'DFSPRC: '/(10(1PE10.1)))
C
C      BLOCK 9:  FRACTION OF IODINE REMAINING IN CONTAINMENT
C      WHICH IS CONVERTED TO VOLATILE FORMS
      READ(ISTDAT,*)(LATEIL(L),L=1,10)
      IF(DIAG)WRITE(IPRINT,2044)(LATEIL(L),L=1,10)
2044  FORMAT(/5X,'LATEIL: '/(10(1PE10.1)))
C
C      BLOCK 10:  FRACTION OF MATERIAL REMAINING IN RCS WHICH IS
C      REVOLATILIZED LATE IN THE ACCIDENT.
C      CASE 1:  ONE HOLE IN RCS
C      CASE 2:  TWO HOLES IN RCS
      READ(ISTDAT,*)((FLATE(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
      IF(DIAG)WRITE(IPRINT,2046)((FLATE(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,2)
2046  FORMAT(/5X,'FLATE: '/(9(1PE10.1)))
C
C      BLOCK 11:  FOR DIRECT HEATING
C      FDCH=FRACTION OF FPME RELEASED FROM CONTAINMENT (FOR EARLY CF
C      ONLY)
      READ(ISTDAT,*)((FDCHL(L,ISP,1),ISP=1,NSP),L=1,10)

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                IF(DIAG)WRITE(IPRINT,2051)((FDCHL(L,ISP,1),ISP=1,NSP),L=1,10)
2051  FORMAT(/5X,'FDCHL: HI PRESSURE'/(9(1PE10.1)))
        READ(ISTDAT,*)((FDCHL(L,ISP,2),ISP=1,NSP),L=1,10)
                IF(DIAG)WRITE(IPRINT,2052)((FDCHL(L,ISP,2),ISP=1,NSP),L=1,10)
2052  FORMAT(/5X,'FDCHL: INT PRESSURE'/(9(1PE10.1)))
C      BLOCK 12: DF FOR POOL SCRUBBING.
C      CASE 1: ACCUMULATOR WATER ONLY
C      CASE 2: FULL CAVITY
        READ(ISTDAT,*)((VPSL(L,ISP,IC),ISP=1,NSP),L=1,10),IC=1,2)
        IF(DIAG)WRITE(IPRINT,2056)((VPSL(L,ISP,IC),ISP=1,NSP),
$      L=1,10),IC=1,2)
2056  FORMAT(/5X,'VPSL:'/(9(1PE10.1)))
C      BLOCK 13: FRACTIONS OF CORE IN HPME (HIGH, MODERATE, LOW)
        READ(ISTDAT,*)(FPMEL(L),L=1,3)
        FPMEL(4)=0.0
        IF(DIAG)WRITE(IPRINT,20566)(FPMEL(L),L=1,3)
20566  FORMAT(5X,'FRACTION OF CORE IN HPME:'/5X,'HIGH      ',F8.3/
$      5X,'MODERATE ',F8.3/5X,'LOW      ',F8.3)
C      BLOCK 14:
C      DATA FOR ICE CONDENSER DECONTAMINATION FACTOR FOR RCS RELEASE
C      FOUR CASES--
C      CASE 1: FANS OPERATING, NO CF
C      CASE 2: FANS OPERATING, CONTAINMENT FAILED
C      CASE 3: FANS NOT OPERATING, DEFAULT CASE
C      CASE 4: HPME OR DCH EVENT
        READ(ISTDAT,*)((DFICVI(L,IC),L=1,10),IC=1,4)
        IF(DIAG)THEN
            DO 16456 IC=1,4
                WRITE(IPRINT,16457)IC,(DFICVI(L,IC),L=1,10)
16456  CONTINUE
            END IF
16457  FORMAT(/5X,'DFICV, CASE ',I2/2X,(10(1PE8.1)))
C      BLOCK 15
C      DATA FOR ICE CONDENSER DECONTAMINATION FACTOR FOR CCI RELEASE
C      THREE CASES--
C      CASE 1: FANS OPERATING, NO CF
C      CASE 2: FANS OPERATING, CONTAINMENT FAILED
C      CASE 3: FANS NOT OPERATING, DEFAULT CASE
        READ(ISTDAT,*)((DFICCI(L,IC),L=1,10),IC=1,3)
        IF(DIAG)THEN
            DO 16458 IC=1,3
                WRITE(IPRINT,16459)IC,(DFICCI(L,IC),L=1,10)
16458  CONTINUE
            END IF
16459  FORMAT(/5X,'DFICC, CASE ',I2/1X,(10(1PE9.1)))
C      THIS IS THE END OF THE DATA INPUT.
8550  CONTINUE
        IF(I2CALL) THEN
            DO 10 ISS=1,NISS
                ISSUE=ISSST(ISS)
                LVL(ISS)=XNDX(ISSUE)
10      CONTINUE
            END IF
            CHH=BIN(1:1)
            EARLY=.FALSE.
            IF(CHH.LE.'D'.OR.BIN(6:6).LT.'C')EARLY=.TRUE.
            IF(DIAG)WRITE(IPRINT,1009)BIN,ISAM,(LVL(ISS),ISS=1,NISS)
1009  FORMAT(///5X,'DIAGNOSTIC OUTPUT FOR BIN ',A20,
$      ' SAMPLE MEMBER ',I4/
$      5X,'ST LEVELS = ',4(5F5.1,3X))
C      MAIN CALCULATION
C
C      SET UP SPRAY INDICES

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Appendix B.1

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C      "TRUE" INDICATES SPRAY IS OPERATING DURING THE FOLLOWING TIME
C      PERIODS.
C      PERIOD 1:  UP TO VESSEL BREACH (EARLY)
C      PERIOD 2:  VESSEL BREACH TO START OF CCI (INTERMEDIATE)
C      PERIOD 3:  DURING CCI (LATE)
C      PERIOD 4:  AFTER CCI (VERY LATE)
C      CALL SPRAY(BIN,ISPR)
C              IF(DIAG)WRITE(IPRINT,1010)(ISPR(L),L=1,4)
1010      FORMAT(5X,"SPRAY" CALLED; ISPR = ',4L1)
C      SET UP FAN INDICES
C      PERIOD 1: UP TO VESSEL BREACH
C      PERIOD 2: AFTER VESSEL BREACH
C      CALL FAN(BIN,IFAN)
C              IF(DIAG)WRITE(IPRINT,1011)(IFAN(L),L=1,2)
1011      FORMAT(5X,"FAN" CALLED; IFAN = ',2L1)
C      RELEASE CHARACTERISTICS
C              CALL RELCHAR(BIN,TW,T1,DT1,E1,T2,DT2,E2,ELEV,ISPR)
C              DTW=T1-TW
C              IF(DIAG)WRITE(IPRINT,2145)TW,DTW,T1,DT1,E1,T2,DT2,E2,ELEV
2145      FORMAT(5X,"RELCHAR" CALLED; RELEASE CHARACTERISTICS: '/
$          9X,'TW',7X,'DTW',6X,'T1',7X,'DT1',6X,'E1',7X,'T2',
$          7X,'DT2',6X,'E2',7X,'ELEV'/5X,9(1PE9.1)/5X,
$          'TIMES IN SEC.--REL. RATES IN WATTS--ELEV. IN METERS')
C      IN VESSEL RELEASE FOR EACH GROUP (FCOR)
C      CALL CORER(BIN,NSP,FCOR,FCORL,LVL(1))
C              IF(DIAG)WRITE(IPRINT,1014)(FCOR(IS),IS=1,NSP)
1014      FORMAT(5X,"CORER" CALLED'/5X,'FCOR = ',9(1PE9.1))
C      IN-VESSEL RETENTION
C      CALL VESREL(BIN,FVES,FVHH,FVHP,FVIP,FVLP,FVV,
$          FVSG,NSP,LVL(2))
C              IF(DIAG)WRITE(IPRINT,1016)(FVES(IS),IS=1,NSP)
1016      FORMAT(5X,"VESREL" CALLED'/5X,'FVES = ',9(1PE9.1))
C      CALCULATE FISSION PRODUCTS ENTERING STEAM GENERATOR
C      (FOR SGTR ONLY)
C      DO 195 ISP=1,NSP
C          XSG(ISP)=0.
C          XOSG(ISP)=0.
C              IF(BIN(6:6).EQ.'C')GOTO 195
C              ICASE=1
C              IF(BIN(6:6).EQ.'B')ICASE=2
C              XSG(ISP)=XINTERPLSC(LVL(12),FISG,ISP,ICASE,ILOG)
C              XOSG(ISP)=XINTERPLSC(LVL(12),FOSG,ISP,ICASE,ILOG)
195      CONTINUE
C              IF(DIAG)WRITE(IPRINT,2078)(XSG(ISP),ISP=1,NSP)
2078      FORMAT(5X,'RELEASE TO SG-S: '/5X,9(1PE9.1))
C              IF(DIAG)WRITE(IPRINT,20781)(XOSG(ISP),ISP=1,NSP)
20781      FORMAT(5X,'RELEASE FROM SG-S: '/5X,9(1PE9.1))
C              ILOG=1
C              VDF=1.0
C              IF(CHH.EQ.'B')VDF=XINTERPL(LVL(3),VDFL,ILOG)
C              IF(DIAG)WRITE(IPRINT,20791)VDF
20791      FORMAT(5X,'VDF = ',1PE10.1)
C      RELEASE OF MATERIAL FROM CONTAINMENT(FCONV AND FCONC)
C      CALL FCONVC(BIN,ISPR,FCONVI,FCONV,FCONCI,
$          FCONC,LVL(4),LVL(6),NSP)
C              IF(DIAG)WRITE(IPRINT,1018)FCONV,(FCONC(IS),IS=1,NSP)
1018      FORMAT(5X,"FCONVC" CALLED'/5X,'FCONV = ',1PE10.1/
$          5X,'FCONC = ',9(1PE10.1))
C      CCI RELEASE
C      CALL CCIREL(BIN,NSP,CCI,FCCI,LVL(5))
C              IF(DIAG)WRITE(IPRINT,1020)(FCCI(IS),IS=1,NSP)
1020      FORMAT(5X,"CCIREL" CALLED'/5X,'FCCI = ',9(1PE9.1))
C      DCH RELEASE

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        IDCH=ICHAR(BIN(9:9))-64
        FPME=FPMEL(IDCH)*(1.-FREM)
        IF(DIAG)WRITE(IPRINT,20777)FPME
20777  FORMAT(5X,'FRACTION OF CORE IN HPME = ',F8.4)
C      FRACTION OF CORE PARTICIPATING IN CCI
        ICCI=ICHAR(BIN(7:7))-64
C      MATERIAL REMAINING IN VESSEL, AND MATERIAL INVOLVED IN HIGH
C      PRESSURE MELT EJECTION, CANNOT PARTICIPATE IN CCI
        FPART=FPARTL(ICCI)*(1.-FREM-FPME)
        IF(DIAG)WRITE(IPRINT,10200)FPART
10200  FORMAT(5X,'FRACTION OF CORE IN CCI = ',F8.3)
C      EFFECTS OF SPRAYS
        CALL SPRDF(BIN,ISPR,DFSPR1,DFSPR2,DFSPV,DFSPRC,DFSPC,
$      LVL(7))
        IF(DIAG)WRITE(IPRINT,1022)DFSPV,DFSPC
1022  FORMAT(5X,'"SPRDF" CALLED; DFSPV = ',F7.1,' DFSPC = ',F7.1)
C      POOL SCRUBBING DF
C      FIND CASE (SHALLOW OR DEEP)
        ICASE=3
        ILOG=1
        IF(BIN(3:3).EQ.'B')ICASE=1
        IF(BIN(3:3).EQ.'D')ICASE=2
        DO 185 ISP=1,NSP
            IF(ICASE.EQ.3)THEN
                VPS(ISP)=1.
            ELSE
                VPS(ISP)=XINTERPLSC(LVL(13),VPSL,ISP,ICASE,ILOG)
            END IF
185    CONTINUE
        IF(DIAG)WRITE(IPRINT,2077)(VPS(ISP),ISP=1,NSP)
2077  FORMAT(5X,'DF(POOL SCRUB):'/5X,9F7.1)
C      FIND EFFECTS OF ICE CONDENSER
        CALL ICE(BIN,IFAN,DFICVI,DFICCI,DFICV,DFICC,DFICDH,FBYPV,
$      FBYPV,FBYPV,LVL(11))
        IF(DIAG)WRITE(IPRINT,20877)DFICV,FBYPV,DFICC,FBYPV
20877  FORMAT(5X,'ICE CONDENSER DFS: '/5X,'RCS: ',1PE10.1,
$      ' BYPASS FRACTION: ',1PE10.1/
$      5X,'CCI: ',1PE10.1,' BYPASS FRACTION: ',1PE10.1)
C      FIND OVERALL DF
        ILOG=1
        DFE=1.0
        DO 22620 ISP=1,NSP
            DFL(ISP)=1.0
22620  CONTINUE
C      FOR V-SEQUENCE WITH WATER:
        IF(CHH.EQ.'B')THEN
            DFE=VDF
            DO 22621 ISP=2,NSP
                DFL(ISP)=AMAX1(VDF,VPS(ISP))
22621  CONTINUE
        ELSE
C      FOR ALL OTHERS:
C      OVERALL DF IS SET EQUAL TO THE LARGEST FOR ALL OPERATIVE
C      MECHANISMS. FOR EARLY CF (BEFORE CCI) DFL CANNOT BE GREATER
C      THAN WHAT THE SPRAY DF WOULD BE, IF SPRAYS WERE OPERATING.
        DFE=DFSPV
        DFE=DFE/((1.-FBYPV)/DFICV+FBYPV)
        ILOG=1
        DO 22622 ISP=2,NSP
            DFL(ISP)=AMAX1(VPS(ISP),DFSPC)
            IF((BIN(1:1).EQ.'D'.OR.BIN(1:1).EQ.'C')
$              .AND.DFL(ISP).GT.1.)DFL(ISP)=
$              AMIN1(DFL(ISP),XINTERPL(LVL(7),DFSPRC,ILOG))

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                DFL(ISP)=DFL(ISP)/((1.-FBYPC)/DFICC+FBYPC)
22622          CONTINUE
                END IF
C          DO NOT ALLOW OVERALL DF-S TO EXCEED 10,000.
                DFE=AMIN1(DFE,1.E4)
                DO 11211 ISP=2,NSP
                    DFL(ISP)=AMIN1(DFL(ISP),1.E4)
11211          CONTINUE
                    IF(DIAG)WRITE(IPRINT,1026)DFE,(DFL(ISP),ISP=1,NSP)
1026          FORMAT(5X,'DFE = ',F7.1/5X,'DFL: '/4X,(9(1PE10.1)))
                CALL DHEAT(BIN,FDCHL,LVL(10),NSP,DST,FCOR,DIAG,IPRINT,
$              FPME,ISPR)
                IF(DIAG)WRITE(IPRINT,17775)(DST(ISP),ISP=1,NSP)
17775          FORMAT(/5X,'DCH RELEASE TO CONTAINMENT: '/9(1PE10.1))
                DI2=DST(2)
C          EARLY RUPTURE OR LARGE LEAK, NO EFFECT OF SPRAYS ON DCH RELEASE.
                DO 176 ISP=2,NSP
                    DST(ISP)=DST(ISP)*FCONV
176          CONTINUE
                    IF(BIN(1:1).EQ.'G')DST(1)=.005*DST(1)
                    IF(DIAG)WRITE(IPRINT,17776)(DST(ISP),ISP=1,NSP)
17776          FORMAT(5X,'DCH RELEASE FROM CONTAINMENT: '/9(1PE10.1))
C          CALCULATE SOURCE TERMS
                FCNG=1.
                IF(BIN(1:1).EQ.'G')FCNG=.005
                ST(1)=FCOR(1)*(XSG(1)*XOSG(1)+(1.-XSG(1))*FVES(1)*FCNG)+DST(1)
                STL(1)=FPART*(1.-FCOR(1))*FCCI(1)*FCNG
                GRCS=ST(1)
                GCCI=STL(1)
                DO 200 ISP=2,NSP
                    ST(ISP)=FCOR(ISP)*(XSG(ISP)*XOSG(ISP)+(1.-XSG(ISP))*
$              FVES(ISP)*FCONV/DFE)+DST(ISP)
                    STL(ISP)=(1.-FCOR(ISP))*FPART*FCCI(ISP)*FCONC(ISP)/
$              DFL(ISP)
200          CONTINUE
C          "LATE" RELEASES OF GROUPS 1-3 ARE TRANSFERRED TO EARLY
C          RELEASES, IF CCI IS PROMPT AND CONTAINMENT FAILURE IS EARLY
C          IF SGTR OCCURS NOBLE GAS RELEASE IS TERMED EARLY
                IF((BIN(1:1).GT.'D'.OR.BIN(3:3).EQ.'F').AND.BIN(6:6).EQ.'C')
$              GOTO 2333
                DO 230 ISP=1,3
                    ST(ISP)=ST(ISP)+STL(ISP)
                    STL(ISP)=0.
230          CONTINUE
C          LATE REVOLATILIZATION FROM THE RCS. RELEASE FRACTIONS FROM
C          CONTAINMENT ARE SET EQUAL TO THOSE FOR "LATE" (CCI) Te.
2333          ILOG=0
                FCONRLX(1)=1.
                FLATEX(1)=1.
C          NOBLE GASES RELEASED IN VESSEL, NOT YET RELEASED TO CONTAINMENT
                SGQ1=FCNG
                IF(BIN(6:6).EQ.'B')SGQ1=1.
                DL1=FCOR(1)*(XSG(1)*(1.-XOSG(1))*SGQ1+(1.-XSG(1))*
$              (1.-FVES(1))*FCNG)
C          NOBLE GASES NOT YET RELEASED, FROM MATERIAL REMAINING IN RCS
                DL2=(1.-FCOR(1))*FREM*FCNG
C          NOBLE GASES IN MATERIAL LEAVING VESSEL BUT NOT IN CCI
                DL3=(1.-FCOR(1))*(1.-FPART-FREM-FPME)*FCNG
C          REVOLATILIZED NOBLE GASES
                DLATE(1)=(DL1+DL2+DL3)
                GTOT=GRCS+GCCI+DLATE(1)
                IF(DIAG)WRITE(IPRINT,7763)GRCS,GCCI,DL1,DL2,DL3,GTOT
7763          FORMAT(/5X,'NOBLE GASES: '/5X,'FROM RCS: ',1PE12.3/

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$      5X,'FROM CCI: ',1PE12.3/5X,'LATE RCS: ',1PE12.3/
$      5X,'LATE REM: ',1PE12.3/5X,'LATE NCC: ',1PE12.3/
$      5X,'TOTAL ',1PE12.3)
C      NO REVOLATILIZATION IF NO VESSEL BREACH
      IF(BIN(5:5).EQ.'F')THEN
        DO 99570 ISP=1,NSP
          DLATE(ISP)=0.
99570    CONTINUE
        ELSE
          ICASE = ICHAR(BIN(11:11))-64
          DO 9957 ISP=2,NSP
            DFLX=DFSPC
            IF(.NOT.ISPR(4))DFLX=1.
            FCONRLX(ISP)=FCONC(4)
            FLATEX(ISP)=XINTERPLSC(LVL(9),FLATE,ISP,ICASE,ILOG)
            SGQ=0.
            IF(BIN(6:6).EQ.'B')SGQ=FCOR(ISP)*XSG(ISP)
            * (1.-XOSG(ISP))
            DLATE(ISP)=FLATEX(ISP)*(FCOR(ISP)*(1.-XSG(ISP))*
$      (1.-FVES(ISP))+FREM*(1.-FCOR(ISP))*FCONRLX(ISP)/DFLX
$      +FLATEX(ISP)*SGQ
            STL(ISP)=STL(ISP)+DLATE(ISP)
9957    CONTINUE
          END IF
          STL(1)=STL(1)+DLATE(1)
          IF(DIAG)WRITE(IPRINT,1050)(FLATEX(ISP),ISP=1,NSP),
$      (DLATE(ISP),ISP=1,NSP)
1050    FORMAT(5X,'LATE REVOLATILIZATION: FLATE = ',9(1PE10.1)/
$      5X,'DLATE = ',9(1PE10.1))
C      MISCELLANEOUS LATE SOURCES OF IODINE
      XLATE=XINTERPL(LVL(8),LATEIL,ILOG)
      CALL CLATEI2(FCOR(2),FVES(2),FCCI(2),
$      FLATEX(2),XLATE,DIAG,IPRINT,BIN,FPART,
$      ST(2),STL(2),DI2,DLATE(2),XSG(2),XOSG(2))
C      IF EARLY RELEASE OVERLAPS LATE RELEASE, A FRACTION OF THE EARLY
C      RELEASE IS PUT INTO THE LATE RELEASE.
      IF(T1+DT1.GT.T2) THEN
        OVERLAP=(T1+DT1-T2)/(T1+DT1)
        DT1=AMAX1(T2-T1,0.)
        DO 7772 ISP=1,NSP
          FRACT=OVERLAP*ST(ISP)
          ST(ISP)=ST(ISP)-FRACT
          STL(ISP)=STL(ISP)+FRACT
7772    CONTINUE
        ENDIF
C      MASS BALANCE OF CORE MATERIAL
      IF(DIAG)THEN
        FM1=FREM
        FM2=FPME
        FM3=FPART
        FM4=(1.-FREM-FPME)-FPART
        SUM=FM1+FM2+FM3+FM4
        WRITE(IPRINT,1058),FM1,FM2,FM3,FM4,SUM
1058    FORMAT(/5X,'CORE DISTRIBUTION: '/
$      10X,'IN RCS ',F7.3/
$      10X,'HPME ',F7.3/
$      10X,'CCI ',F7.3/
$      10X,'OTHER ',F7.3/
$      10X,' ',-----'/
$      10X,'TOTAL ',F7.3)
        WRITE(IPRINT,1032)(ST(IS),IS=1,NSP),
$      (STL(IS),IS=1,NSP)
1032    FORMAT(5X,'SOURCE TERMS: '/5X,'RCS: ',9(1PE9.1)/

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$      5X,'CCI: ',9(1PE9.1))
      END IF
C     TEST THAT RELEASES FOR ALL SPECIES DO NOT EXCEED 1.0
TEST=.FALSE.
DO 300 ISP=1,NSP
    IF(ST(ISP)+STL(ISP)-1..GT.1.E-3)THEN
        TEST=.TRUE.
        BAD=ST(ISP)+STL(ISP)
        WRITE (IPRINT,5000)BIN,ISP,BAD
    END IF
300 CONTINUE
    IF(TEST)STOP9999
5000 FORMAT('   BIN ',A20,' GROUP ',I1,
$' ERROR IN SOURCE TERM; TOTAL RELEASE = ',E15.7)
C     NOBLE GAS RELEASE SHOULD EQUAL 1.0, EXCEPT FOR MELTTHROUGH OR NO
CONTAINMENT FAILURE.
    RNG=ST(1)+STL(1)
    IF(CHH.LT.'G'.AND.ABS(1.-RNG).GE.1.E-2.AND.BIN(5:5).NE.'F')THEN
        WRITE(IPRINT,5010)BIN,RNG
        STOP 9998
    END IF
5010 FORMAT('   BIN ',A20,' GROUP 1 ',
$' TOTAL RELEASE = ',E15.7,' SHOULD BE 1.0')
    RETURN
END
SUBROUTINE RELCHAR ( BIN, TW,T1,DT1,E1, T2,DT2,E2, ELEV,ISPR )
C
C                                     Original by WBM, Autumn 1988
C                                     Revised by RJB, 11 Feb 1989
C
LOGICAL ISPR(4)
CHARACTER*20 BIN
CHARACTER CHH1, CHH3, CHH6, CHH10
C
C THIS SUBROUTINE COMPUTES THE RELEASE CHARACTERISTICS --
C WARNING TIME, RELEASE TIMES, AND ENERGY OF THE RELEASE
C ALL TIMES ARE IN SECONDS
C TW = WARNING TIME -- USUALLY THE TIME OF CORE COLLAPSE, BUT
C THE TIME THE CORE UNCOVERED (TAF) FOR V OR CF BEFORE CM
C NOTE: TW IS NOT THE WARNING INTERVAL, BUT TIME SINCE THE
C START OF THE ACCIDENT
C
C T1 = TIME OF START OF THE FIRST OR EARLY RELEASE
C ( T1 IS THE SAME AS T2, IF THERE IS NO EARLY RELEASE)
C DTW = WARNING INTERVAL = T1 - TW
C DT1 = DURATION OF THE EARLY RELEASE
C E1 = ENERGY RELEASE RATE OF THE EARLY RELEASE ( WATTS )
C
C T2 = TIME OF START OF THE SECOND OR LATE RELEASE.
C DT2 = DURATION OF THE LATE RELEASE
C E2 = ENERGY RELEASE RATE OF THE LATE RELEASE ( WATTS )
C
C ELEV = ELEVATION OF THE RELEASE ( METERS )
C
C GET THE LETTER FOR FOUR CHARACTERISTICS OF THE BIN:
C CHARACTERISTIC 1 - CF TIME
C CHARACTERISTIC 3 - CCI
C CHARACTERISTIC 6 - SGTR
C CHARACTERISTIC 10 - CF SIZE
CHH1 = BIN(1:1)
CHH3 = BIN(3:3)
CHH6 = BIN(6:6)
CHH10 = BIN(10:10)

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C
C SET THE DEFAULT CORE UNCOVERY TIME TO 300 MINUTES = 5 HOURS
TCU = 18000.
C
C SET DEFAULT RELEASE DURATIONS --
C CHH10 = A FOR CATASTROPHIC RUPTURE ( 10 SECONDS )
C CHH10 = B FOR RUPTURE ( 3.3 MINUTES )
C CHH10 = C FOR LEAK OR BASEMAT MELT-THRU ( 3 HOURS )
C CHH10 = D FOR NO CF OR BYPASS ONLY ( 24 HOURS )
C IF ( CHH10 .EQ. 'A' ) THEN
  DT1 = 200.
  DT2 = 200.
  ELSEIF ( CHH10 .EQ. 'B' ) THEN
    DT1 = 200.
    DT2 = 200.
  ELSEIF ( CHH10 .EQ. 'C' ) THEN
    DT1 = 10800.
    DT2 = 10800.
  ELSEIF ( CHH10 .EQ. 'D' ) THEN
    DT1 = 86400.
    DT2 = 86400.
  ENDIF
C
C SET DEFAULT ENERGIES AND ELEVATION
E1 = 0.
E2 = 0.
ELEV = 10.
C
C FIRST CONSIDER THE SGTRS
IF ( CHH6 .NE. 'C' ) GO TO 70
C
C NEXT CONSIDER THE V's, AND THEN SORT ON CF TIME
IF ( CHH1 .LE. 'B' ) GO TO 10
IF ( CHH1 .LE. 'D' ) GO TO 30
IF ( CHH1 .EQ. 'E' ) GO TO 40
IF ( CHH1 .EQ. 'F' ) GO TO 50
IF ( CHH1 .EQ. 'G' ) GO TO 60
C
C V-SEQUENCE -- CHH1 = A FOR V-DRY, CHH1 = B FOR V-WET
10 TCU = 1250.
  TW = TCU
  T1 = 2400. + TCU
  DT1 = 1800.
  E1 = 3.7E6
  IF ( CHH1 .EQ. 'B' ) E1 = E1 / 2.
  T2 = 9000. + TCU
  DT2 = 21600.
  E2 = 1.7E5
  ELEV = 0.
  RETURN
C
C CF AT OR BEFORE VB -- CHH1 = C FOR CF BEFORE VB, = D FOR CF AT VB
30 TW = 4300. + TCU
  T1 = 10000. + TCU
  E1 = 5.6E9 / DT1
  IF ( ISPR(1) .OR. ISPR(2) ) E1 = E1 / 10.
  DT2 = 21600.
  E2 = 1.6E6
  IF ( ISPR(3) ) E2 = E2 / 10.
C
C DETERMINE IF CCI WILL BE PROMPT OR DELAYED --
C CHH3 = A FOR PROMPT - DRY CHH3 = B FOR PROMPT - SHALLOW
C CHH3 = C FOR NO CCI CHH3 = D FOR PROMPT - DEEP

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Appendix B.1

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C      CHH3 = E FOR SHORT DELAY - DRY      CHH3 = F FOR LONG DELAY - DRY
C
C      IF ( CHH3 .EQ. 'C' ) GO TO 34
C PROMPT CCI -- CHH3 = A, B, OR D
C      IF ( CHH3 .LE. 'D' ) T2 = 11000. + TCU
C SHORT DELAYED CCI -- CHH3 = E
C      IF ( CHH3 .EQ. 'E' ) T2 = 16000. + TCU
C LONG DELAYED CCI -- CHH3 = F
C      IF ( CHH3 .EQ. 'F' ) T2 = 28000. + TCU
C      RETURN
C
C NO CCI -- CHH3 = C
34    T2 = 1.E6
      DT2 = 1.E6
      RETURN
C
C LATE OR VERY LATE FAILURE -- CHH1 = E
40    TW = 4300. + TCU
      T1 = 29000. + TCU
      DT1 = 0.
      T2 = 29000. + TCU
      E2 = 7.E9 / DT2
      IF ( ISPR(3) ) E2 = E2 / 10.
      RETURN
C
C FAILURE IN THE FINAL PERIOD ( AFTER 24 HOURS ) -- CHH1 = F
50    TW = 4300. + TCU
      T1 = 29000. + TCU
      DT1 = 0.
      T2 = 86400. + T1
      E2 = 7.E8 / DT2
      IF ( ISPR(4) ) E2 = E2 / 10.
      RETURN
C
C NO CONTAINMENT FAILURE -- CHH1 = G
60    TW = 4300. + TCU
      T1 = 29000. + TCU
      DT1 = 0.
      T2 = T1
      DT2 = 86400.
      ELEV = 0.
      RETURN
C
C STEAM GENERATOR TUBE RUPTURES -- SGTRs
70    E1 = 1.0E6
C USE THE DEFAULT VALUES FOR DT2 UNLESS THERE IS NO CF,
C THEN USE 6 HOURS
C      IF ( CHH10 .EQ. 'D' ) DT2 = 21600.
C SGTRs -- SEPARATE THE "H" SGTRs FROM THE "G" SGTRs
C      IF ( CHH6 .EQ. 'A' ) GO TO 80
C
C SGTRs WITH THE SECONDARY SRVs STUCK OPEN -- HINY-NXY
C      TW = 10 HOURS, T1 = 14.2 HOURS, DT1 = 1 HOUR
C      TW = 36000.
C      T1 = 51000.
C      DT1 = 3600.
C      GO TO 83
C
C SGTRs WITH THE SECONDARY SRVs RECLOSING -- GLYY-YaY
C      TW = 3.5 HOURS, T1 = 5.5 HOURS, DT1 = 1 HOUR
80    TW = 12600.
      T1 = 19800.
      DT1 = 3600.

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C
C NOW SORT OUT THE CCI RELEASES
83 IF ( CHH3 .EQ. 'C' ) GO TO 88
C PROMPT CCI -- CHH3 = A, B, OR D -- ADD 16.7 MINUTES
  IF ( CHH3 .LE. 'D' ) T2 = T1 + 1000.
C SHORT DELAYED CCI -- CHH3 = E -- ADD 1.67 HOURS
  IF ( CHH3 .EQ. 'E' ) T2 = T1 + 6000.
C LONG DELAYED CCI -- CHH3 = F -- ADD 5.0 HOURS
  IF ( CHH3 .EQ. 'F' ) T2 = T1 + 18000.
  RETURN
C
C NO CCI -- CHH3 = C
88 T2 = 1.0E6
  DT2 = 1.0E6
  RETURN
  END

      SUBROUTINE CORER(BIN,NSP,FCOR,FCORL,LVL)
      REAL LVL
      CHARACTER*20 BIN
C      RELEASE OF RADIONUCLIDES FROM THE CORE.
      DIMENSION FCOR(9),FCORL(10,9,4)
      IC=ICHAR(BIN(8:8))-64
      ILOG=1
      DO 10 ISP=1,NSP
        FCOR(ISP)=XINTERPLSC(LVL,FCORL,ISP,IC,ILOG)
10      CONTINUE
      RETURN
      END
      SUBROUTINE CCIREL(BIN,NSP,CCI,FCCI,LVL)
      DIMENSION CCI(10,9,4),FCCI(9)
      REAL LVL
      CHARACTER*20 BIN
C      DEGREE OF ZR OXIDATION
      IC=ICHAR(BIN(8:8))-64
C      IS WATER PRESENT?
      IF(BIN(3:3).EQ.'B'.OR.BIN(3:3).EQ.'D') IC=IC+2
      ILOG=1
      FCCI(1)=1.0
C      CALCULATE RELEASE DURING CORE-CONCRETE INTERACTION.
      IF(BIN(3:3).EQ.'C') GOTO 20
C      NON-COOLABLE BED; CCI OCCURS.
      DO 10 ISP=2,NSP
        FCCI(ISP)=XINTERPLSC(LVL,CCI,ISP,IC,ILOG)
10      CONTINUE
      RETURN
C      PERMANENTLY COOLABLE DEBRIS BED; NO CCI OCCURS.
20      DO 30 ISP=2,NSP
        FCCI(ISP)=0.
30      CONTINUE
      RETURN
      END
      SUBROUTINE SPRAY (BIN,ISPR)
      LOGICAL ISPR(4)
      CHARACTER*20 BIN
      CHARACTER CHSP
C      SETS UP THE "ISPR" MATRIX.
C      ISPR(1) = .TRUE. : SPRAYS BEFORE VESSEL BREACH.
C      ISPR(2) = .TRUE. : SPRAYS AFTER VESSEL BREACH BUT BEFORE CCI
C      ISPR(3) = .TRUE. : SPRAYS DURING CCI.
C      ISPR(4) = .TRUE. : SPRAYS AFTER CCI.
C
      CHSP=BIN(2:2)
      DO 10 ISP=1,4

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Appendix B.1

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        ISPR(ISP)=.FALSE.
10      CONTINUE
        IF(CHSP.LE.'D')ISPR(1)=.TRUE.
        IF(CHSP.GE.'B'.AND.CHSP.LE.'D')ISPR(2)=.TRUE.
        IF(CHSP.GE.'C'.AND.CHSP.LE.'F')ISPR(3)=.TRUE.
        IF(CHSP.EQ.'D'.OR.CHSP.EQ.'F'.OR.CHSP.EQ.'G')ISPR(4)=.TRUE.
        RETURN
      END
      SUBROUTINE FAN(BIN,IFAN)
      CHARACTER*20 BIN
      LOGICAL IFAN(2)
C      SET UP FAN INDICES
      IFAN(1)=.FALSE.
      IF(BIN(14:14).LE.'B')IFAN(1)=.TRUE.
      IFAN(2)=.FALSE.
      IF(BIN(14:14).EQ.'B'.OR.BIN(14:14).EQ.'C')IFAN(2)=.TRUE.
      RETURN
      END
      SUBROUTINE ICE(BIN,IFAN,DFICVI,DFICCI,DFICV,DFICC,DFICDH,
$      FBYPV,FBYPC,LVL)
C      FIND DF-S FOR ICE CONDENSER.  DFICV APPLIES TO RCS RELEASE.
C      DFICC APPLIES TO CCI RELEASE.
      DIMENSION DFICVI(10,5),DFICCI(10,5)
      CHARACTER*20 BIN
      REAL LVL
      LOGICAL IFAN(2)
      DATA FBYPV,FBYPC/.1,.1/
C      FOR V-SEQUENCE, ICE IS INEFFECTIVE
      IF(BIN(1:1).LE.'B')THEN
        DFICV=1.
        DFICC=1.
        FBYPV=1.
        FBYPC=1.
        DFICDH=1.
        RETURN
      END IF
      ILOG=1
C      FIND CASE FOR RCS RELEASE
C      CASE 3 IS THE DEFAULT
      ICASV=3
      IF(.NOT.IFAN(1))GOTO 100
      IF(BIN(1:1).EQ.'C'.OR.BIN(1:1).EQ.'D')THEN
        ICASV=2
      ELSE
        ICASV=1
      END IF
C      FIND CASE FOR CCI RELEASE
C      CASE 3 IS DEFAULT
100    ICASC=3
      IF(.NOT.IFAN(2))GOTO 200
      IF(BIN(1:1).EQ.'C'.OR.BIN(1:1).EQ.'D'.OR.(BIN(1:1).EQ.'E'
&      .AND.BIN(3:3).EQ.'F'))THEN
        ICASC=2
      ELSE
        ICASC=1
      END IF
200    DFICV=XINTERPLC(LVL,DFICVI,ICASV,ILOG)
        DFICC=XINTERPLC(LVL,DFICCI,ICASC,ILOG)
        ICASDH=4
        DFICDH=XINTERPLC(LVL,DFICVI,ICASDH,ILOG)
C      FIND WHETHER ICE CONDENSER IS BYPASSED DURING RCS RELEASE
        FBYPV=0.
C      PARTIAL BYPASS ONLY IF ICE CONDENSER WALL IS BREACHED

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IF(BIN(12:12).EQ.'B'.AND.BIN(1:1).EQ.'C')FBYPV=FBYPVO
IF(BIN(12:12).EQ.'C')FBYPV=1.
C IF FANS OPERATE, ICE CONDENSER IS PARTIALLY EFFECTIVE, EVEN IF
C ALL ICE IS MELTED
IF(IFAN(1).AND.BIN(12:12).EQ.'C'.AND.BIN(1:1).NE.'C')FBYPV=.8
C FIND WHETHER ICE CONDENSER IS BYPASSED DURING CCI RELEASE
FBYPC=0.
IF(BIN(13:13).EQ.'B'.AND.(BIN(1:1).EQ.'C'.OR.BIN(1:1).EQ.'D'))
$ FBYPC=FBYPCO
IF(BIN(13:13).EQ.'C')FBYPC=1.
IF(IFAN(2).AND.BIN(13:13).EQ.'C'.AND.BIN(1:1).GT.'D')FBYPC=.8
RETURN
END

SUBROUTINE CLATEI2(FCOR,FVES,FCCI,FLATE,XLATE,
$ DIAG,IPRINT,BIN,FPART,ST,STL,DI2,DLATE,XISG,XOSG)
LOGICAL DIAG
CHARACTER*20 BIN
CHARACTER CHH
CHH=BIN(1:1)
C CONTRIBUTION OF MISCELLANEOUS LATE SOURCES OF IODINE,
C INCLUDING (BUT NOT LIMITED TO) ORGANIC IODIDES.
C
C RELRCS = FRACTION RELEASED FROM THE RCS AND CCI.
C CONTI2 = FRACTION REMAINING IN CONTAINMENT.
C RELI = FRACTION RELEASED TO THE ENVIRONMENT, FROM CONTAINMENT.
C
C REVOLATILIZATION AND I FROM SG'S IS NOT INCLUDED
C
DSG=FCOR*XISG*XOSG
RELI=ST+STL-DLATE-DSG
FRCS=FVES*(1.-XISG)
RELRCS=FCOR*FRCS+(1.-FCOR)*FPART*FCCI+DI2
CONTI2=RELRCS-RELI
C IF 50% OR MORE HAS ALREADY BEEN RELEASED, REDUCE ADDED
C AMOUNT.
ADDI2=CONTI2*XLATE
IF(RELI.GT.0.5) ADDI2=ADDI2*2.*(1.-AMAX1(0.5,RELI))
IF(CHH.EQ.'G') ADDI2=ADDI2*.005
STL=STL+ADDI2
1000 IF(DIAG)WRITE(IPRINT,1000)XLATE,RELRCS,RELI,CONTI2,ADDI2
$ FORMAT(/5X,'XLATE = ',F8.4/
$ 5X,'REL. TO CONT. = ',1PE10.1,'REL. FROM CONT. = ',
$ 1PE10.1,' REM. IN CONT. = ',1PE10.1/5X,
$ 'ADDED IODINE = ',1PE10.1)
RETURN
END
SUBROUTINE VESREL(BIN,FVES,FVHH,FVHP,
$ FVIP,FVLP,FVV,FVSG,NSP,LVL)
$ DIMENSION FVES(9),FVHH(10,9),FVHP(10,9),FVIP(10,9),FVLP(10,9),
$ FVV(10,9),FVSG(10,9)
REAL LVL
CHARACTER CHH
CHARACTER*20 BIN
CHH=BIN(1:1)
ILOG=1
C RELEASE OF RADIONUCLIDES FROM THE VESSEL
C
C V-SEQUENCE HAS SPECIAL TREATMENT
C
IF(CHH.LE.'B')GOTO 100
IF(BIN(6:6).LE.'B')GOTO 200
IGO=ICHAR(BIN(4:4))-64
DO 10 ISP=1,NSP

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Appendix B.1

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      GOTO (11,12,13,14),IGO
11      FVES(ISP)=XINTERPLS(LVL,FVHH,ISP,ILOG)
      GOTO 10
12      FVES(ISP)=XINTERPLS(LVL,FVHP,ISP,ILOG)
      GOTO10
13      FVES(ISP)=XINTERPLS(LVL,FVIP,ISP,ILOG)
      GOTO10
14      FVES(ISP)=XINTERPLS(LVL,FVLP,ISP,ILOG)
10      CONTINUE
C      IF NO VESSEL BREACH, REDUCE RELEASE (EXCEPT NG) BY 2.0
      IF(BIN(5:5).EQ.'F')THEN
          DO 17 ISP=2,NSP
              FVES(ISP)=FVES(ISP)/2.
17          CONTINUE
      END IF
      RETURN
100     DO 40 ISP=1,NSP
          FVES(ISP)=XINTERPLS(LVL,FVV,ISP,ILOG)
40      CONTINUE
      RETURN
200     DO 50 ISP=1,NSP
          IF(BIN(6:6).EQ.'A')THEN
              FVES(ISP)=XINTERPLS(LVL,FVSG,ISP,ILOG)
          ELSE
              FVES(ISP)=XINTERPLS(LVL,FVV,ISP,ILOG)
          END IF
50      CONTINUE
      RETURN
      END
      SUBROUTINE FCONVC(BIN,ISPR,FCONVI,FCONV,FCONCI,
          $      FCONC,LVL4,LVL6,NSP)
          DIMENSION FCONVI(10,6)
          DIMENSION FCONCI(10,9,6),FCONC(9)
          REAL LVL4,LVL6
          CHARACTER*20 BIN
          LOGICAL ISPR(4)
          CHARACTER CHH1,CHH10
          CHH1=BIN(1:1)
          CHH10=BIN(10:10)
          ILOG=1
C      RELEASE OF MATERIAL FROM CONTAINMENT.
C      FCONV: RELEASE OF MATERIAL FROM RCS
C      FCONC: RELEASE OF MATERIAL FROM CCI
C
C      CASE 1 = EARLY SMALL LEAK, DRY CONTAINMENT.
C      CASE 2 = EARLY SMALL LEAK, WET CONTAINMENT.
C      CASE 3 = EARLY RUPTURE OR LARGE LEAK, UPPER COMP.
C      CASE 4 = EARLY RUPTURE OR LARGE LEAK, LOWER COMP.
C      CASE 5 = LATE RUPTURE OR LARGE LEAK
C      CASE 6 = V-SEQUENCE
C
      IF(CHH1.LE.'B')GOTO 100
      IF(CHH1.EQ.'C')GOTO 110
      IF(CHH1.EQ.'D')IJ1=1
      IF(CHH1.EQ.'E')IJ1=2
      IF(CHH1.EQ.'F')IJ1=3
      IF(CHH1.EQ.'G')IJ1=4
      IJ2=ICHAR(CHH10)-64
      IF(IJ1.EQ.4.OR.IJ2.EQ.4)GOTO 120
      IGO=(IJ1-1)*3+IJ2
      GOTO(10,20,30,40,40,60,80,80,80),IGO
C      CATASTROPHIC RUPTURE AT VESSEL BREACH; USE LARGE FCONV & FCONC
10      FM=FCONVI(5,3)

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C      FI=XINTERPLC(LVL4,FCONVI,3,ILOG)
      USE 95-TH PERCENTILE OF CASE 3 AS MEDIAN
      FX=FCONVI(7,3)
      IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
        FCONV=1.
      ELSE
        YI=FI/(1.-FI)
        YM=FM/(1.-FM)
        YS=FX/(1.-FX)
        PHI=YS/YM
        FCONV=PHI*YI/(1.+PHI*YI)
      END IF
      DO 11 ISP=2,NSP
        FM=FCONCI(5,ISP,3)
        FI=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
        FX=FCONCI(7,ISP,3)
        IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
          FCONC(ISP)=1.
        ELSE
          YI=FI/(1.-FI)
          YM=FM/(1.-FM)
          YS=FX/(1.-FX)
          PHI=YS/YM
          FCONC(ISP)=PHI*YI/(1.+PHI*YI)
        END IF
11     CONTINUE
        FCONC(1)=1.
        RETURN
C      LARGE BREAK AT VESSEL BREACH
20     ICASV=3
        ICASC=3
C      LARGE BREAK IN LOWER COMPARTMENT
        IF(BIN(12:12).EQ.'B'.AND.BIN(1:1).EQ.'C'.AND.
$      BIN(10:10).LE.'B')THEN
          ICASV=4
          ICASC=4
        END IF
        GOTO 150
C      SMALL LEAK AT VESSEL BREACH
30     ICASV=1
        IF(ISPR(1))ICASV=2
        ICASC=1
        IF(ISPR(1).OR.ISPR(2).OR.ISPR(3))ICASC=2
        GOTO 150
C      CATASTROPHIC RUPTURE OR RUPTURE LATE
40     IF(ISPR(2).OR.ISPR(3))THEN
          FACTV=XINTERPLC(LVL4,FCONVI,5,ILOG)/FCONVI(5,5)
          FCONV=.01*FACTV
          ICASC=5
C      FOR DELAYED CCI, A LATE CF IS THE SAME AS EARLY CF
          IF(BIN(3:3).EQ.'F')ICASC=3
          DO 41 ISP=2,NSP
            FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,ICASC,ILOG)
41     CONTINUE
            FCONC(1)=1.
            RETURN
          ELSE
            ICASV=5
            ICASC=5
            IF(BIN(3:3).EQ.'F')ICASC=3
            GOTO 150
          END IF
C      LATE LEAK

```

Appendix B.1

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60      IF(ISPR(2).OR.ISPR(3))GOTO 65
C      NO SPRAYS AFTER VB
          FACTV=XINTERPLC(LVL4,FCONVI,1,ILOG)/FCONVI(5,1)
          FCONV=5.E-3*FACTV
          FCONC(1)=1.
          DO 61 ISP=2,NSP
C      IF CCI IS LONG DELAYED, "LATE" LEAK IS SAME AS EARLY
C      USE EARLY FOR TE AND RU
          IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6)THEN
              FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,1,ILOG)
          ELSE
              FACTC=XINTERPLSC(LVL6,FCONCI,ISP,1,ILOG)/FCONCI(5,ISP,1)
              FCONC(ISP)=1.E-2*FACTC
          END IF
61      CONTINUE
          RETURN
C      SPRAYS OPERATE AFTER VB; REMOVE RCS RELEASE
65      FACTV=XINTERPLC(LVL4,FCONVI,2,ILOG)/FCONVI(5,2)
          FCONV=.001*FACTV
          DO 67 ISP=2,NSP
              IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6)THEN
                  FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)
              ELSE
                  FACTC=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)/FCONCI(5,ISP,2)
              IF(ISPR(3))THEN
                  FCONC(ISP)=.005*FACTC
              ELSE
                  FCONC(ISP)=1.E-2*FACTC
              IF(BIN(3:3).EQ.'F'.OR.ISP.EQ.4.OR.ISP.EQ.6)
                  FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,2,ILOG)
              END IF
          END IF
67      CONTINUE
          FCONC(1)=1.
          RETURN
C      VERY LATE (24 HRS) RUPTURE OR LEAK
80      FCONV=1.E-6
          DO 85 ISP=2,NSP
              FACTC=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)/FCONCI(5,ISP,3)
              FCONC(ISP)=1.E-4*FACTC
85      CONTINUE
          FCONC(1)=1.
          RETURN
C      V SEQUENCE (CASE 4)
100     ICASV=6
          ICASC=6
          GOTO 150
C      CONTAINMENT FAILURE BEFORE VESSEL BREACH OR ISOLATION FAILURE
110     IF(CHH10.LE.'B')THEN
C      CATASTROPHIC RUPTURE OR RUPTURE BEFORE VESSEL BREACH
          FM=FCONVI(5,3)
          FI=XINTERPLC(LVL4,FCONVI,3,ILOG)
C      ORDINARY RUPTURE USES 75-TH PERCENTILE AS MEDIAN
          FX=FCONVI(6,3)
C      CATASTROPHIC RUPTURE USES 99-TH PERCENTILE
          IF(CHH10.EQ.'A')FX=FCONVI(8,3)
          IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
              FCONV=1.
          ELSE
              YI=FI/(1.-FI)
              YM=FM/(1.-FM)
              YS=FX/(1.-FX)
              PHI=YS/YM

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      FCONV=PHI*YI/(1.+PHI*YI)
    END IF
    DO 111 ISP=2,NSP
      IF(CHH10.EQ.'A')THEN
        FM=FCONCI(5,ISP,3)
        FI=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
        FX=FCONCI(8,ISP,3)
        IF(FI.EQ.1..OR.FM.EQ.1..OR.FX.EQ.1.)THEN
          FCONC(ISP)=1.
        ELSE
          YI=FI/(1.-FI)
          YM=FM/(1.-FM)
          YS=FX/(1.-FX)
          PHI=YS/YM
          FCONC(ISP)=PHI*YI/(1.+PHI*YI)
        END IF
      ELSE
        FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,3,ILOG)
      END IF
111    CONTINUE
      FCONC(1)=1.
      RETURN
C    LEAK OR SMALL ISOLATION FAILURE BEFORE VESSEL BREACH
C    USE AVERAGE OF CASES 1 OR 2 AND 3
    ELSE
      IIFC=1
      IF(ISPR(1))IIFC=2
      F1=XINTERPLC(LVL4,FCONVI,IIFC,ILOG)
      F2=XINTERPLC(LVL4,FCONVI,3,ILOG)
      FCONV=(F1+F2)/2.
      DO 114 IS=2,NSP
        FCONC(IS)=XINTERPLSC(LVL6,FCONCI,IS,IIFC,ILOG)
114    CONTINUE
      FCONC(1)=1.
    END IF
    RETURN
C    NO FAILURE
120    FCONV=1.E-6
      FCONC(1)=.005
      DO 121 ISP=2,NSP
        FCONC(ISP)=1.E-6
121    CONTINUE
      RETURN
C    CALCULATE FCONV AND FCONC FROM GIVEN CASE
150    FCONV=XINTERPLC(LVL4,FCONVI,ICASV,ILOG)
      DO 151 ISP=2,NSP
        FCONC(ISP)=XINTERPLSC(LVL6,FCONCI,ISP,ICASC,ILOG)
151    CONTINUE
      FCONC(1)=1.
      RETURN
END
$    SUBROUTINE SPRDF(BIN,ISPR,DFSPR1,DFSPR2,DFSPV,DFSPRC,DFSPC,
      LVL)
      DIMENSION DFSPR1(10),DFSPR2(10),DFSPRC(10)
      LOGICAL ISPR(4)
      REAL LVL
      CHARACTER*20 BIN
      CHARACTER CHH1,CHH10
      CHH1=BIN(1:1)
      CHH10=BIN(10:10)
      ILOG=1
C    DF FOR SPRAYS.
C    DFSPV IS THE DF FOR VESSEL RELEASE.  DFSPC IS

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Appendix B.1

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C      THE DF FOR CCI RELEASE. NO CREDIT FOR SPRAYS (EARLY OR LATE)
C      FOR V-SEQUENCE OR LARGE CF BEFORE MELT.
C      DEFAULT IS NO SPRAYS.
          DFSPV=1.
          DFSPC=1.
          IF(CHH1.LE.'B'.OR.(CHH1.EQ.'C'.AND.CHH10.LE.'B'))RETURN
C      EARLY FAILURE
          IF(CHH1.GT.'D')GOTO 100
          IF(ISPR(3))DFSPC=XINTERPL(LVL,DFSPRC,ILOG)
          IF(BIN(4:4).LE.'B'.AND.CHH10.LE.'B')THEN
              IF(ISPR(1))DFSPV=XINTERPL(LVL,DFSPR1,ILOG)
          ELSE
              IF(ISPR(1))DFSPV=XINTERPL(LVL,DFSPR2,ILOG)
          END IF
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
          DFSPC=AMIN1(DFSPC,1.E4)
          DFSPV=AMIN1(DFSPV,1.E4)
          RETURN
100      IF(CHH1.GT.'E')GOTO 110
          IF(ISPR(1).OR.ISPR(2).OR.ISPR(3))DFSPV=
$          10.*XINTERPL(LVL,DFSPR2,ILOG)
          IF(ISPR(3))DFSPC=XINTERPL(LVL,DFSPRC,ILOG)
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
          DFSPC=AMIN1(DFSPC,1.E4)
          DFSPV=AMIN1(DFSPV,1.E4)
          RETURN
110      IF(ISPR(1).OR.ISPR(2).OR.ISPR(3).OR.ISPR(4))
$          DFSPV=10.*XINTERPL(LVL,DFSPR2,ILOG)
          IF(ISPR(3).OR.ISPR(4))DFSPC=10.*XINTERPL(LVL,DFSPRC,ILOG)
C      SPRAY DF SHOULD NOT BE GREATER THAN 10,000.
          DFSPC=AMIN1(DFSPC,1.E4)
          DFSPV=AMIN1(DFSPV,1.E4)
          RETURN
          END
          SUBROUTINE DHEAT(BIN,FDCHL,LDCH,NSP,DST,FCOR,DIAG,IPRINT,FPME,ISPR)
C
C      MODEL DEVELOPED BY D. A. POWERS
C      DCH RELEASE OF NUCLIDE "I": (ADDITION TO ST "I")
C      DST(I)=(1.-FCOR(I))*FPME*FDCH(I)
C      FPME=FRACTION OF CORE PARTICIPATING IN PRESSURIZED MELT EJECTION
C      FPME ASSUMED NOT TO PARTICIPATE IN CCI
C      FDCH(I)=FRACTION OF EJECTED MELT RELEASED TO CONTAINMENT
C      DIMENSION FDCHL(10,9,2),DST(9),FCOR(9),FDCH(9)
          LOGICAL DIAG,ISPR(4)
          REAL LDCH
          CHARACTER*20 BIN
C      CONTRIBUTION DUE TO AEROSOLIZATION IS ONLY CALCULATED FOR
C      CONTAINMENT FAILURE AT VESSEL BREACH.
C      NOT CALCULATED FOR LOW PRESSURE SEQUENCES
          DO 1 ISP=1,NSP
              DST(ISP)=0.
1          CONTINUE
              IF(FPME.EQ.0..OR.BIN(4:4).GT.'C')RETURN
              CASE 1: HIGH PRESSURE
              CASE 2: INTERMEDIATE PRESSURE
                  IC=1
                  IF(BIN(4:4).GT.'B')IC=2
C      CONTAINMENT FAILURE LATE: DO NOT CALCULATE DCH RELEASE
C      EARLY LEAK AND SPRAYS OPERATE: DO NOT CALCULATE DCH RELEASE
                  IF((BIN(1:1).EQ.'D'.OR.BIN(1:1).EQ.'C')
$                      .AND.(BIN(10:10).LE.'B'.OR.BIN(10:10).
$                      EQ.'C'.AND..NOT.ISPR(1))) GOTO 5
                  IF(DIAG)WRITE(IPRINT,950)

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950      FORMAT(5X,'DCH RELEASE NOT CALCULATED')
      DST(1)=(1.-FCOR(1))*FPME
      RETURN
5        ILOG=1
      DO 10 ISP=1,NSP
          FDCH(ISP)=XINTERPLSC(LDCH,FDCHL,ISP,IC,ILOG)
          DST(ISP)=(1.-FCOR(ISP))*FPME*FDCH(ISP)
10       CONTINUE
      IF (DIAG)WRITE(IPRINT,1000)(FDCH(ISP),ISP=1,NSP)
1000    FORMAT(5X,'FDCH = ',9(1PE8.1))
      RETURN
      END
      SUBROUTINE WEIGHT (NSP,ST,WE,WL)
      DIMENSION ST(9),WFE(9),WFL(9)
      DATA (WFE(I),I=1,9)/.08,1.,.12,.78,.8,2.13,8.31,8.,.55/
      DATA (WFL(I),I=1,9)/.0011,.1,1.,.104,.7,1.19,2.62,5.4,.2/
      WE=0.
      WL=0.
      DO 10 ISP=1,NSP
          WE=WE+ST(ISP)*WFE(ISP)
          WL=WL+ST(ISP)*WFL(ISP)
10       CONTINUE
      RETURN
      END
      REAL FUNCTION XINTERPL(LEVEL,PARAM,ILOG)
      DIMENSION PARAM(10),CDF(9),PARAMX(10)
      REAL LEVEL
      DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
      IF(LEVEL.LT.0.)THEN
          XINTERPL=PARAM(10)
          RETURN
      ELSE IF(LEVEL.GE.1.)THEN
          XINTERPL=PARAM(9)
          RETURN
      ELSE IF(LEVEL.EQ.0.)THEN
          XINTERPL=PARAM(1)
          RETURN
      ELSE
          IF(ILOG.EQ.0)THEN
              DO 2 L=1,9
                  PARAMX(L)=PARAM(L)
2          CONTINUE
              ELSE
                  DO 4 L=1,9
                      PARAMX(L)=LOG(PARAM(L))
4          CONTINUE
              END IF
              DO 6 L=2,9
                  IF(CDF(L).LE.LEVEL)GOTO 6
                  FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
                  GOTO 8
6          CONTINUE
              L=9
              FR=1.
8          XINTERPL=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
              IF(ILOG.GT.0)XINTERPL=EXP(XINTERPL)
              RETURN
          END IF
      END
      REAL FUNCTION XINTERPLS(LEVEL,PARAM,ISP,ILOG)
      DIMENSION PARAM(10,9),PARAMX(10),CDF(9)
      REAL LEVEL
      DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./

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Appendix B.1

```

      IF (LEVEL.LT.0.) THEN
        XINTERPLS=PARAM(10,ISP)
        RETURN
      ELSE IF (LEVEL.GE.1.) THEN
        XINTERPLS=PARAM(9,ISP)
        RETURN
      ELSE IF (LEVEL.EQ.0.) THEN
        XINTERPLS=PARAM(1,ISP)
        RETURN
      ELSE
        IF (ILOG.EQ.0) THEN
          DO 2 L=1,9
            PARAMX(L)=PARAM(L,ISP)
2          CONTINUE
          ELSE
            DO 4 L=1,9
              PARAMX(L)=LOG(PARAM(L,ISP))
4            CONTINUE
            END IF
            DO 6 L=2,9
              IF (CDF(L).LE.LEVEL) GOTO 6
              FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
              GOTO 8
6            CONTINUE
            L=9
            FR=1.
8            XINTERPLS=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
            IF (ILOG.GT.0) XINTERPLS=EXP(XINTERPLS)
            RETURN
          END IF
        END
      REAL FUNCTION XINTERPLSC(LEVEL,PARAM,ISP,ICASE,ILOG)
      DIMENSION PARAM(10,9,5),PARAMX(9),CDF(9)
      REAL LEVEL
      DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
      IF (LEVEL.LT.0.) THEN
        XINTERPLSC=PARAM(10,ISP,ICASE)
        RETURN
      ELSE IF (LEVEL.GE.1.) THEN
        XINTERPLSC=PARAM(9,ISP,ICASE)
        RETURN
      ELSE IF (LEVEL.EQ.0.) THEN
        XINTERPLSC=PARAM(1,ISP,ICASE)
        RETURN
      ELSE
        IF (ILOG.EQ.0) THEN
          DO 2 L=1,9
            PARAMX(L)=PARAM(L,ISP,ICASE)
2          CONTINUE
          ELSE
            DO 4 L=1,9
              PARAMX(L)=LOG(PARAM(L,ISP,ICASE))
4            CONTINUE
            END IF
            DO 6 L=2,9
              IF (CDF(L).LE.LEVEL) GOTO 6
              FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
              GOTO 8
6            CONTINUE
            L=9
            FR=1.
8            XINTERPLSC=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
            IF (ILOG.GT.0) XINTERPLSC=EXP(XINTERPLSC)

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        RETURN
END IF
END
REAL FUNCTION XINTERPLC(LEVEL,PARAM,ICASE,ILOG)
DIMENSION PARAM(10,4),PARAMX(9),CDF(9)
REAL LEVEL
DATA CDF /0.,.01,.05,.25,.5,.75,.95,.99,1./
IF(LEVEL.LT.0.)THEN
    XINTERPLC=PARAM(10,ICASE)
    RETURN
ELSE IF(LEVEL.GE.1.)THEN
    XINTERPLC=PARAM(9,ICASE)
    RETURN
ELSE IF (LEVEL.EQ.0.) THEN
    XINTERPLC=PARAM(1,ICASE)
    RETURN
ELSE
    IF(ILOG.EQ.0)THEN
        DO 2 L=1,9
            PARAMX(L)=PARAM(L,ICASE)
            CONTINUE
        ELSE
            DO 4 L=1,9
                PARAMX(L)=LOG(PARAM(L,ICASE))
                CONTINUE
            END IF
            DO 6 L=2,9
                IF(CDF(L).LE.LEVEL)GOTO 6
                FR=(LEVEL-CDF(L-1))/(CDF(L)-CDF(L-1))
                GOTO 8
            CONTINUE
            L=9
            FR=1.
            XINTERPLC=PARAMX(L-1)+FR*(PARAMX(L)-PARAMX(L-1))
            IF(ILOG.GT.0)XINTERPLC=EXP(XINTERPLC)
        RETURN
    END IF
END

```

APPENDIX B.2 SEQSOR Data Base

8.0E-02	2.0E-02	1.0E-02	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09
9.9E-02	3.3E-02	2.4E-02	2.3E-03	3.0E-05	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.1E-04
1.8E-01	8.4E-02	6.7E-02	1.3E-02	1.5E-04	1.0E-09	1.0E-09	1.0E-09	1.0E-09	2.2E-04
8.0E-01	3.7E-01	3.0E-01	7.6E-02	7.6E-04	5.0E-05	2.0E-05	2.0E-05	2.0E-05	1.7E-03
9.0E-01	6.9E-01	5.9E-01	2.0E-01	4.0E-03	2.0E-03	1.0E-04	1.5E-04	6.4E-03	
1.0E+00	9.1E-01	8.3E-01	4.6E-01	1.3E-02	1.2E-02	9.5E-04	2.5E-03	2.7E-02	
1.0E+00	1.0E+00	1.0E+00	8.9E-01	5.2E-01	5.8E-02	2.1E-02	8.5E-02	5.2E-01	
1.0E+00	1.0E+00	1.0E+00	9.8E-01	1.0E+00	1.4E-01	1.0E-01	5.1E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.7E-01	1.1E-01	1.0E+00	1.0E+00	
1.0E+00	9.9E-01	9.9E-01	2.7E-01	1.3E-01	1.0E-06	1.0E-07	1.0E-07	1.3E-01	
9.9E-02	9.9E-02	3.5E-02	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.6E-01	1.4E-01	8.1E-02	3.0E-03	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	2.2E-04
4.2E-01	2.8E-01	1.7E-01	1.8E-02	2.5E-04	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.2E-03
8.0E-01	5.6E-01	4.2E-01	9.7E-02	2.1E-03	5.0E-05	2.0E-05	2.0E-05	4.2E-03	
9.2E-01	7.5E-01	8.2E-01	3.3E-01	6.4E-03	4.6E-03	1.0E-04	1.5E-04	8.6E-03	
1.0E+00	9.6E-01	8.9E-01	5.9E-01	1.8E-02	2.0E-02	1.2E-03	3.0E-03	3.0E-02	
1.0E+00	1.0E+00	1.0E+00	9.1E-01	5.1E-01	8.1E-02	2.1E-02	8.5E-02	5.2E-01	
1.0E+00	1.0E+00	1.0E+00	9.9E-01	1.0E+00	1.4E-01	1.0E-01	5.1E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.9E-01	1.1E-01	1.0E+00	1.0E+00	
1.0E+00	9.9E-01	9.9E-01	8.4E-01	1.3E-01	1.0E-06	1.0E-07	1.0E-07	1.3E-01	FCOR*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	9.3E-03	5.1E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	
1.0E+00	8.6E-02	4.2E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	
1.0E+00	3.5E-01	3.5E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	
1.0E+00	7.7E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	
1.0E+00	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	2.4E-01	2.0E-01	1.5E-01	1.1E-01	1.0E-01	1.0E-01	1.0E-01	1.1E-01	FVHH*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	
1.0E+00	9.3E-03	5.1E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03	
1.0E+00	8.6E-02	4.2E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	2.8E-02	
1.0E+00	3.5E-01	3.5E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	1.8E-01	
1.0E+00	7.7E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	
1.0E+00	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	2.8E-01	2.8E-01	9.0E-02	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	FVHP*
1.0E+00	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	
1.0E+00	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	3.0E-05	
1.0E+00	1.1E-02	9.0E-03	8.0E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	
1.0E+00	2.0E-01	1.3E-01	1.2E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	
1.0E+00	4.1E-01	2.9E-01	2.5E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	
1.0E+00	6.1E-01	5.9E-01	4.3E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	
1.0E+00	8.9E-01	8.9E-01	8.9E-01	8.7E-01	8.7E-01	8.7E-01	8.7E-01	8.7E-01	
1.0E+00	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	5.0E-01	5.0E-01	2.0E-02	3.4E-01	3.4E-01	3.4E-01	3.4E-01	3.4E-01	FVIP*
1.0E+00	2.0E-09	1.1E-02	5.9E-03	5.9E-03	5.9E-03	5.9E-03	5.9E-03	5.9E-03	
1.0E+00	1.2E-01	7.2E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	
1.0E+00	3.1E-01	2.0E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	
1.0E+00	5.2E-01	4.0E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	3.3E-01	
1.0E+00	8.7E-01	8.7E-01	6.7E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01	
1.0E+00	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	8.7E-01	8.7E-01	8.3E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	FVLP*
1.0E+00	6.5E-02	6.2E-02	5.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	8.1E-02	
1.0E+00	7.9E-02	1.4E-01	5.3E-02	8.5E-02	8.5E-02	8.5E-02	8.5E-02	8.5E-02	
1.0E+00	1.6E-01	1.5E-01	6.4E-02	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01	
1.0E+00	4.1E-01	4.0E-01	1.1E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	1.7E-01	
1.0E+00	6.1E-01	6.0E-01	2.5E-01	3.5E-01	3.5E-01	3.5E-01	3.5E-01	3.5E-01	

1.0E+00	9.0E-03	8.9E-03	7.1E-02	1.0E-02	7.5E-03	1.0E-02	1.0E-02	1.0E-01	
1.0E+00	1.1E-02	2.2E-02	7.3E-02	2.2E-02	7.9E-03	1.1E-02	1.1E-02	1.1E-02	
1.0E+00	2.4E-02	2.4E-02	8.8E-02	1.3E-02	9.4E-03	1.3E-02	1.3E-02	1.3E-02	
1.0E+00	8.3E-02	8.3E-02	1.5E-01	2.3E-02	1.7E-02	2.3E-02	2.3E-02	2.3E-02	
1.0E+00	1.7E-01	1.7E-01	3.2E-01	5.8E-02	4.4E-02	5.8E-02	5.8E-02	5.8E-02	
1.0E+00	3.3E-01	3.3E-01	6.3E-01	1.9E-01	1.5E-01	1.9E-01	1.9E-01	1.9E-01	
1.0E+00	8.7E-01	8.2E-01	9.5E-01	7.3E-01	6.7E-01	7.3E-01	7.3E-01	7.3E-01	
1.0E+00	9.3E-01	9.3E-01	9.9E-01	9.2E-01	8.9E-01	9.2E-01	9.2E-01	9.2E-01	
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	
1.0E+00	1.7E-01	1.7E-01	3.2E-01	5.8E-02	4.4E-02	5.8E-02	5.8E-02	5.8E-02	FVSG*

1.0E+00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
1.0E+00	4.9E-07	4.9E-07	5.2E-07	5.2E-07	5.2E-07	5.2E-07	5.2E-07	5.2E-07	5.2E-07
1.0E+00	2.8E-05	2.8E-07	3.8E-05	3.8E-05	3.8E-05	3.8E-05	3.8E-05	3.8E-05	3.8E-05
1.0E+00	7.3E-02	6.2E-02	4.0E-02	3.0E-02	3.0E-02	3.0E-02	3.0E-02	3.0E-02	3.0E-02
1.0E+00	2.7E-01	2.6E-01	1.7E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01
1.0E+00	5.6E-01	5.5E-01	4.3E-01	5.5E-01	5.5E-01	5.5E-01	5.5E-01	5.5E-01	5.5E-01
1.0E+00	8.0E-01	7.8E-01	7.7E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01	7.6E-01
1.0E+00	9.6E-01	9.5E-01	9.4E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01	9.1E-01
1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
1.0E+00	2.7E-01	2.6E-01	1.7E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01

[illegible]

1.0E-03	2.0E-03	8.0E-03	8.8E-02	1.9E-01	4.2E-01	6.9E-01	7.9E-01	9.1E-01	1.0E-01
1.0E-03	3.0E-03	9.0E-03	1.1E-01	2.3E-01	4.7E-01	7.4E-01	8.7E-01	9.5E-01	1.0E-01
1.0E-02	8.9E-02	2.0E-01	4.6E-01	6.8E-01	8.0E-01	8.9E-01	9.4E-01	9.9E-01	6.4E-01
4.6E-02	1.6E-01	2.7E-01	5.0E-01	7.3E-01	8.8E-01	9.8E-01	1.0E+00	1.0E+00	9.8E-01
1.0E-05	1.0E-04	1.0E-03	3.0E-03	3.5E-02	1.6E-01	5.6E-01	6.7E-01	7.4E-01	1.0E-01
1.3E-02	5.9E-02	1.6E-01	3.4E-01	5.0E-01	7.0E-01	8.6E-01	9.5E-01	9.7E-01	8.0E-01

FCONV*

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Appendix B.2

1.0E+00	2.0E-01	2.0E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01
1.0E+00	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01
1.0E+00	6.8E-01	6.8E-01	6.8E-01	6.8E-01	6.8E-01	6.8E-01	6.8E-01	6.8E-01	6.8E-01
1.0E+00	7.8E-01	7.8E-01	7.8E-01	7.8E-01	7.8E-01	7.8E-01	7.8E-01	7.8E-01	7.8E-01
1.0E+00	8.8E-01	8.8E-01	8.8E-01	8.8E-01	8.8E-01	8.8E-01	8.8E-01	8.8E-01	8.8E-01
1.0E+00	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
1.0E+00	1.0E-03	1.0E-03	4.0E-03	4.0E-03	4.0E-03	4.0E-03	4.0E-03	4.0E-03	4.0E-03
1.0E+00	3.0E-03	3.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03	9.0E-03
1.0E+00	9.0E-03	9.0E-03	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02
1.0E+00	1.1E-01	1.1E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01
1.0E+00	2.3E-01	2.3E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01	2.4E-01
1.0E+00	4.6E-01	4.6E-01	4.6E-01	4.6E-01	4.6E-01	4.6E-01	4.6E-01	4.6E-01	4.6E-01
1.0E+00	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01
1.0E+00	8.6E-01	8.6E-01	8.6E-01	8.6E-01	8.6E-01	8.6E-01	8.6E-01	8.6E-01	8.6E-01
1.0E+00	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01	9.5E-01
1.0E+00	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
1.0E+00	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02	1.0E-02
1.0E+00	8.9E-02	8.9E-02	8.8E-02	8.8E-02	8.8E-02	8.8E-02	8.8E-02	8.8E-02	8.8E-02
1.0E+00	1.9E-01	1.9E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01
1.0E+00	4.5E-01	4.5E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01	4.1E-01
1.0E+00	6.3E-01	6.3E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01	6.0E-01
1.0E+00	7.5E-01	7.5E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01	7.3E-01
1.0E+00	8.8E-01	8.8E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01	8.5E-01
1.0E+00	9.1E-01	9.1E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01	9.0E-01
1.0E+00	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01	9.9E-01
1.0E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
1.0E+00	2.5E-02	2.5E-02	2.5E-02	2.5E-02	2.5E-02	2.5E-02	2.5E-02	2.5E-02	2.5E-02
1.0E+00	1.6E-01	1.6E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01
1.0E+00	2.6E-01	2.6E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01
1.0E+00	5.2E-01	5.2E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01
1.0E+00	7.3E-01	7.3E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01	7.0E-01
1.0E+00	8.5E-01	8.5E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01
1.0E+00	9.4E-01	9.4E-01	9.4E-01	9.4E-01	9.4E-01	9.4E-01	9.4E-01	9.4E-01	9.4E-01
1.0E+00	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01	9.6E-01
1.0E+00	9.8E-01	9.8E-01	9.8E-01	9.8E-01	9.8E-01	9.8E-01	9.8E-01	9.8E-01	9.8E-01
1.0E+00	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
1.0E+00	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
1.0E+00	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
1.0E+00	1.0E-03	1.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03
1.0E+00	1.4E-02	1.4E-02	3.6E-02	2.0E-02	3.6E-02	2.0E-02	2.0E-02	2.0E-02	2.0E-02
1.0E+00	6.7E-02	6.7E-02	1.1E-01	8.0E-02	1.1E-01	8.0E-02	8.0E-02	8.0E-02	8.0E-02
1.0E+00	1.9E-01	1.9E-01	3.2E-01	2.1E-01	3.2E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01
1.0E+00	6.2E-01	6.2E-01	6.4E-01	6.2E-01	6.4E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01
1.0E+00	7.2E-01	7.2E-01	7.4E-01	7.2E-01	7.4E-01	7.2E-01	7.2E-01	7.2E-01	7.2E-01
1.0E+00	7.5E-01	7.5E-01	8.5E-01	7.5E-01	8.5E-01	7.5E-01	7.5E-01	7.5E-01	7.5E-01
1.0E+00	1.0E-01	1.0E-01	3.7E-01	1.6E-01	3.7E-01	1.6E-01	1.6E-01	1.6E-01	1.6E-01
1.0E+00	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03	5.3E-03
1.0E+00	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02	2.4E-02
1.0E+00	1.1E-01	1.1E-01	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02	9.3E-02
1.0E+00	3.1E-01	3.1E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01
1.0E+00	5.0E-01	5.0E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01	4.7E-01
1.0E+00	6.6E-01	6.6E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01	6.5E-01
1.0E+00	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01	7.7E-01
1.0E+00	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01	8.4E-01
1.0E+00	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01	9.2E-01
1.0E+00	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
1.0E+00	1.0E+00	1.0E+00	1.1E-02	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09
1.0E+00	1.0E+00	1.0E+00	2.4E-02	2.0E-05	1.0E-09	1.0E-09	1.0E-09	1.0E-09	9.0E-05
1.0E+00	1.0E+00	1.0E+00	1.0E-01	3.2E-04	1.0E-09	1.0E-09	2.0E-05	4.3E-04	
1.0E+00	1.0E+00	1.0E+00	3.6E-01	1.9E-03	1.0E-06	2.4E-04	2.9E-04	2.7E-03	
1.0E+00	1.0E+00	1.0E+00	5.7E-01	5.0E-02	2.3E-05	8.6E-04	1.2E-03	4.5E-02	
1.0E+00	1.0E+00	1.0E+00	6.7E-01	2.3E-01	3.3E-04	2.2E-02	2.7E-02	1.9E-01	
1.0E+00	1.0E+00	1.0E+00	9.5E-01	6.4E-01	1.7E-02	9.6E-02	9.8E-02	5.2E-01	
1.0E+00	1.0E+00	1.0E+00	9.8E-01	9.4E-01	8.3E-02	1.8E-02	1.9E-01	9.0E-01	
1.0E+00	1.0E+00	1.0E+00	9.9E-01	1.0E+00	1.2E-01	2.6E-01	2.3E-01	1.0E+00	
1.0E+00	1.0E+00	1.0E+00	4.5E-01	1.7E-01	3.8E-06	8.7E-03	6.5E-03	1.0E-01	
1.0E+00	1.0E+00	1.0E+00	7.2E-03	1.0E-09	1.0E-09	1.0E-09	1.0E-09	1.0E-09	

FCONC*

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1.0E+00 1.0E+00 1.0E+00 1.6E-02 2.0E-05 1.0E-09 1.0E-09 1.0E-09 5.0E-05
1.0E+00 1.0E+00 1.0E+00 5.9E-02 2.7E-04 1.0E-09 1.0E-09 1.0E-05 3.4E-04
1.0E+00 1.0E+00 1.0E+00 2.3E-01 1.6E-03 1.0E-09 2.2E-04 2.3E-04 1.9E-03
1.0E+00 1.0E+00 1.0E+00 4.9E-01 5.7E-02 2.3E-05 7.0E-04 9.5E-04 3.1E-02
1.0E+00 1.0E+00 1.0E+00 6.3E-01 2.1E-01 3.3E-04 8.8E-03 1.1E-03 1.7E-01
1.0E+00 1.0E+00 1.0E+00 9.0E-01 4.8E-01 1.7E-02 8.6E-02 9.3E-02 4.4E-01
1.0E+00 1.0E+00 1.0E+00 9.7E-01 8.7E-01 8.3E-02 1.8E-01 1.8E-01 8.5E-01
1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.0E+00 1.2E-01 2.4E-01 2.5E-01 1.0E+00
1.0E+00 1.0E+00 1.0E+00 4.5E-01 1.7E-01 3.8E-06 8.7E-03 6.5E-03 1.0E-01

1.0E+00 1.0E+00 1.0E+00 2.5E-03 1.0E-09 1.0E-09 1.0E-09 1.0E-09 1.0E-09
1.0E+00 1.0E+00 1.0E+00 7.2E-03 2.0E-05 1.0E-09 1.0E-09 1.0E-09 2.0E-05
1.0E+00 1.0E+00 1.0E+00 2.8E-02 1.4E-04 1.0E-09 1.0E-09 1.0E-05 5.0E-05
1.0E+00 1.0E+00 1.0E+00 1.3E-01 8.4E-04 1.0E-09 9.0E-05 1.1E-04 9.7E-04
1.0E+00 1.0E+00 1.0E+00 2.4E-01 2.0E-02 4.0E-06 3.9E-04 4.7E-04 2.0E-02
1.0E+00 1.0E+00 1.0E+00 3.6E-01 2.0E-01 6.6E-05 5.0E-03 8.1E-03 1.6E-01
1.0E+00 1.0E+00 1.0E+00 9.1E-01 4.1E-01 1.0E-02 7.4E-02 8.3E-02 3.4E-01
1.0E+00 1.0E+00 1.0E+00 9.8E-01 8.1E-01 5.0E-02 9.8E-02 1.3E-01 7.5E-01
1.0E+00 1.0E+00 1.0E+00 1.0E+00 9.6E-01 6.9E-02 1.1E-01 1.6E-01 9.2E-01
1.0E+00 1.0E+00 1.0E+00 4.5E-01 1.7E-01 3.8E-06 8.7E-03 6.5E-03 1.0E-01

1.0E+00 1.0E+00 1.0E+00 1.7E-03 1.0E-09 1.0E-09 1.0E-09 1.0E-09 1.0E-09
1.0E+00 1.0E+00 1.0E+00 5.2E-03 1.0E-05 1.0E-09 1.0E-09 1.0E-09 2.0E-05
1.0E+00 1.0E+00 1.0E+00 2.2E-02 1.1E-04 1.0E-09 1.0E-09 1.0E-09 5.0E-05
1.0E+00 1.0E+00 1.0E+00 1.2E-01 5.1E-04 1.0E-09 9.0E-05 1.0E-04 7.5E-04
1.0E+00 1.0E+00 1.0E+00 2.3E-01 1.0E-02 4.0E-06 3.1E-04 4.3E-04 1.1E-02
1.0E+00 1.0E+00 1.0E+00 3.4E-01 1.8E-01 6.6E-05 4.2E-03 6.6E-03 1.4E-01
1.0E+00 1.0E+00 1.0E+00 8.6E-01 3.0E-01 1.0E-02 7.3E-02 7.9E-02 2.5E-01
1.0E+00 1.0E+00 1.0E+00 9.6E-01 7.0E-01 5.0E-02 9.8E-02 1.0E-01 6.1E-01
1.0E+00 1.0E+00 1.0E+00 9.9E-01 8.8E-01 6.9E-02 1.0E-01 1.2E-01 7.7E-01
1.0E+00 1.0E+00 1.0E+00 4.5E-01 1.7E-01 3.8E-06 8.7E-03 6.5E-03 1.0E-01 FCCI*

2.8E+00 2.6E+00 2.2E+00 2.0E+00 1.8E+00 1.7E+00 1.6E+00 1.4E+00 1.0E+00 2.6E+00 DFSPR1*

2.8E+03 2.6E+03 1.8E+3 7.4E+01 4.0E+01 9.4E+00 3.0E+00 2.4E+00 2.3E+00 4.5E+01 DFSPR2*

3.2E+03 2.9E+03 2.0E+03 2.8E+02 2.8E+01 1.4E+01 7.7E+00 6.8E+00 6.7E+00 3.0E+01 DFSPRC*

0.0E+00 1.0E-03 5.0E-03 1.0E-02 5.0E-02 8.0E-02 1.0E-01 1.0E-01 1.0E-01 0.0E+00 LATEIL

1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.1E-02 1.0E-03 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 4.5E-02 2.3E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E-01 7.2E-02 2.4E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 4.4E-01 1.7E-01 2.1E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 8.0E-01 2.5E-01 4.1E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E+00 7.5E-01 8.0E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 3.6E-02 2.7E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.3E-01 9.5E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 3.0E-01 2.7E-01 7.7E-02 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 7.2E-01 7.0E-01 6.3E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 9.2E-01 9.1E-01 8.9E-01 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
1.0E+00 1.0E+00 1.0E+00 1.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 FLATE*

1.0E+00 6.7E-01 6.7E-01 2.3E-03 5.2E-05 5.0E-05 5.2E-05 5.2E-05 5.2E-05
1.0E+00 6.7E-01 6.7E-01 3.4E-03 7.0E-05 7.3E-05 7.0E-05 7.0E-05 7.0E-05
1.0E+00 6.8E-01 6.8E-01 1.7E-02 2.3E-04 3.3E-04 2.3E-04 2.3E-04 2.3E-04
1.0E+00 7.5E-01 7.5E-01 6.8E-02 1.3E-03 7.7E-03 1.3E-03 1.3E-03 1.3E-03
1.0E+00 9.2E-01 9.2E-01 2.0E-01 6.0E-03 2.2E-02 6.0E-03 6.0E-03 9.0E-03
1.0E+00 9.7E-01 9.7E-01 2.8E-01 2.5E-02 8.2E-02 1.8E-02 1.8E-02 4.3E-02
1.0E+00 1.0E+00 1.0E+00 3.6E-01 2.3E-01 2.1E-01 6.3E-02 6.3E-02 2.9E-01
1.0E+00 1.0E+00 1.0E+00 4.0E-01 3.9E-01 3.6E-01 1.3E-01 1.6E-01 3.9E-01
1.0E+00 1.0E+00 1.0E+00 4.0E-01 4.4E-01 1.6E-01 2.0E-01 4.2E-01
1.0E+00 9.2E-01 9.2E-01 2.0E-01 6.0E-03 2.2E-02 6.0E-03 6.0E-03 9.0E-03 FDCHL-HP*

1.0E+00 6.7E-01 6.7E-01 2.3E-03 5.5E-05 5.2E-05 5.5E-05 5.5E-05 5.5E-05

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Appendix B.2

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1.0E+00 6.7E-01 6.7E-01 3.4E-03 7.0E-05 7.3E-05 7.0E-05 7.0E-05 7.0E-05
1.0E+00 6.8E-01 6.8E-01 1.7E-02 1.8E-04 2.8E-04 1.8E-04 1.8E-04 1.8E-04
1.0E+00 7.5E-01 7.5E-01 6.7E-02 7.7E-04 7.1E-03 7.7E-04 7.7E-04 7.7E-04
1.0E+00 9.2E-01 9.2E-01 2.0E-01 4.7E-03 2.0E-02 4.7E-03 4.7E-03 7.7E-03
1.0E+00 9.7E-01 9.7E-01 2.8E-01 2.1E-02 7.8E-02 1.5E-02 1.5E-02 3.9E-02
1.0E+00 1.0E+00 1.0E+00 3.5E-01 2.2E-01 2.0E-01 5.0E-02 5.0E-02 2.8E-01
1.0E+00 1.0E+00 1.0E+00 3.8E-01 3.7E-01 3.4E-01 1.1E-01 1.4E-01 3.7E-01
1.0E+00 1.0E+00 1.0E+00 3.8E-01 4.2E-01 3.9E-01 1.3E-01 1.8E-01 4.0E-01
1.0E+00 9.2E-01 9.2E-01 2.0E-01 4.7E-03 2.0E-02 4.7E-03 4.7E-03 7.7E-03 FDCHL-IP*

1.0E+00 4.1E+03 4.1E+03 1.6E+03 4.1E+03 1.6E+03 4.1E+03 4.1E+03 4.1E+03
1.0E+00 3.6E+03 3.6E+03 1.5E+03 3.6E+03 1.5E+03 3.6E+03 3.6E+03 3.6E+03
1.0E+00 3.3E+03 3.3E+03 1.3E+03 3.3E+03 1.3E+03 3.3E+03 3.3E+03 3.3E+03
1.0E+00 1.0E+02 1.0E+02 4.2E+01 1.0E+02 4.2E+01 1.0E+02 1.0E+02 1.0E+02
1.0E+00 5.0E+00 5.0E+00 2.0E+00 5.0E+00 2.0E+00 5.0E+00 5.0E+00 5.0E+00
1.0E+00 2.4E+00 2.4E+00 1.0E+00 2.4E+00 1.0E+00 2.4E+00 2.4E+00 2.4E+00
1.0E+00 1.4E+00 1.4E+00 1.0E+00 1.4E+00 1.0E+00 1.4E+00 1.4E+00 1.4E+00
1.0E+00 1.4E+00 1.4E+00 1.0E+00 1.4E+00 1.0E+00 1.4E+00 1.4E+00 1.4E+00
1.0E+00 1.3E+00 1.3E+00 1.0E+00 1.3E+00 1.0E+00 1.3E+00 1.3E+00 1.3E+00
1.0E+00 5.0E+00 5.0E+00 2.0E+00 5.0E+00 2.0E+00 5.0E+00 5.0E+00 5.0E+00

1.0E+00 2.1E+04 2.1E+04 1.1E+04 2.1E+04 1.1E+04 2.1E+04 2.1E+04 2.1E+04
1.0E+00 1.8E+04 1.8E+04 9.4E+03 1.8E+04 9.4E+03 1.8E+04 1.8E+04 1.8E+04
1.0E+00 1.7E+04 1.7E+04 8.6E+03 1.7E+04 8.6E+03 1.7E+04 1.7E+04 1.7E+04
1.0E+00 5.2E+02 5.2E+02 2.7E+02 5.2E+02 2.7E+02 5.2E+02 5.2E+02 5.2E+02
1.0E+00 2.5E+01 2.5E+01 1.3E+01 2.5E+01 2.5E+01 1.3E+01 2.5E+01 2.5E+01
1.0E+00 1.2E+01 1.2E+01 6.3E+00 1.2E+01 6.3E+00 1.2E+01 1.2E+01 1.2E+01
1.0E+00 7.2E+00 7.2E+00 3.8E+00 7.2E+00 3.8E+00 7.2E+00 7.2E+00 7.2E+00
1.0E+00 6.9E+00 6.9E+00 3.6E+00 6.9E+00 3.6E+00 6.9E+00 6.9E+00 6.9E+00
1.0E+00 6.4E+00 6.4E+00 3.4E+00 6.4E+00 3.4E+00 6.4E+00 6.4E+00 6.4E+00
1.0E+00 2.5E+01 2.5E+01 1.3E+01 2.5E+01 1.3E+01 2.5E+01 2.5E+01 2.5E+01 VPSL*

.398 .265 .195 FPME*

3.0E+01 2.8E+01 1.8E+01 6.0E+00 2.8E+00 1.6E+00 1.2E+00 1.1E+00 1.0E+00 4.0E+00
1.0E+01 9.7E+00 8.2E+00 4.0E+00 1.9E+00 1.2E+00 1.0E+00 1.0E+00 1.0E+00 3.0E+00
4.3E+01 4.1E+01 3.5E+01 2.4E+01 7.0E+00 2.3E+00 1.3E+00 1.1E+00 1.0E+00 7.0E+00
8.1E+01 6.5E+01 3.2E+01 6.7E+00 3.9E+00 2.4E+00 1.4E+00 1.1E+00 1.0E+00 7.0E+00 DF1CV*

3.0E+01 2.8E+01 1.8E+01 6.0E+00 2.8E+00 1.6E+00 1.2E+00 1.1E+00 1.0E+00 7.0E+00
1.0E+01 9.7E+00 8.2E+00 4.0E+00 2.0E+00 1.2E+00 1.1E+00 1.0E+00 1.0E+00 3.0E+00
2.0E+01 1.9E+01 1.3E+01 3.5E+00 2.5E+00 1.7E+00 1.1E+00 1.0E+00 1.0E+00 7.0E+00 DF1CC*

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APPENDIX B.3 Other Input Files for SEQSOR Sample Problem

SEQSOR Execution Title, Options, and Input Files Identification
(unit number 5)

SEQSOR LHS SAMPLE RUN, 29 NOV 89, FULLY SAMPLED ST'S

1 2 3 7 6 9

225 13 2

194 195 196 197 198 199 200 201 202 203 204 205 206

T T

Appendix B.3

SEQSOR Accident Progression Bins for Sample Problem
(unit number 2)

```
      1 SEQUOYAH LHS SAMPLE PROBLEM SOURCE TERM BINS
        14      10
AHADBCAADDAAAB
BHADBCABDCAAAA
CEACACABBBAAAC
DACBACDABAAAAAB
DHADDCAADBAAAD
EEADBCAADAAAAAC
FHADBBABDCAAAAB
FHDDBCAADBBAAAB
GDCDFADADDBAAA
GGADBCAADDBAAD
```

```
      2 SEQUOYAH LHS SAMPLE PROBLEM SOURCE TERM BINS
        14      10
AHADBCAADDAAAB
BHADBCABDCAAAA
CEACACABBBAAAC
DACBACDABAAAAAB
DHADDCAADBAAAD
EEADBCAADAAAAAC
FHADBBABDCAAAAB
FHDDBCAADBBAAAB
GDCDFADADDBAAA
GGADBCAADDBAAD
```


SEQSOR LHS Data for Sample Problem
(unit number 3)

1	225	3.5399001E-04	6.0285052E-04	4.3683054E-04	
9.6827047E-03	3.2210488E-02	3.0892715E-04	0.4924710	1.4592935E-06	
8.6298032E-06	2.2164979E-03	2.6637129E-04	3.3354794E-03	3.3892822E-03	
3.4471713E-03	1.5265922E-03	6.5318360E-03	5.0735725E-03	6.7475606E-03	
8.8641038E-03	4.6257810E-03	6.3648694E-03	5.0264383E-03	1.1846624E-02	
2.3960986E-03	3.7857667E-02	2.5222162E-02	1.0086675E-02	0.4398739	
2.9683612E-02	5.4961196E-03	2.3092715E-02	4.3823151E-03	0.2202953	
2.6366885E-03	2.1601625E-04	5.0041042E-05	6.953879	3.886692	
5.540817	0.8713937	7.5144403E-02	2.1614835E-02	5.2777841E-06	
1.0646378E-10	0.1005590	5.6515490E-03	0.6808658	0.2481593	
1.000000	0.0000000E+00	1.000000	0.0000000E+00	1.000000	
0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	
1.000000	0.9339868	0.8607095	0.7005973	0.5505260	
0.2245988	0.0000000E+00	1.000000	2.5314836E-05	4.3616846E-02	
1.9496463E-05	100.7922	140.3367	96.00608	114.0013	
116.2816	140.3367	101.0761	0.7581816	0.7592369	
0.7582521	0.9579013	1.000000	0.0000000E+00	0.0000000E+00	
0.2009321	0.1795383	0.1560093	0.3985319	0.2556332	
0.2267472	9.7108684E-02	9.4898805E-02	8.2814790E-02	0.9009095	
0.8647147	0.8647147	3.181121	503.6263	0.9861787	
4.182230	7.153377	1.000000	0.0000000E+00	2.3933770E-05	
2.3933769E-06	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	
1.000000	0.0000000E+00	0.1649937	0.2987063	0.6247640	
0.6355426	0.6099190	0.7525542	0.7483876	0.7560370	
2.7637659E-03	0.8623834	0.0000000E+00	1.000000	401.0208	
526.8783	1327.899	1460.689	931.6105	1329.165	
354.7878	390.2665	123.4936	143.5344	358.7532	
644.7799	245.5196	421.6789	179.1074	243.9053	
325.4782	604.2252	295.3302	555.4473	446.6648	
338.5927	203.0492	440.6477	326.4586	197.0322	
355.4190	262.0122	164.7948	292.3054	506.8757	
221.9334	363.9805	167.3142	215.0347	416.9267	
317.2985	192.4164	330.6937	246.9920	157.2632	
358.8487	681.0647	288.2724	478.3880	200.4695	
272.2384	455.0783	348.4305	208.0039	352.8109	
263.2769	165.4056	0.0000000E+00	1.000000	0.0000000E+00	
1.000000	0.0000000E+00	1.000000	0.0000000E+00	1.000000	
0.1840940	0.9219183	0.7767851	248.9246	284.6055	
189.0873	164.8542	330.1008	1.000000	0.0000000E+00	
0.4120833	0.2769569	0.8501862	0.3911590	0.9128404	
0.3126738	0.2266819	0.3903577	0.1356898	0.2704439	
0.3023252	0.8784549	0.3753839	0.3689810	0.6347040	
0.2387150	0.5770960	0.4464180	0.7155810	0.5198310	
0.3702620	0.4736050	0.3634250	0.7458590	0.4489900	
1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	
0.0000000E+00	0.0000000E+00				
2	225	1.2585639E-03	6.8317552E-04	5.5716292E-04	
0.1088430	2.7399201E-02	2.6235315E-03	0.1909083	1.1898912E-05	
1.0416487E-04	1.4504470E-04	1.1706948E-04	3.1530724E-03	3.1418568E-03	
2.9624300E-03	3.2214394E-03	6.7607343E-02	7.8411801E-03	8.9595439E-03	
1.3485635E-02	1.3441803E-03	1.8677799E-03	1.5742712E-03	9.8971063E-03	
5.0644487E-02	7.1042858E-02	0.1050926	4.3274239E-03	0.2966649	
4.5168628E-03	1.6102967E-03	8.2974406E-03	2.8539672E-02	0.1201739	
2.1384121E-03	2.6227735E-04	1.6108173E-04	13.92161	4.087850	
3.504517	1.060805	1.1538493E-02	3.0065093E-02	2.2132100E-04	
1.9914093E-09	8.4104165E-02	2.2931259E-04	0.8154643	0.9430274	
0.0000000E+00	1.000000	0.0000000E+00	1.000000	0.0000000E+00	
1.000000	0.0000000E+00	1.000000	0.0000000E+00	1.000000	
0.0000000E+00	0.9895464	0.9811088	0.9577289	0.9426081	
3.2616116E-02	1.000000	0.0000000E+00	1.3549058E-04	0.9999050	
6.8554022E-05	211.5079	249.4770	163.3774	196.3079	
232.9538	264.6770	205.0329	0.7958722	0.7985171	
0.7981634	0.9989483	1.000000	0.0000000E+00	0.0000000E+00	
0.2547317	0.2184510	0.1932344	0.4918974	0.3412284	
0.2857314	0.1093553	0.1093553	0.1093553	0.5004686	
0.5004686	0.1004794	7.553236	667.4907	0.7117218	
10.59014	25.24805	0.0000000E+00	1.000000	1.0000000E-07	
9.9999999E-09	1.000000	0.0000000E+00	0.0000000E+00	1.000000	
0.0000000E+00	0.0000000E+00	9.7191975E-02	0.1576176	0.3473774	
0.3330882	0.3221677	0.4450815	0.4434231	0.4449936	
2.9577062E-02	0.8862116	0.0000000E+00	1.000000	293.5829	

Appendix B.3

350.3744	173.1320	190.4453	118.7792	139.4202
111.0471	122.1518	67.38076	65.89574	59.27991
99.35970	52.78566	69.61686	42.43990	39.35984
57.02279	119.6655	55.79994	81.98826	120.1027
108.8199	58.56850	95.81411	60.24269	34.27990
86.98267	63.37410	35.84561	45.12279	52.36555
34.30564	35.08846	33.19989	22.11136	58.33987
39.15705	23.70280	46.92847	31.28564	19.81710
62.33133	125.5767	59.08277	85.17395	45.55417
47.15411	133.2112	92.15981	50.25418	112.6597
77.66266	43.00560	0.0000000E+00	1.000000	1.000000
0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	1.000000
0.1219998	0.9997649	0.7278737	226.8363	259.9443
239.5947	238.8880	211.5409	0.0000000E+00	1.000000
9.5143072E-02	0.7052636	0.9528593	5.4667000E-02	0.4326958
0.8105817	0.4098254	0.6012148	0.6064691	0.5475962
0.4222150	0.6518838	0.9117922	0.4363160	0.7286910
0.3664730	0.7914130	0.6989050	0.8721780	0.7358660
0.5848180	0.7996900	0.6794370	0.9667190	0.7849060
1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
0.0000000E+00	0.0000000E+00			

APPENDIX B.4 SEQSOR Procedure File

\$ SET DEFAULT (LNSMITH.SEQSOR TEXT)	
\$ ASSIGN SEQ_MSG_LHS_SAMPLE.OUT	FOR001
\$ ASSIGN SEQ_BIN_LHS.DAT	FOR002
\$ ASSIGN SEQ_LHS_HCUBE.DAT	FOR003
\$ ASSIGN SEQ_SETUP_LHS_SAMPLE.DAT	FOR005
\$ ASSIGN SEQ_RELEASE_LHS_SAMPLE.OUT	FOR006
\$ ASSIGN SEQ_ST.DAT	FOR009
\$ RUN SEQSOR.EXE	

APPENDIX B.5 SEOSOR Sample Problem Output

SEQSOR LHS SAMPLE RUN, 29 NOV 89, FULLY SAMPLED ST'S

14	9	20	2								
1	AHADBCAADDAAAB										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00						
3.700E+06	9.932E-01	2.483E-01	2.597E-01	7.230E-03	1.733E-04	4.246E-05	4.411E-06	5.737E-06	3.119E-04		
1.700E+05	6.826E-03	1.388E-02	3.955E-05	2.251E-01	1.556E-01	2.408E-03	2.152E-02	2.273E-02	1.266E-01		
1	BHADBCABDCAAAA										
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00						
1.850E+06	9.938E-01	9.891E-02	9.959E-02	4.693E-03	1.446E-04	3.137E-05	1.899E-06	2.470E-06	2.235E-04		
1.700E+05	6.206E-03	1.675E-02	5.249E-05	8.395E-02	5.201E-02	1.036E-03	7.145E-03	5.174E-03	4.648E-02		
1	CEACACABBBAAAC										
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01						
2.800E+07	9.938E-01	8.208E-02	8.676E-02	1.146E-02	1.836E-04	1.398E-03	1.614E-04	1.615E-04	2.025E-04		
1.600E+05	6.206E-03	1.258E-02	1.109E-04	6.023E-02	3.731E-02	7.433E-04	5.125E-03	3.712E-03	3.334E-02		
1	DACBACDABAAAAAB										
2.230E+04	2.800E+04	2.000E+02	1.000E+06	1.000E+06	1.000E+01						
2.800E+06	8.979E-01	7.240E-02	8.628E-02	1.346E-02	3.103E-04	1.766E-03	3.103E-04	3.103E-04	3.206E-04		
1.600E+06	1.021E-01	2.672E-03	1.584E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
1	DHADDCAADBAAAAD										
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01						
2.800E+07	9.932E-01	6.918E-02	7.937E-02	8.038E-04	1.260E-05	3.087E-06	3.207E-07	4.171E-07	2.268E-05		
1.600E+06	6.826E-03	1.824E-02	7.568E-05	1.003E-01	6.936E-02	1.073E-03	9.591E-03	1.013E-02	5.643E-02		
1	EEADBCAADAAAAAC										
2.230E+04	4.700E+04	0.000E+00	4.700E+04	2.000E+02	1.000E+01						
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
3.500E+06	1.000E+00	1.974E-02	1.387E-05	1.919E-05	7.884E-06	2.052E-07	1.090E-06	1.152E-06	6.414E-06		
1	FHADBBABDCAAAAB										
3.600E+04	5.100E+04	1.000E+03	5.200E+04	1.080E+04	1.000E+01						
1.000E+06	9.465E-01	4.603E-01	4.307E-01	1.325E-01	2.821E-03	6.118E-04	3.704E-05	4.817E-05	4.360E-03		
0.000E+00	5.353E-02	3.567E-02	2.153E-02	6.633E-03	1.468E-04	3.070E-05	2.638E-06	2.978E-06	2.231E-04		
1	FHDDBCAADBBAAAB										
2.230E+04	4.700E+04	0.000E+00	1.334E+05	2.000E+02	1.000E+01						
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
3.500E+06	1.000E+00	1.964E-02	4.282E-07	1.606E-07	4.412E-08	6.902E-10	7.662E-09	6.629E-09	3.636E-08		
1	GDCDFADADDBAAA										
1.260E+04	1.980E+04	3.600E+03	1.000E+06	1.000E+06	1.000E+01						
1.000E+06	7.070E-01	3.481E-01	2.696E-01	1.151E-01	1.614E-03	3.959E-04	4.128E-05	5.370E-05	2.906E-03		
0.000E+00	0.000E+00	2.479E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
1	GGADBCAADDBAAD										
2.230E+04	4.700E+04	0.000E+00	4.700E+04	8.640E+04	0.000E+00						
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
0.000E+00	5.000E-03	9.821E-05	6.213E-11	7.514E-11	5.020E-11	7.860E-13	6.937E-12	7.328E-12	4.088E-11		

APPENDIX B.5 SEOSOR Sample Problem Output
(Continued)

Appendix B.5

SEOSOR LHS SAMPLE RUN, 29 NOV 89, FULLY SAMPLED ST'S

14	9	20	2									
2	AHADBCAADDAAAB											
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00							
3.700E+06	9.626E-01	5.943E-01	6.066E-01	1.506E-03	2.101E-05	1.117E-09	9.082E-10	9.082E-10	3.390E-05			
1.700E+05	3.740E-02	2.020E-02	2.081E-03	3.215E-01	1.347E-02	6.428E-06	3.965E-04	5.322E-04	1.371E-02			
2	BHADBCABDCAAAA											
1.250E+03	3.650E+03	1.800E+03	1.025E+04	2.160E+04	0.000E+00							
1.850E+06	9.743E-01	2.689E-01	3.042E-01	1.142E-03	2.190E-05	6.230E-10	5.066E-10	5.066E-10	8.627E-05			
1.700E+05	2.571E-02	4.368E-02	2.789E-03	1.416E-01	7.895E-03	5.583E-07	1.859E-04	2.351E-04	5.292E-03			
2	CEACACABBBAAAC											
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01							
2.800E+07	9.743E-01	2.061E-01	2.390E-01	1.733E-02	5.160E-04	2.122E-03	4.801E-04	4.801E-04	8.747E-04			
1.600E+05	2.571E-02	4.687E-02	4.686E-03	8.423E-02	4.684E-03	3.312E-07	1.103E-04	1.395E-04	3.140E-03			
2	DACBACDABAAAAAB											
2.230E+04	2.800E+04	2.000E+02	1.000E+06	1.000E+06	1.000E+01							
2.800E+06	4.403E-01	1.055E-01	1.071E-01	2.627E-02	9.815E-04	3.513E-03	9.193E-04	9.193E-04	1.511E-03			
1.600E+06	5.597E-01	1.646E-02	4.736E-03	6.228E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00			
2	DHADDCAADBAAAAD											
2.230E+04	2.800E+04	2.000E+02	2.900E+04	2.160E+04	1.000E+01							
2.800E+07	9.626E-01	2.396E-01	2.455E-01	2.270E-04	2.379E-06	1.264E-10	1.028E-10	1.028E-10	3.838E-06			
1.600E+06	3.740E-02	4.658E-02	2.285E-03	1.297E-01	5.422E-03	2.587E-06	1.596E-04	2.142E-04	5.518E-03			
2	EEADBCAADA AAAAC											
2.230E+04	4.700E+04	0.000E+00	4.700E+04	2.000E+02	1.000E+01							
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00			
3.500E+06	1.000E+00	6.068E-02	2.206E-03	1.042E-03	2.517E-05	1.626E-08	7.407E-07	9.942E-07	2.561E-05			
2	FHADBBABDCAAAAB											
3.600E+04	5.100E+04	1.000E+03	5.200E+04	1.080E+04	1.000E+01							
1.000E+06	9.279E-01	1.392E-01	8.664E-02	8.223E-03	1.649E-04	4.691E-09	3.814E-09	3.814E-09	6.495E-04			
0.000E+00	7.211E-02	5.517E-02	4.332E-03	4.245E-04	8.986E-06	2.870E-10	1.767E-08	2.230E-08	3.297E-05			
2	FHDDBCAADBBAAB											
2.230E+04	4.700E+04	0.000E+00	1.334E+05	2.000E+02	1.000E+01							
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00			
3.500E+06	1.000E+00	5.790E-02	5.309E-06	1.867E-06	3.662E-08	3.496E-12	1.129E-09	1.366E-09	3.808E-08			
2	GDCDFADADD BAAA											
1.260E+04	1.980E+04	3.600E+03	1.000E+06	1.000E+06	1.000E+01							
1.000E+06	1.300E-01	2.801E-02	2.196E-02	9.034E-03	6.979E-05	3.780E-09	3.100E-09	3.100E-09	1.132E-04			
0.000E+00	0.000E+00	6.810E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00			
2	GGADBCAADD BAAAD											
2.230E+04	4.700E+04	0.000E+00	4.700E+04	8.640E+04	0.000E+00							
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00			
0.000E+00	5.000E-03	2.895E-04	5.145E-10	2.682E-10	1.106E-11	5.269E-15	3.249E-13	4.361E-13	1.127E-11			

APPENDIX C
PBSOR FILES

APPENDIX C.1 PBSOR Fortran Listing

```

PROGRAM PBSOR
C*****ADAPTATION OF RELTRAC INPUT PROCESSOR FOR USE IN PBSOR
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1        EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2        ECF, ICF, NCD
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT

C
C
C*****READ KEYWORDS AND RELATED INFORMATION FROM UNIT 5.
C*****KEYWORDS DETERMINE OPERATION OF RELCLC:
C***** (1) BINNED INPUT WITH SAMPLING
C***** (2) BINNED INPUT WITHOUT SAMPLING
C***** (3) DIRECT INPUT WITH SAMPLING
C***** (4) DIRECT INPUT WITHOUT SAMPLING
CALL INPUT
C*****CHECK FOR BINNED EXECUTION
IF (BINNED) THEN
C*****CHECK FOR SAMPLING EXECUTION
IF (SAMPLE) THEN
C*****BINNED INPUT WITH SAMPLING
CALL BINSMP
ELSE
C*****BINNED INPUT WITHOUT SAMPLING
CALL BIN
ENDIF
ELSE
C*****CHECK FOR SAMPLING EXECUTION
IF (SAMPLE) THEN
C*****DIRECT INPUT WITH SAMPLING
CALL DIRSMP
ELSE
C*****DIRECT INPUT WITHOUT SAMPLING
CALL DIR
ENDIF
ENDIF
STOP
END
SUBROUTINE INPUT
C*****PROCESS KEYWORD INPUT ON UNIT 5
PARAMETER (MAXLEN=101)
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1        EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2        ECF, ICF, NCD
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
CHARACTER*80 FILNAM
CHARACTER*80 DEFFIL, SAMFIL, VECFIL
COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL

```

Appendix C.1

```

      CHARACTER CARD*(MAXLEN), CVAL*(MAXLEN), KEYWRD*20
C*****SET LOGICAL TYPES FOR FREE FORMAT SUBROUTINE RDSTRG
      LOGICAL EOR, LVAL, TYPE(4)
C
C
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
      IC=1
C*****READ RECORD
      READ(5,1001) CARD
C*****READ MODE SWITCH
      CALL RDSTRG (CARD, IC, KEYWRD, LVAL, IVAL, RVAL, KLNTH, TYPE,
1              EOR)
C*****CHECK FOR BINNED OR DIRECT EXECUTION
      IF (KEYWRD(1:KLNTH) .EQ. 'BINNED') THEN
C*****SET BINNED EXECUTION TYPE
          BINNED=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'DIRECT') THEN
C*****SET DIRECT EXECUTION TYPE
          BINNED=.FALSE.
      ELSE
C*****MODE SWITCH WAS NEITHER BINNED NOR DIRECT SO PRINT ERROR
MESSAGE
          WRITE(6,5030)
          STOP
      ENDIF
C*****SET DEFAULT VALUES
      SAMPLE=.FALSE.
      NOCALC=.FALSE.
      PRTINP=.FALSE.
      NOBS=1
      REPRTB=.FALSE.
      BYRUN=.FALSE.
      CONSFL=.FALSE.
      DIAG=.FALSE.
      EXPERT=.FALSE.
C*****INITIALIZE NUMBER OF BINS
      NBIN=0
C*****READ TITLE
      READ(5,1001) TITLE
C*****PRINT MESSAGE FOR EXECUTION TYPE AND TITLE
      WRITE(6,1003) KEYWRD(1:KLNTH), TITLE
      WRITE(6,1002) CARD
      WRITE(6,1002) TITLE
C*****PROCESS KEYWORDS
      666 CONTINUE
C*****READ RECORD
      READ(5,1001,END=6000) CARD
      WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
      IC=1
      500 CONTINUE
C*****READ CHARACTER STRING FOR COMPARISON AGAINST KEYWORDS
      CALL RDSTRG (CARD, IC, KEYWRD, LVAL, IVAL, RVAL, KLNTH, TYPE,
1              EOR)
C*****CHECK FOR END-OF-RECORD
      IF (EOR) GO TO 666
C*****CHECK CHARACTER STRING AGAINST KEYWORDS
      IF (KEYWRD(1:KLNTH) .EQ. 'SAMPLE') THEN
C*****SET SAMPLE TYPE TO .TRUE.
          SAMPLE=.TRUE.
C*****OBTAIN SAMPLE INFORMATION
C*****OBTAIN NUMBER OF SAMPLE VECTORS TO BE EXECUTED

```



```

      CALL RDSTRG (CARD, IC, CVAL, LVAL, NOBS, RVAL, LENGTH, TYPE,
1          EOR)
C*****CHECK FOR INTEGER VALUE
      IF (TYPE(3)) THEN
C*****OBTAIN SAMPLE VECTOR NUMBER TO BEGIN EXECUTION
      CALL RDSTRG (CARD, IC, CVAL, LVAL, NSTART, RVAL, LENGTH,
1          TYPE, EOR)
C*****CHECK FOR INTEGER VALUE
      IF (TYPE(3)) THEN
C*****OBTAIN NAME OF FILE CONTAINING SAMPLE VECTORS
      CALL RDSTRG (CARD, IC, FILNAM, LVAL, IVAL, RVAL, LENGTH,
1          TYPE, EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (TYPE(1)) THEN
C*****CHARACTER VALUE FOUND, OPEN SAMPLE VECTOR FILE
      OPEN(3, FILE=FILNAM, STATUS='OLD', ERR=8000, READONLY)
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9200
      ENDIF
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9100
      ENDIF
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9100
      ENDIF
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'NORUN') THEN
C*****SET TYPE FOR VALIDATION OF INPUT ONLY, NO EXECUTION
      NOCALC=.TRUE.
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'DEFAULT') THEN
C*****READ NAME OF FILE CONTAINING DEFAULT VALUES
      CALL RDSTRG (CARD, IC, DEFFIL, LVAL, IVAL, RVAL, LENGTH, TYPE,
1          EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (.NOT. TYPE(1)) GO TO 9100
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'VECPOS') THEN
C*****READ NAME OF FILE CONTAINING SAMPLE VECTOR POSTION INFORMATION
      CALL RDSTRG (CARD, IC, SAMFIL, LVAL, IVAL, RVAL, LENGTH, TYPE,
1          EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (.NOT. TYPE(1)) GO TO 9100
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'BINFILE') THEN
C*****READ A BIN ARRAY FILE
C*****CHECK FOR BINNED EXECUTION
      IF (BINNED) THEN
C*****READ NAME OF FILE CONTAINING BIN INFORMATION
      CALL RDSTRG (CARD, IC, FILNAM, LVAL, IVAL, RVAL, LENGTH,
1          TYPE, EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (TYPE(1)) THEN
C*****CHARACTER VALUE FOUND SO OPEN BIN FILE
      OPEN(4, FILE=FILNAM, STATUS='OLD', ERR=8000, READONLY)
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9200
      ENDIF
      ELSE
C*****NO BINS USED FOR DIRECT EXECUTION, PRINT ERROR MESSAGE
      GO TO 9300
      ENDIF

```

Appendix C.1

```

      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'PRTINP') THEN
C*****SET CONTROL FLAG PRTINP
      PRTINP=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'REPORTB') THEN
C*****SET CONTROL FLAG REPORTB
      REPRTB=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'KPBYSRUN') THEN
C*****SET CONTROL FLAG KPBYSRUN
      BYRUN=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'CONSFL') THEN
C*****SET CONTROL FLAG CONSFL
      CONSFL=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'DIAG') THEN
C*****SET DIAGNOSTIC PRINT CONTROL FLAG DIAG
      DIAG=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'EXPERT') THEN
C*****SET EXPERT OPINION CONTROL FLAG EXPERT
      EXPERT=.TRUE.
      ELSE
C*****INVALID KEYWORD, PRINT ERROR MESSAGE
      WRITE(6,5020) KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      ENDIF
      GO TO 500
6000 CONTINUE
C*****VALIDATE COMBINATION OF FLAGS
      IF (EXPERT .AND. ((.NOT. BINNED) .OR. (.NOT. SAMPLE))) THEN
      WRITE(6,6001)
      STOP
      ENDIF
      IF (NOCALC) STOP
C*****PRINT CONTROL INFORMATION
      IF (SAMPLE) WRITE(6,5025) NOBS, NSTART
C*****CALCULATE TOTAL NUMBER OF SOURCE TERMS FOR BINNED/SAMPLED
EXECUTION
      IF (BINNED .AND. BYRUN) THEN
C*****READ BIN FILE TO DETERMINE TOTAL NUMBER OF SOURCE TERMS
      NTOT=0
      NSAMPL=NSTART + NOBS - 1
      DO 7000 IOBS=1,NSAMPL
      READ(4,1001) BTITLE
      READ(4,*) NDM, NBN
      IF (IOBS .GE. NSTART) NTOT=NTOT + NBN
      IF (NBN .GT. 0) READ(4,1001) (BINARR(1)(1:NDM),I=1,NBN)
7000 CONTINUE
      REWIND 4
      ENDIF
      RETURN
C*****FILE OPEN ERROR
8000 WRITE(6,5022) FILNAM, KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      GO TO 500
9100 CONTINUE
C*****PRINT ERROR MESSAGE FOR WRONG TYPE OF VARIABLE
      WRITE(6,9101) KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      GO TO 500
9200 CONTINUE
C*****PRINT ERROR MESSAGE FOR NO FILE NAME
      WRITE(6,9201) KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      GO TO 500

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9300 CONTINUE
C*****PRINT ERROR MESSAGE FOR BINNED KEYWORD USED FOR DIRECT EXECUTION
      WRITE(6,9301) KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      GO TO 500
9500 CONTINUE
C*****PRINT ERROR MESSAGE FOR INVALID EVENT NAME FOR OFFSET CONTROL
      WRITE(6,9501) KEYWRD(1:KLNTH), CVAL(1:LENGTH)
      NOCALC=.TRUE.
      GO TO 500
C*****FORMAT STATEMENTS
1001 FORMAT(A)
1002 FORMAT(11X,A)
1003 FORMAT(/1X,130(' '),
1      /1X,48(' '),5X,'PBSOR ',A,' EXECUTION',5X,48(' '),
2      /1X,20(' '),5X,A,5X,20(' '),
3      /1X,130(' '),/)
1004 FORMAT(1X,A)
5020 FORMAT(1X,'>>>>>UNRECOGNIZED KEYWORD (' ,A,')',/)
5022 FORMAT(1X,'>>>>>OPEN ERROR ON FILE ',A,' FOR KEYWORD ',A,/)
5025 FORMAT(/1X,'THE INPUT WILL BE SAMPLED WITH ',I4,
1      ' SAMPLE VECTOR(S) STARTING WITH SAMPLE VECTOR ',I4,/)
5030 FORMAT(1X,'>>>>>UNRECOGNIZED MODE SWITCH',/)
6001 FORMAT(1X,'>>>>>BINNED AND SAMPLE FLAGS MUST BE SPECIFIED ',
1      'TO USE EXPERT OPINION TABLES')
9101 FORMAT(1X,'>>>>>VALUE(S) FOLLOWING KEYWORD ',A,' INVALID',/)
9201 FORMAT(1X,'>>>>>NO FILE NAME FOUND FOLLOWING KEYWORD ',A,/)
9301 FORMAT(1X,'>>>>>INVALID KEYWORD (' ,A,') SPECIFIED FOR DIRECT ',
1      'EXECUTION',/)
9501 FORMAT(1X,'>>>>>UNABLE TO LOCATE EVENT NAME ',A,' DURING ',
1      'PROCESSING OF KEYWORD ',A,/)
      END
      SUBROUTINE DIR
C*****IMPLEMENTS PBSOR RUNS WHICH INVOLVE DIRECT INPUT WITHOUT
C*****SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1      STL(MAXSPC), STIL, STRVOL(MAXSPC),
2      ST1(MAXSPC), ST2(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFPVA(MAXSPC),
1      DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2      FCCI(MAXSPC), DFCV(MAXSPC), VBPUF(MAXSPC),
3      FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),

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4          DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5          VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6          EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7          TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8          DT1, DT2, DTVB, PUFF, ELEV
COMMON /BINNED/ FCORO(MAXSPC,MAXCAS), FVESO(MAXSPC,MAXCAS),
1          DFVPAO(MAXSPC,MAXCAS), DFCPAO(MAXSPC,MAXCAS),
2          FDCHO(MAXSPC,MAXCAS), FEVSEO(MAXSPC,MAXCAS),
3          FCCIO(MAXSPC,MAXCAS), DFCAVO(MAXSPC,MAXCAS),
4          VBPUFO(MAXSPC,MAXCAS), FCONVO(MAXSPC,MAXCAS),
5          FCONCO(MAXSPC,MAXCAS), RBDFO(MAXSPC,MAXCAS),
6          DFSPRVO(MAXSPC,MAXCAS), DFSPRCO(MAXSPC,MAXCAS),
7          FREVOO(MAXSPC,MAXCAS), FLTI10(MAXCAS),
8          FLTI20(MAXCAS), FHPEO(MAXCAS), EVSEO(MAXCAS),
8          FPLBYO(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
9          DT10(MAXTIM), DT20(MAXTIM), DTVBO(MAXTIM),
A          PUFFO(MAXTIM)
COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1          FVESL(MAXSPC,MAXLEV,MAXCAS),
2          FREVOL(MAXSPC,MAXLEV,MAXCAS),
3          FCCIL(MAXSPC,MAXLEV,MAXCAS),
4          FCONVL(MAXSPC,MAXLEV,MAXCAS),
5          FCONCL(MAXSPC,MAXLEV,MAXCAS),
6          FLTI1L(MAXLEV,MAXCAS), FLTI2L(MAXLEV,MAXCAS),
7          RBDL(MAXSPC,MAXLEV,MAXCAS),
8          FDCHL(MAXSPC,MAXLEV,MAXCAS),
9          FEVSEL(MAXSPC,MAXLEV,MAXCAS),
A          DFVPAL(MAXSPC,MAXLEV,MAXCAS),
B          DFCPAL(MAXSPC,MAXLEV,MAXCAS),
C          DFCAVL(MAXSPC,MAXLEV,MAXCAS),
D          DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
E          DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
F          PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)
DATA IOBS / 1 /, IBIN / 1 /

C
C
C*****SET NUMBER OF SAMPLE VALUES
      NVART=1
      XLHS(1)=0.0
C*****DEFINE VARIABLE NAMES FOR DEFAULT INPUT
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM FILE DEFFIL
      CALL SETDEF
C*****PRINT DEFAULT VALUE INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
          WRITE(6,1010)
          STOP
      ENDIF
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
      CALL TRANS (FCOR(1), FCORO(1,1), FCORL(1,1,1))
C*****PRINT CONTENTS OF COMMON BLOCKS
      IF (REPRTB) CALL WRREL
C*****SET TOTAL NUMBER OF SOURCE TERMS
      NTOT=1
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
      IF (CONSFL) WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****PERFORM SOURCE TERM CALCULATIONS

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      CALL PBSORC (IOBS, IBIN)
C*****PRINT PROCESSING SUMMARY
      WRITE(6,2003)
      RETURN
C*****FORMAT STATEMENTS
1006 FORMAT(1X,A,/1X,4I10)
1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION OF INPUT')
2003 FORMAT(/1X,'SINGLE DIRECT EXECUTION PROCESSED')
      END
      SUBROUTINE DIRSMP
C*****IMPLEMENTS PBSOR RUNS WHICH INVOLVE DIRECT INPUT WITH
C*****SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1          NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2          ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3          LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1          STL(MAXSPC), STIL, STRVOL(MAXSPC),
2          ST1(MAXSPC), ST2(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1          DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2          FCCI(MAXSPC), DFCAV(MAXSPC), VBPUF(MAXSPC),
3          FCONV(MAXSPC), FCONC(MAXSPC), RBDP(MAXSPC),
4          DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5          VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6          EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7          TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8          DT1, DT2, DTVB, PUFF, ELEV
      COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS), FVES0(MAXSPC,MAXCAS),
1          DFVPA0(MAXSPC,MAXCAS), DFCPA0(MAXSPC,MAXCAS),
2          FDCH0(MAXSPC,MAXCAS), FEVSE0(MAXSPC,MAXCAS),
3          FCCI0(MAXSPC,MAXCAS), DFCAV0(MAXSPC,MAXCAS),
4          VBPUF0(MAXSPC,MAXCAS), FCONV0(MAXSPC,MAXCAS),
5          FCONC0(MAXSPC,MAXCAS), RBDP0(MAXSPC,MAXCAS),
6          DFSPRV0(MAXSPC,MAXCAS), DFSPRC0(MAXSPC,MAXCAS),
7          FREVO0(MAXSPC,MAXCAS), FLTI10(MAXCAS),
8          FLTI20(MAXCAS), FHPE0(MAXCAS), EVSE0(MAXCAS),
8          FPLBY0(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
9          DT10(MAXTIM), DT20(MAXTIM), DTVB0(MAXTIM),
A          PUFF0(MAXTIM)
      COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1          FVESL(MAXSPC,MAXLEV,MAXCAS),
2          FREVOL(MAXSPC,MAXLEV,MAXCAS),
3          FCCIL(MAXSPC,MAXLEV,MAXCAS),
4          FCONVL(MAXSPC,MAXLEV,MAXCAS),
5          FCONCL(MAXSPC,MAXLEV,MAXCAS),

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6          FLT11L(MAXLEV,MAXCAS), FLT12L(MAXLEV,MAXCAS),
7          RBDL(MAXSPC,MAXLEV,MAXCAS),
8          FDCHL(MAXSPC,MAXLEV,MAXCAS),
9          FEVSEL(MAXSPC,MAXLEV,MAXCAS),
A          DFVPAL(MAXSPC,MAXLEV,MAXCAS),
B          DFCPAL(MAXSPC,MAXLEV,MAXCAS),
C          DFCAVL(MAXSPC,MAXLEV,MAXCAS),
D          DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
E          DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
F          PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)
DATA IBIN / 1 /

C
C
C*****DEFINE VARIABLE NAMES AND POSITION INFORMATION FOR DEFAULT
C*****INPUT AND SAMPLE VECTOR SUBSTITUTION
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM FILE DEFFIL
      CALL SETDEF
C*****SET SAMPLE VECTOR POSITIONS
      CALL VECPOS
C*****PRINT DEFAULT VALUE AND SAMPLE VECTOR POSITION INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
          WRITE(6,1010)
          STOP
      ENDIF
C*****SKIP TO STARTING SAMPLE VECTOR
      IF (NSTART .NE. 1) THEN
          DO 1000 ISKIP=1,NSTART-1
              READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
          1000 CONTINUE
      ENDIF
C*****SET TOTAL NUMBER OF SOURCE TERMS
      NTOT=NOBS
C*****PROCESS SAMPLE VECTORS
      DO 2000 IOBS=1,NOBS
C*****READ CURRENT SAMPLE VECTOR
          READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
C*****SET NUMBER OF SAMPLE VALUES
          NVART=NLHS
C*****TRANSFER SAMPLE VECTOR VALUES TO DEFAULT ARRAY
          CALL SUBVEC
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
          CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****PRINT CONTENTS OF COMMON BLOCKS
          IF (REPRTB) CALL WRREL
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
          IF (CONSFL .AND. (IOBS .EQ. 1))
              1 WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****PERFORM SOURCE TERM CALCULATIONS
          CALL PBSORC (IOBS+NSTART-1, IBIN)
          2000 CONTINUE
C*****PRINT PROCESSING SUMMARY
          IF (NOBS .EQ. 1) THEN
              WRITE(6,2003) NOBS
          ELSE
              WRITE(6,2004) NSTART, NSTART+NOBS-1, NOBS
          ENDIF

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      RETURN
C*****FORMAT STATEMENTS
1006 FORMAT(1X,A,/1X,4I10)
1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION OF INPUT')
2003 FORMAT(/1X,I5,' SAMPLE VECTOR PROCESSED')
2004 FORMAT(/1X,'SAMPLE VECTORS ',I4,' THRU ',I5,
1      ' WERE PROCESSED (TOTAL OF ',I5,')')
      END
      SUBROUTINE BIN
C*****IMPLEMENTS PBSOR RUNS WHICH INVOLVE BINNED INPUT WITHOUT
C*****SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRITNP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,

1      EXPERT, PRITNP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1      STL(MAXSPC), STIL, STRVOL(MAXSPC),
2      ST1(MAXSPC), ST2(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1      DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2      FCCI(MAXSPC), DFCAV(MAXSPC), VBPUF(MAXSPC),
3      FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4      DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5      VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6      EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7      TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8      DT1, DT2, DTVB, PUFF, ELEV
      COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS), FVES0(MAXSPC,MAXCAS),
1      DFVPA0(MAXSPC,MAXCAS), DFCPA0(MAXSPC,MAXCAS),
2      FDCH0(MAXSPC,MAXCAS), FEVSE0(MAXSPC,MAXCAS),
3      FCCI0(MAXSPC,MAXCAS), DFCAV0(MAXSPC,MAXCAS),
4      VBPUF0(MAXSPC,MAXCAS), FCONV0(MAXSPC,MAXCAS),
5      FCONC0(MAXSPC,MAXCAS), RBDF0(MAXSPC,MAXCAS),
6      DFSPRV0(MAXSPC,MAXCAS), DFSPRC0(MAXSPC,MAXCAS),
7      FREVO0(MAXSPC,MAXCAS), FLTI10(MAXCAS),
8      FLTI20(MAXCAS), FHPE0(MAXCAS), EVSE0(MAXCAS),
8      FPLBY0(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
9      DT10(MAXTIM), DT20(MAXTIM), DTVB0(MAXTIM),
A      PUFF0(MAXTIM)
      COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1      FVESL(MAXSPC,MAXLEV,MAXCAS),
2      FREVOL(MAXSPC,MAXLEV,MAXCAS),
3      FCCIL(MAXSPC,MAXLEV,MAXCAS),
4      FCONVL(MAXSPC,MAXLEV,MAXCAS),
5      FCONCL(MAXSPC,MAXLEV,MAXCAS),
6      FLTI1L(MAXLEV,MAXCAS), FLTI2L(MAXLEV,MAXCAS),

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7          RBDL (MAXSPC,MAXLEV,MAXCAS),
8          FDCHL (MAXSPC,MAXLEV,MAXCAS),
9          FEVSEL (MAXSPC,MAXLEV,MAXCAS),
A          DFVPAL (MAXSPC,MAXLEV,MAXCAS),
B          DFCPAL (MAXSPC,MAXLEV,MAXCAS),
C          DFCAVL (MAXSPC,MAXLEV,MAXCAS),
D          DFSPRVL (MAXSPC,MAXLEV,MAXCAS),
E          DFSPRCL (MAXSPC,MAXLEV,MAXCAS),
F          PRBLEV (MAXLEV)
COMMON /LHSBLK/ XLHS (MAXSMP)
DATA IOBS / 1 /

C
C
C*****DEFINE VARIABLE NAMES FOR DEFAULT INPUT
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM FILE DEFFIL
      CALL SETDEF
C*****PRINT DEFAULT VALUE INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
          WRITE(6,1010)
          STOP
      ENDIF
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
      CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****ONE SET OF BIN DEFINITIONS IS USED
      READ(4,1001) BTITLE
      READ(4,*) NDM, NBIN
C*****SET NUMBER OF SAMPLE VALUES EQUAL TO VALUE OF BIN DIMENSION
      NVART=NDM
      IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,1011) NBIN, MAXBIN, NBIN
          STOP
      ENDIF
      IF (NBIN .GT. 0) READ(4,1002) (BINARR(I)(1:NDM),I=1,NBIN)
      WRITE(6,1003) BTITLE, NBIN, (I, BINARR(I)(1:NDM),I=1,NBIN)
      WRITE(6,1004)
C*****SET TOTAL NUMBER OF SOURCE TERMS
      NTOT=NBIN
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
      IF (CONSFL) WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****LOOP OVER INDIVIDUAL BINS
      DO 1000 IBIN=1,NBIN
C*****TRANSLATE CURRENT BIN ID TO PARAMETERS FOR USE IN RELCLC
          CALL BINTRN (IBIN)
C*****PRINT CONTENTS OF COMMON BLOCKS
          IF (REPTB) CALL WRREL
C*****PERFORM SOURCE TERM CALCULATIONS
          CALL PBSORC (IOBS, IBIN)
      1000 CONTINUE
C*****PRINT NUMBER OF BINS PROCESSED
      WRITE(6,2003) NBIN
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT(A)
      1002 FORMAT(1X,A)
      1003 FORMAT(/1X,130('='),
          1          //1X,'BINNING INFORMATION',

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2      /1X,A,
3      //1X,'THE FOLLOWING ',I7,' BIN(S) ARE TO BE PROCESSED:',
4      //(1X,I7,'-',A))
1004 FORMAT(/1X,130('='),//)
1006 FORMAT(1X,A,/1X,4I10)
1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION OF INPUT')
1011 FORMAT(/1X,'>>>>NUMBER OF BINS (',I7,') READ FROM FILE IS ',
1      'LARGER THAN ALLOWED DIMENSION (',I7,')',
2      /1X,'>>>>INCREASE PARAMETER MAXBIN TO AT LEAST ',I7,
3      /1X,'>>>>EXECUTION TERMINATED')
2003 FORMAT(/1X,I7,' BIN(S) PROCESSED')
      END
      SUBROUTINE BINSMP
C*****IMPLEMENTS PBSOR RUNS WHICH INVOLVE BINNED INPUT WITH SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PR TINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PR TINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1      STL(MAXSPC), STIL, STRVOL(MAXSPC),
2      ST1(MAXSPC), ST2(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1      DF CPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2      FCCI(MAXSPC), DFCAV(MAXSPC), VBPUF(MAXSPC),
3      FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4      DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5      VALISS(MAXISS), FLT11, FLT12, NSPEC, FLV, FHPE,
6      EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7      TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8      DT1, DT2, DTVB, PUFF, ELEV
      COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS), FVES0(MAXSPC,MAXCAS),
1      DFVPA0(MAXSPC,MAXCAS), DF CPA0(MAXSPC,MAXCAS),
2      FDCH0(MAXSPC,MAXCAS), FEVSE0(MAXSPC,MAXCAS),
3      FCCI0(MAXSPC,MAXCAS), DFCAV0(MAXSPC,MAXCAS),
4      VBPUF0(MAXSPC,MAXCAS), FCONV0(MAXSPC,MAXCAS),
5      FCONC0(MAXSPC,MAXCAS), RBDF0(MAXSPC,MAXCAS),
6      DFSPRV0(MAXSPC,MAXCAS), DFSPRC0(MAXSPC,MAXCAS),
7      FREVO0(MAXSPC,MAXCAS), FLT110(MAXCAS),
8      FLT120(MAXCAS), FHPE0(MAXCAS), EVSE0(MAXCAS),
8      FPLBY0(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
9      DT10(MAXTIM), DT20(MAXTIM), DTVB0(MAXTIM),
A      PUFF0(MAXTIM)
      COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1      FVESL(MAXSPC,MAXLEV,MAXCAS),
2      FREVOL(MAXSPC,MAXLEV,MAXCAS),
3      FCCIL(MAXSPC,MAXLEV,MAXCAS),

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4          FCONVL(MAXSPC,MAXLEV,MAXCAS),
5          FCONCL(MAXSPC,MAXLEV,MAXCAS),
6          FLTI1L(MAXLEV,MAXCAS), FLTI2L(MAXLEV,MAXCAS),
7          RBDFL(MAXSPC,MAXLEV,MAXCAS),
8          FDCHL(MAXSPC,MAXLEV,MAXCAS),
9          FEVSEL(MAXSPC,MAXLEV,MAXCAS),
A          DFVPAL(MAXSPC,MAXLEV,MAXCAS),
B          DFCPAL(MAXSPC,MAXLEV,MAXCAS),
C          DFCAVL(MAXSPC,MAXLEV,MAXCAS),
D          DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
E          DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
F          PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)

C
C
C*****DEFINE VARIABLE NAMES AND POSITION INFORMATION FOR DEFAULT
C*****INPUT AND SAMPLE VECTOR SUBSTITUTION
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM FILE DEFFIL
      CALL SETDEF
C*****SET SAMPLE VECTOR POSITIONS
      CALL VECPOS
C*****PRINT DEFAULT VALUE AND SAMPLE VECTOR POSITION INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
        WRITE(6,1010)
        STOP
      ENDIF
      IF (.NOT. BYRUN) THEN
C*****READ SET OF BINS WHICH WILL BE USED FOR ALL SAMPLES
        READ(4,1001) BTITLE
        READ(4,*) NDM, NBIN
        IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,1011) NBIN, MAXBIN, NBIN
          STOP
        ENDIF
        IF (NBIN .GT. 0) READ(4,1002) (BINARR(I)(1:NDM),I=1,NBIN)
        WRITE(6,1003) IOBS, BTITLE, NBIN,
1          (I, BINARR(I)(1:NDM),I=1,NBIN)
        WRITE(6,1004)
C*****SET TOTAL NUMBER OF SOURCE TERMS
        NTOT=NBIN * NOBS
      ENDIF
C*****CHECK FOR STARTING SAMPLE VECTOR
      IF (NSTART .NE. 1) THEN
C*****SKIP TO STARTING SAMPLE VECTOR
        DO 1000 ISKIP=1,NSTART-1
C*****READ SAMPLE VECTOR VALUES
          READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
          IF (BYRUN) THEN
C*****READ BIN DEFINITIONS FOR CURRENT SAMPLE VECTOR
            READ(4,1001) BTITLE
            READ(4,*) NDM, NBIN
            IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
              WRITE(6,1011) NBIN, ISKIP, MAXBIN, NBIN
              STOP
            ENDIF

```

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                IF (NBIN .GT. 0) READ(4,1002)
1                (BINARR(I)(1:NDM),I=1,NBIN)
                ENDIF
1000    CONTINUE
        ENDIF
C*****PROCESS SAMPLE VECTOR
        DO 3000 IOBS=1,NOBS
C*****READ CURRENT SAMPLE VECTOR VALUES
        READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
C*****VALIDATE NUMBER OF SAMPLE VECTOR VALUES
        IF (NLHS .GT. MAXSMP) THEN
            WRITE(6,1005) NLHS, MAXSMP
            STOP
        ENDIF
C*****TRANSFER SAMPLE VECTOR VALUES
        CALL SUBVEC
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
        CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
        IF (CONSFL .AND. (IOBS .EQ. 1))
1            WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****USE EXPERT OPINION TABLES
        IF (EXPERT) CALL EXPTAB
C*****CHECK FOR SEPARATE BIN DEFINITIONS FOR EACH SAMPLE
        IF (BYRUN) THEN
C*****READ SET OF BINS FOR CURRENT SAMPLE
            READ(4,1001) BTITLE
            READ(4,*) NDM, NBIN
            IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
                WRITE(6,1011) NBIN, NSTART+IOBS-1, MAXBIN, NBIN
                STOP
            ENDIF
            IF (NBIN .GT. 0) READ(4,1002) (BINARR(I)(1:NDM),I=1,NBIN)
            WRITE(6,1003) IOBS, BTITLE, NBIN,
1                (I, BINARR(I)(1:NDM),I=1,NBIN)
            WRITE(6,1004)
        ENDIF
C*****SET NUMBER OF LHS VARIABLES PLUS NUMBER OF BIN DEFINITIONS
        NVART=NLHS + NDM
C*****LOOP OVER INDIVIDUAL BINS
        DO 2000 IBIN=1,NBIN
C*****TRANSLATE CURRENT BIN ID TO PARAMETERS FOR USE IN RELCLC
            CALL BINTRN (IBIN)
C*****PRINT CONTENTS OF COMMON BLOCKS
            IF (REPRTB) CALL WRREL
C*****PERFORM SOURCE TERM CALCULATIONS
            CALL PBSORC (IOBS+NSTART-1, IBIN)
        2000    CONTINUE
C*****PRINT NUMBER OF BINS PROCESSED FOR CURRENT SAMPLE VECTOR
        WRITE(6,2003) NBIN, IOBS+NSTART-1
        3000 CONTINUE
        RETURN
C*****FORMAT STATEMENTS
1001 FORMAT(A)
1002 FORMAT(1X,A)
1003 FORMAT(/1X,130('='),
1        //1X,'BINNING INFORMATION FOR SAMPLE VECTOR ',I4,
2        /1X,A,
3        //1X,'THE FOLLOWING ',I7,' BIN(S) ARE TO BE PROCESSED:',
4        /(1X,I7,'-',A))
1004 FORMAT(/1X,130('='),/)

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1005 FORMAT(/1X,'>>>>NUMBER OF SAMPLE VECTOR VALUES (' ,I4,
1      ' ) READ FROM UNIT 3 EXCEEDS ',
2      /1X,'>>>>MAXIMUM NUMBER ALLOWED (MAXSMP=' ,I4,' )',
3      /1X,'>>>>EXECUTION TERMINATED')
1006 FORMAT(1X,A,/1X,4I10)
1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION OF INPUT')
1011 FORMAT(/1X,'>>>>NUMBER OF BINS (' ,I7,' ) READ FROM UNIT 4, ',
1      'SAMPLE VECTOR ' ,I4,
2      ' , IS LARGER THAN ALLOWED DIMENSION (' ,I7,' )',
3      /1X,'>>>>INCREASE PARAMETER MAXBIN TO AT LEAST ' ,I7,
4      /1X,'>>>>EXECUTION TERMINATED')
2003 FORMAT(/1X,I7,' BIN(S) PROCESSED FOR SAMPLE VECTOR ' ,I4)
      END
      SUBROUTINE DEFINE
C*****DEFINE NAMES AND DIMENSIONS OF VARIABLES TO BE SET THROUGH
C*****DEFAULT INPUT AND SAMPLE VECTOR SUBSTITUTION
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PR TINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PR TINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
C*****DEFINE VARIABLE NAMES AND CORRESPONDING DIMENSIONS TO BE SET
C*****THROUGH DEFAULT AND SAMPLE VECTOR SUBSTITUTION FOR BINNED
C*****EXECUTION. VARIABLE NAMES AND DIMENSIONS CORRESPOND EXACTLY
C*****TO ORDER OF VARIABLES IN COMMON BLOCKS:
C***** (1) BASVAL, (2) BINNED, AND (3) EXPERT
C*****AS IF THESE COMMON BLOCKS ARE CONCATENTATED.
      DATA NAME /
1      'FCOR', 'FVES', 'DFVPA', 'DFCPA',
2      'FDCH', 'FEVSE', 'FCCI', 'DFCAV',
3      'VBPUF', 'FCONV', 'FCONC', 'RBDF',
4      'DFSPRV', 'DFSPRC', 'FREVO', 'VALISS',
5      'FLT11', 'FLT12', 'NSPEC', 'FLV', 'FHPE', 'EVSE', 'FPLBY',
6      'TC11', 'TC12', 'TC21', 'TC22', 'TB11', 'TB12',
7      'TB21', 'TB22', 'TBX1', 'TBX2', 'TBS2', 'TBR2',
8      'TW', 'T1', 'T2', 'DT1', 'DT2', 'DTVB', 'PUFF', 'ELEV',
9      'FCORO', 'FVESO', 'DFVPAO',
A      'DFCPAO', 'FDCHO', 'FEVSEO',
B      'FCCIO', 'DFCAVO', 'VBPUFO',
C      'FCONVO', 'FCONCO', 'RBDFO',
D      'DFSPRVO', 'DFSPRCO', 'FREVOO', 'FLT11O',
E      'FLT12O', 'FHPEO', 'EVSEO', 'FPLBYO',
F      'TWO', 'T1O', 'DT1O', 'DT2O', 'DTVBO',
G      'PUFFO',
H      'FCORL', 'FVESL',
I      'FREVOL', 'FCCIL',
J      'FCONVL', 'FCONCL',
K      'FLT11L', 'FLT12L', 'RBDFL',
L      'FDCHL', 'FEVSEL',
M      'DFVPAL', 'DFCPAL',

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N   'DFCAVL', 'DFSPRVL',
O   'DFSPRCL', 'PRBLEV',
P   14* ' ' /
C*****DEFINE 3 DIMENSIONS FOR EACH OF THE VARIABLES
DATA IDIMEN /
1   MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
2   MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
3   MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
4   MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXISS,1,1,
5   1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
6   1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
7   1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
8   1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
9   MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
A   MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
B   MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
C   MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
D   MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXCAS,1,1,
E   MAXCAS,1,1, MAXCAS,1,1, MAXCAS,1,1, MAXCAS,1,1,
F   MAXTIM,1,1, MAXTIM,1,1, MAXTIM,1,1, MAXTIM,1,1, MAXTIM,1,1,
G   MAXTIM,1,1,
H   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
I   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
J   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
K   MAXLEV,MAXCAS,1, MAXLEV,MAXCAS,1, MAXSPC,MAXLEV,MAXCAS,
L   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
M   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
N   MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
O   MAXSPC,MAXLEV,MAXCAS, MAXLEV,1,1,
P   42*0 /
C*****DEFINE NUMBERS OF VALUES IN COMMON BLOCKS:
C***** (1) BASVAL, (2) BINNED, AND (3) EXPERT
DATA NVCB1 / 197 /, NVCB2 / 1157 /, NVCB3 / 9950 /, NVCB4 / 0 /,
1   NVCB5 / 0 /
C
C
C*****INITIALIZE MAXIMUM LENGTH OF VARIABLE NAMES
NCHAR=7
C*****SET DEFAULT TYPES TO .FALSE.
DO 1000 I=1,MAXVAL
  LDEFLT(I)=.FALSE.
1000 CONTINUE
C*****INITIALIZE NUMBER OF VARIABLES
NVAR=0
C*****INITIALIZE TOTAL NUMBER OF VALUES
NVAL=1
C*****SET POSITION INFORMATION
DO 2000 IVAR=1,MAXVAR
C*****CHECK FOR BLANK VARIABLE NAME
  IF (NAME(IVAR) .EQ. ' ') GO TO 3000
C*****INCREMENT NUMBER OF VARIABLES
  NVAR=NVAR + 1
C*****SAVE STARTING POSITION OF CURRENT VARIABLE
  ISPOS(NVAR)=NVAL
C*****CHECK FOR NON-ZERO DIMENSIONS
  IF ((IDIMEN(1,NVAR) .LE. 0) .OR. (IDIMEN(2,NVAR) .LE. 0) .OR.
1    (IDIMEN(3,NVAR) .LE. 0)) THEN
C*****PRINT ERROR MESSAGE
  WRITE(6,1001) NAME(IVAR), (IDIMEN(I,NVAR),I=1,3)
  NOCALC=.TRUE.
  ENDIF
C*****INCREMENT TOTAL NUMBER OF VALUES

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        NVAL=NVAL + IDIMEN(1,NVAR)*IDIMEN(2,NVAR)*IDIMEN(3,NVAR)
2000 CONTINUE
3000 CONTINUE
C*****SET TOTAL NUMBER OF VALUES
        NVAL=NVAL - 1
C*****VALIDATE TOTAL NUMBER OF VALUES AGAINST MAXIMUM DIMENSION
        IF (NVAL .GT. MAXVAL) THEN
C*****PRINT ERROR MESSAGE
                WRITE(6,3001) NVAL, MAXVAL, NVAL
                NOCALC=.TRUE.
        ENDIF
C*****VALIDATE TOTAL NUMBER OF VALUES AGAINST SUM OF VALUES IN
C*****DEFAULTED COMMON BLOCKS
        IF (NVAL .NE. NVCB1+NVCB2+NVCB3+NVCB4+NVCB5) THEN
C*****PRINT ERROR MESSAGE
                WRITE(6,3002) NVAL, NVCB1+NVCB2+NVCB3+NVCB4+NVCB5
                NOCALC=.TRUE.
        ENDIF
C*****SET ASCII CODE FOR CHARACTERS I AND N
        ICI=ICHAR('I')
        ICN=ICHAR('N')
C*****INITIALIZE VALUE POINTER
        IVAL=1
C*****SET VARIABLE TYPES
        DO 5000 IVAR=1,NVAR
C*****INITIALIZE POINTER ARRAY
                IPNT(IVAR)=IVAR
C*****SET ASCII CODE FOR FIRST CHARACTER OF VARIABLE NAME
                IC=ICHAR(NAME(IVAR)(1:1))
C*****COMPARE ASCII CODE TO I THRU N RANGE (INTEGER VARIABLE)
                IF ((IC .GE. ICI) .AND. (IC .LE. ICN)) THEN
C*****SET REAL VARIABLE FLAG TO .FALSE. (INTEGER VARIABLE)
                        LREAL(IVAL)=.FALSE.
                ELSE
C*****SET REAL VARIABLE FLAG TO .TRUE. (REAL VARIABLE)
                        LREAL(IVAL)=.TRUE.
                ENDIF
C*****SET ALL TYPES FOR CURRENT VARIABLE
                IFIRST=IVAL
                ILAST=IVAL - 1 + IDIMEN(1,IVAR)*IDIMEN(2,IVAR)*IDIMEN(3,IVAR)
                DO 4000 I=IFIRST,ILAST
                        LREAL(I)=LREAL(IVAL)
                4000 CONTINUE
C*****RESET VALUE POINTER
                IVAL=ILAST + 1
        5000 CONTINUE
C*****ALL INFORMATION FOR VARIABLES THAT MAY BE SET THROUGH DEFAULT
C*****AND VECTOR POSITION HAS BEEN SAVED
C*****SORT LIST OF VARIABLE NAMES USING POINTER IPNT TO FACILITATE
C*****SEARCHING
        CALL CSORT (NVAR, NAME, IPNT)
        RETURN
C*****FORMAT STATEMENTS
1001 FORMAT(1X,'>>>>DIMENSIONS FOR VARIABLE ',A,' MUST BE GREATER ',
1      'THAN 0',
2      /1X,'>>>>DIMENSION 1 =',I5,', DIMENSION 2 =',I5,
3      ', DIMENSION 3 =',I5,
4      /1X,'>>>>CHECK VARIABLE DEFINITIONS IN SUBROUTINE DEFINE',/)
3001 FORMAT(1X,'>>>>NUMBER OF VARIABLES (NVAR=',I5,') EXCEEDS ',
1      'DIMENSION (MAXVAR=',I5,')',
2      /1X,'>>>>CHECK VARIABLE DEFINITIONS IN SUBROUTINE DEFINE ',
3      'AND/OR',

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4      /1X,'>>>>RESET PARAMETER MAXVAR TO AT LEAST ',I5,/)
3002 FORMAT(1X,'>>>>NUMBER OF VALUES WHICH CAN BE SET THROUGH ',
1      'DEFAULT AND VECTOR SUBSTITUTION ('',I5,'')',
2      /1X,'>>>>SHOULD BE EQUAL TO THE TOTAL NUMBER OF VALUES ',
3      'IN THE COMMON BLOCKS TO BE SET ',
4      /1X,'>>>>(NVCB1+NVCB2+NVCB3+NVCB4+NVCB5='',I5,'') ',
5      '-- SUBROUTINE DEFINE',/)
END
SUBROUTINE SETDEF
C*****SET DEFAULT VALUES BY READING VARIABLE NAMES AND CORRESPONDING
C*****VALUES FROM FILE DESIGNATED FOR DEFAULT VALUES (DEFFIL)
PARAMETER (MAXLEN=101, MAXVLN=20)
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
CHARACTER*7 NAME
LOGICAL LDEFLT, LREAL
COMMON /DEFLT1/ NAME(MAXVAR)
COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
CHARACTER*80 DEFFIL, SAMFIL, VECFIL
COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL
CHARACTER*(MAXLEN) CARD
CHARACTER*(MAXVLN) CVAL, TMPVAL
DIMENSION INDX(3)
LOGICAL EOR, TYPE(4), LVAL
CHARACTER*10 IFRMT
COMMON /VALUES/ RVL(MAXVAL)
DIMENSION IVL(MAXVAL)
EQUIVALENCE (IVL, RVL)
C
C
C*****PRINT HEADER MESSAGE
IF (PRTINP) WRITE(6,1003) DEFFIL
C*****WRITE INTEGER FORMAT FOR READING VARIABLE ARRAY INDICES
WRITE(IFRMT,1004) MAXVLN
C*****INITIALIZE CURRENT VALUE POSITION
IVPOS=-1
C*****OPEN DEFAULT FILE
OPEN(1, FILE=DEFFIL, STATUS='OLD', READONLY, ERR=9100)
1000 CONTINUE
C*****READ RECORD
READ(1,1001,END=8000) CARD
C*****PRINT RECORD
IF (PRTINP) WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
IC=1
2000 CONTINUE
C*****READ NEXT VALUE ON RECORD
CALL RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL, LENGTH, TYPE, EOR)
C*****CHECK FOR END-OF-RECORD
IF (EOR) GO TO 1000
C*****CHECK FOR CHARACTER VALUE (VARIABLE NAME)

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      IF (TYPE(1)) THEN
C*****INITIALIZE ARRAY SPECIFICATIONS
      INDX(1)=1
      INDX(2)=1
      INDX(3)=1
C*****CHARACTER VALUE (VARIABLE NAME) FOUND
C*****CHECK FOR LEFT PARENTHESIS IN VARIABLE NAME
      ILPAR=INDEX(CVAL, '(')
      IF (ILPAR.NE. 0) THEN
C*****FOUND LEFT PARENTHESIS, CHECK FOR RIGHT PARENTHESIS
      IRPAR=INDEX(CVAL, ')')
      IF (IRPAR.NE. 0) THEN
C*****FOUND RIGHT PARENTHESIS, CHECK FOR COMMA
      ICOMMA=INDEX(CVAL, ',')
      IF (ICOMMA.NE. 0) THEN
C*****FOUND COMMA, DETERMINE FIRST ARRAY INDEX
      IS=ILPAR + 1
      IE=ICOMMA
      IND=1
3000      CONTINUE
      IE=IE - 1
      IF (CVAL(IE:IE).EQ. ' ') GO TO 3000
      IF (IE.GE. IS) THEN
C*****SET CURRENT ARRAY INDEX
      TMPVAL=' '
      TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
      READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
      ELSE
C*****INVALID ARRAY INDEX
      WRITE(6,3001) IND, CVAL(1:LENGTH)
      NOCALC=.TRUE.
      ENDIF
C*****CHECK FOR FINAL ARRAY INDEX FOUND
      IF (ICOMMA.GT. 0) THEN
      IS=ICOMMA + 1
C*****LOCATE NEXT COMMA
      ICOMMA=INDEX(CVAL(IS:LENGTH), ',')
      IF (ICOMMA.GT. 0) THEN
      ICOMMA=IS + ICOMMA - 1
      IE=ICOMMA
      ELSE
      IE=IRPAR
      ENDIF
C*****INCREMENT COUNTER FOR CURRENT ARRAY INDEX
      IND=IND + 1
      IF (IND.GT. 3) THEN
C*****MORE THAN 3 ARRAY INDICES
      WRITE(6,3002) CVAL(1:LENGTH)
      IVPOS=-1
      NOCALC=.TRUE.
      GO TO 2000
      ENDIF
      GO TO 3000
      ENDIF
      ELSE
C*****NO COMMA FOUND, ONLY ONE ARRAY INDEX
      IS=ILPAR + 1
      IE=IRPAR
      IND=1
4000      CONTINUE
      IE=IE - 1
      IF (CVAL(IE:IE).EQ. ' ') GO TO 4000

```



```

      IF (IE .GE. IS) THEN
C*****SET SINGLE ARRAY INDEX
      TMPVAL=' '
      TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
      READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
      ELSE
C*****INVALID ARRAY INDEX
      WRITE(6,4001) CVAL(1:LENGTH)
      NOCALC=.TRUE.
      ENDIF
    ENDIF
C*****BLANK OUT ARRAY INDEX PORTION OF VARIABLE NAME
      CVAL(ILPAR:MAXVLN)=' '
      ELSE
C*****ERROR IN ARRAY INDEX SPECIFICATION
      WRITE(6,4001) CVAL(1:LENGTH)
      NOCALC=.TRUE.
      ENDIF
    ENDIF
C*****SEARCH FOR VARIABLE NAME
      CALL SEARCH (NVAR, CVAL(1:LENGTH), NAME, IPNT, IPOINT)
C*****CHECK FOR VARIABLE NAME FOUND
      IF (IPOINT .GT. 0) THEN
C*****VARIABLE NAME FOUND, VALIDATE ARRAY INDICES
      IF ((INDX(1) .GE. 1) .AND. (INDX(2) .GE. 1) .AND.
1         (INDX(3) .GE. 1) .AND.
2         (INDX(1) .LE. IDIMEN(1,IPNT(IPOINT))) .AND.
3         (INDX(2) .LE. IDIMEN(2,IPNT(IPOINT))) .AND.
4         (INDX(3) .LE. IDIMEN(3,IPNT(IPOINT)))) THEN
C*****VALID ARRAY INDICES, SET CURRENT VALUE POSITION
      IVPOS=ISPOS(IPNT(IPOINT)) + INDX(1) +
1         (INDX(2)-1)*IDIMEN(1,IPNT(IPOINT)) +
2         (INDX(3)-1)*IDIMEN(1,IPNT(IPOINT))*
3         IDIMEN(2,IPNT(IPOINT)) - 1
      ELSE
C*****INVALID ARRAY INDICES
      WRITE(6,4002) NAME(IPNT(IPOINT)),
1         (I, INDX(I), IDIMEN(I,IPNT(IPOINT))),I=1,3)
C*****SET INVALID VALUE POSITION
      IVPOS=-1
      NOCALC=.TRUE.
      ENDIF
    ELSE
C*****VARIABLE NAME NOT FOUND
      WRITE(6,4003) CVAL(1:LENGTH)
C*****SET INVALID VALUE POSITION
      IVPOS=-1
      NOCALC=.TRUE.
      ENDIF
    ELSE IF (TYPE(3)) THEN
C*****CHECK FOR VALID VALUE POSITION
      IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING CURRENT VARIABLE
      IP=IPNT(IPOINT)
      IPNXTV=ISPOS(IP) + IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
      IF (IVPOS .LT. IPNXTV) THEN
C*****INTEGER VALUE FOUND SO CHECK FOR INTEGER VARIABLE TYPE
      IF (.NOT. LREAL(IVPOS)) THEN
C*****INTEGER VARIABLE SO TRANSFER INTEGER VALUE
      IVL(IVPOS)=IVAL
C*****SET DEFAULT FLAG

```

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```

                LDEFLT(IVPOS)=.TRUE.
            ELSE
C*****REAL VARIABLE, PRINT ERROR MESSAGE
                WRITE(6,4004) NAME(IPNT(IPOINT)), IVAL
                NOCALC=.TRUE.
            ENDIF
        ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
                WRITE(6,4006) NAME(IPNT(IPOINT)),
1                (IDIMEN(I,IPNT(IPOINT)),I=1,3)
                NOCALC=.TRUE.
            ENDIF
C*****INCREMENT VALUE POSITION
                IVPOS=IVPOS + 1
            ENDIF
        ELSE IF (TYPE(4)) THEN
C*****CHECK FOR VALID VALUE POSITION
                IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING CURRENT VARIABLE
                    IP=IPNT(IPOINT)
                    IPNXTV=ISPOS(IP) + IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
                    IF (IVPOS .LT. IPNXTV) THEN
C*****REAL VALUE FOUND SO CHECK FOR REAL VARIABLE TYPE
                        IF (LREAL(IVPOS)) THEN
C*****REAL VARIABLE SO TRANSFER REAL VALUE
                            RVL(IVPOS)=RVAL
C*****SET DEFAULT FLAG
                            LDEFLT(IVPOS)=.TRUE.
                        ELSE
C*****INTEGER VARIABLE, PRINT ERROR MESSAGE
                            WRITE(6,4005) NAME(IPNT(IPOINT)), RVAL
                            NOCALC=.TRUE.
                        ENDIF
                    ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
                        WRITE(6,4006) NAME(IPNT(IPOINT)),
1                        (IDIMEN(I,IPNT(IPOINT)),I=1,3)
                        NOCALC=.TRUE.
                    ENDIF
C*****INCREMENT VALUE POSITION
                        IVPOS=IVPOS + 1
                    ENDIF
                ENDIF
                GO TO 2000
            8000 CONTINUE
C*****CLOSE DEFAULT FILE
                CLOSE (1)
                RETURN
            9100 CONTINUE
C*****ERROR IN OPENING DEFAULT FILE
                WRITE(6,9101) DEFFIL
                STOP
            9200 CONTINUE
C*****ERROR IN READING ARRAY INDEX
                WRITE(6,9201)
                NOCALC=.TRUE.
                GO TO 1000
C*****FORMAT STATEMENTS
            1001 FORMAT(A)
            1002 FORMAT(11X,A)
            1003 FORMAT('1',/1X,130('*'),

```

```

1      /1X,53('*'),5X,'DEFAULT INPUT',5X,54('*'),
2      /1X,17('*'),5X,'FILE =',A,5X,17('*'),
3      /1X,130('*'),/)
1004 FCRMAT('I',I2,'')
3001 FORMAT(1X,'>>>>DEFAULT VARIABLE ARRAY INDEX ',I1,' FOR ',
1      'VARIABLE ',A,' IS INVALID',/)
3002 FORMAT(1X,'>>>>MORE THAN 3 ARRAY INDICES GIVEN FOR VARIABLE ',A,
1      'ON DEFAULT FILE')
4001 FORMAT(1X,'>>>>DEFAULT VARIABLE ARRAY INDEX FOR ',
1      'VARIABLE ',A,' IS INVALID',/)
4002 FORMAT(1X,'>>>>ARRAY INDICES FOR DEFAULT VARIABLE ',A,
1      ' ARE OUT OF RANGE:'
2      /(1X,'>>>> INDEX',I2,' =',I5,' , VALID RANGE = 1 TO ',I5,/:))
4003 FORMAT(1X,'>>>>DEFAULT VARIABLE NAME ',A,
1      ' NOT FOUND IN DEFAULT VARIABLE LIST',/)
4004 FORMAT(1X,'>>>>ATTEMPT TO DEFAULT REAL VARIABLE (' ,A,
1      ') TO INTEGER VALUE (' ,I10,')',/)
4005 FORMAT(1X,'>>>>ATTEMPT TO DEFAULT INTEGER VARIABLE (' ,A,
1      ') TO REAL VALUE (' ,1PE10.3,')',/)
4006 FORMAT(1X,'>>>>INVALID ARRAY POSITION ENCOUNTERED WHILE ',
1      'SETTING DEFAULT VALUES FOR VARIABLE--',
2      A,'(' ,I2,',' ,I2,',' ,I2,')')
8001 FORMAT('1')
9101 FORMAT(1X,'>>>>ERROR OPENING DEFAULT FILE ',A,/)
9201 FORMAT(1X,'>>>>ERROR IN READING PREVIOUS ARRAY INDEX')
END
SUBROUTINE VECPOS
C*****SET SAMPLE VECTOR POSITIONS BY READING VARIABLE NAMES AND
C*****CORRESPONDING SAMPLE VECTOR POSITIONS FROM FILE DESIGNATED
C*****FOR SAMPLE VECTOR POSITIONS (SAMFIL)
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
PARAMETER (MAXLEN=101, MAXVLN=20)
CHARACTER*7 NAME
LOGICAL LDEFLT, LREAL
COMMON /DEFLT1/ NAME(MAXVAR)
COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2      ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3      LREAL(MAXVAL)
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
CHARACTER*80 DEFFIL, SAMFIL, VECFIL
COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL
CHARACTER*(MAXLEN) CARD
CHARACTER*(MAXVLN) CVAL, TMPVAL
CHARACTER*10 IFRMT
DIMENSION INDX(3)
LOGICAL EOR, TYPE(4), LVAL
C
C
C*****PRINT HEADER MESSAGE
IF (PRTINP) WRITE(6,1003) SAMFIL
C*****WRITE INTEGER FORMAT FOR READING VARIABLE ARRAY INDICES
WRITE(IFRMT,1004) MAXVLN
C*****INITIALIZE CURRENT VALUE POSITION

```

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      IVPOS=-1
C*****OPEN SAMPLE VECTOR POSITION FILE
      OPEN(1, FILE=SAMFIL, STATUS='OLD', READONLY, ERR=9100)
      1000 CONTINUE
C*****READ RECORD
      READ(1,1001,END=9000) CARD
C*****PRINT RECORD
      IF (PRTINP) WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
      IC=1
      2000 CONTINUE
C*****READ NEXT VALUE ON RECORD
      CALL RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL, LENGTH, TYPE, EOR)
C*****CHECK FOR END-OF-RECORD
      IF (EOR) GO TO 1000
C*****CHECK FOR CHARACTER VALUE (VARIABLE NAME)
      IF (TYPE(1)) THEN
C*****INITIALIZE ARRAY SPECIFICATIONS
          INDX(1)=1
          INDX(2)=1
          INDX(3)=1
C*****CHARACTER VALUE (VARIABLE NAME) FOUND
C*****CHECK FOR LEFT PARENTHESIS IN VARIABLE NAME
          ILPAR=INDEX(CVAL, '(')
          IF (ILPAR.NE. 0) THEN
C*****FOUND LEFT PARENTHESIS, CHECK FOR RIGHT PARENTHESIS
              IRPAR=INDEX(CVAL, ')')
              IF (IRPAR.NE. 0) THEN
C*****FOUND RIGHT PARENTHESIS, CHECK FOR COMMA
                  ICOMMA=INDEX(CVAL, ',')
                  IF (ICOMMA.NE. 0) THEN
C*****FOUND COMMA, DETERMINE FIRST ARRAY INDEX
                      IS=ILPAR + 1
                      IE=ICOMMA
                      IND=1
                      3000 CONTINUE
                      IE=IE - 1
                      IF (CVAL(IE:IE).EQ. ' ') GO TO 3000
                      IF (IE.GE. IS) THEN
C*****SET CURRENT ARRAY INDEX
                          TMPVAL=' '
                          TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
                          READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
                      ELSE
C*****INVALID ARRAY INDEX
                          WRITE(6,3001) IND, CVAL(1:LENGTH)
                          NOCALC=.TRUE.
                      ENDIF
C*****CHECK FOR FINAL ARRAY INDEX FOUND
                          IF (ICOMMA.GT. 0) THEN
                              IS=ICOMMA + 1
C*****LOCATE NEXT COMMA
                              ICOMMA=INDEX(CVAL(IS:LENGTH), ',')
                              IF (ICOMMA.GT. 0) THEN
                                  ICOMMA=IS + ICOMMA - 1
                                  IE=ICOMMA
                              ELSE
                                  IE=IRPAR
                              ENDIF
C*****INCREMENT COUNTER FOR CURRENT ARRAY INDEX
                              IND=IND + 1
                              IF (IND.GT. 3) THEN

```

```

C*****MORE THAN 3 ARRAY INDICES
      WRITE(6,3002) CVAL(1:LENGTH)
      IVPOS=-1
      NOCALC=.TRUE.
      GO TO 2000
    ENDIF
    GO TO 3000
  ENDIF
ELSE
C*****NO COMMA FOUND, ONLY ONE ARRAY INDEX
      IS=ILPAR + 1
      IE=IRPAR
      IND=1
4000    CONTINUE
      IE=IE - 1
      IF (CVAL(IE:IE) .EQ. ' ') GO TO 4000
      IF (IE .GE. IS) THEN
C*****SET SINGLE ARRAY INDEX
          TMPVAL=' '
          TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
          READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
        ELSE
C*****INVALID ARRAY INDEX
          WRITE(6,4001) CVAL(1:LENGTH)
          NOCALC=.TRUE.
        ENDIF
      ENDIF
C*****BLANK OUT ARRAY INDEX PORTION OF VARIABLE NAME
      CVAL(ILPAR:MAXVLN)=' '
    ELSE
C*****ERROR IN ARRAY INDEX SPECIFICATION
      WRITE(6,4001) CVAL(1:LENGTH)
      NOCALC=.TRUE.
    ENDIF
  ENDIF
C*****SEARCH FOR VARIABLE NAME
      CALL SEARCH (NVAR, CVAL(1:LENGTH), NAME, IPNT, IPOINT)
C*****CHECK FOR VARIABLE NAME FOUND
      IF (IPOINT .GT. 0) THEN
C*****VARIABLE NAME FOUND, VALIDATE ARRAY INDICES
        IF ((INDX(1) .GE. 1) .AND. (INDX(2) .GE. 1) .AND.
1          (INDX(2) .GE. 1) .AND.
2          (INDX(1) .LE. IDIMEN(1,IPNT(IPOINT))) .AND.
3          (INDX(2) .LE. IDIMEN(2,IPNT(IPOINT))) .AND.
4          (INDX(3) .LE. IDIMEN(3,IPNT(IPOINT)))) THEN
C*****VALID ARRAY INDICES, SET CURRENT VALUE POSITION
          IVPOS=ISPOS(IPNT(IPOINT)) + INDX(1) +
1            (INDX(2)-1)*IDIMEN(1,IPNT(IPOINT)) +
2            (INDX(3)-1)*IDIMEN(1,IPNT(IPOINT))*
3            IDIMEN(2,IPNT(IPOINT)) - 1
        ELSE
C*****INVALID ARRAY INDICES
          WRITE(6,4002) CVAL(1:LENGTH),
1            (I, INDX(I), IDIMEN(I,IPNT(IPOINT))),I=1,3)
C*****SET INVALID VALUE POSITION
          IVPOS=-1
          NOCALC=.TRUE.
        ENDIF
      ELSE
C*****VARIABLE NAME NOT FOUND
          WRITE(6,4003) CVAL(1:LENGTH)
          NOCALC=.TRUE.

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        ENDIF
    ELSE IF (TYPE(3)) THEN
C*****CHECK FOR VALID VALUE POSITION
        IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING CURRENT VARIABLE
            IP=IPNT(IPOINT)
            IPNXTV=ISPOS(IP) + IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
            IF (IVPOS .LT. IPNXTV) THEN
C*****TRANSFER INTEGER VALUE TO SAMPLE VECTOR POSITION
                ISMPPS(IVPOS)=IVAL
            ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
                WRITE(6,4006) NAME(IPNT(IPOINT)),
1                 (IDIMEN(I,IPNT(IPOINT)),I=1,2)
                NOCALC=.TRUE.
            ENDIF
C*****INCREMENT VALUE POSITION
                IVPOS=IVPOS + 1
            ENDIF
        ELSE IF (TYPE(4)) THEN
C*****REAL VALUE TYPE, INVALID FOR SAMPLE VECTOR POSITION
            WRITE(6,4004) RVAL, NAME(IPNT(IPOINT))
            NOCALC=.TRUE.
        ENDIF
        GO TO 2000
    9000 CONTINUE
C*****CLOSE SAMPLE VECTOR POSITION FILE
        CLOSE (1)
        RETURN
    9100 CONTINUE
C*****ERROR IN OPENING SAMPLE VECTOR POSITION FILE
        WRITE(6,9101) SAMFIL
        STOP
    9200 CONTINUE
C*****ERROR IN READING ARRAY INDEX
        WRITE(6,9201)
        NOCALC=.TRUE.
        GO TO 1000
C*****FORMAT STATEMENTS
    1001 FORMAT(A)
    1002 FORMAT(11X,A)
    1003 FORMAT('1',/1X,130('*'),
1           /1X,46('*'),5X,'SAMPLE VECTOR POSITION INPUT',5X,46('*'),
2           /1X,17('*'),5X,'FILE =' ,A,5X,17('*'),
3           /1X,130('*'),/)
    1004 FORMAT('(I',I2,')')
    3001 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE ARRAY INDEX ',
1           I1,' FOR VARIABLE ',A,' IS INVALID',/)
    3002 FORMAT(1X,'>>>>MORE THAN 3 ARRAY INDICES GIVEN FOR VARIABLE ',A,
1           'ON SAMPLE VECTOR POSITION FILE')
    4001 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE ARRAY INDEX ',
1           'FOR VARIABLE ',A,' IS INVALID',/)
    4002 FORMAT(1X,'>>>>ARRAY INDICES FOR SAMPLE VECTOR POSITION ',
1           'VARIABLE ',A,' ARE OUT OF RANGE:',
2           /(1X,'>>>> INDEX',I2,' =',I5,', VALID RANGE = 1 TO ',I5,/:))
    4003 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE NAME ',A,
1           ' NOT FOUND IN DEFAULT VARIABLE LIST',/)
    4004 FORMAT(1X,'>>>>ATTEMPT TO USE REAL VALUE (' ,1PE10.2,') TO ',
1           'SPECIFY SAMPLE VECTOR POSITION FOR VARIABLE ',A,/)
    4006 FORMAT(1X,'>>>>INVALID ARRAY POSITION ENCOUNTERED WHILE ',
1           'SETTING DEFAULT VALUES FOR VARIABLE--',

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```

      2      A,(' ',I2,', ',I2,', ',I2,', ')')
9101 FORMAT(1X,'>>>>ERROR OPENING SAMPLE VECTOR POSITION FILE ',A,/)
9201 FORMAT(1X,'>>>>ERROR IN READING PREVIOUS ARRAY INDEX')
      END
      SUBROUTINE RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL,
1      LENGTH, TYPE, EOR)
C*****CONVERTS A RECORD STRING TO A CHARACTER VALUE, A LOGICAL VALUE,
C*****A REAL VALUE, AND AN INTEGER VALUE
      PARAMETER (IL=100)
      CHARACTER*(*) CARD, CVAL
      CHARACTER*(IL) TMPCRD
      CHARACTER*8 IFRMT, LFRMT, RFRMT
      LOGICAL EOR, FIRST, LVAL, TYPE(4)
      DATA FIRST / .TRUE. /

C
C
C*****CHECK FOR FIRST TIME INTO ROUTINE
      IF (FIRST) THEN
C*****WRITE INTEGER AND REAL FORMATS
          WRITE(IFRMT,1001) IL
          WRITE(RFRMT,1002) IL
          WRITE(LFRMT,1003) IL
C*****RESET INITIALLIZATION TYPE
          FIRST=.FALSE.
      ENDIF
C*****SET LENGTH OF INCOMING RECORD
      ILMAX=LEN(CARD)
C*****SET LENGTH OF CHARACTER VARIABLE
      LENCVAL=LEN(CVAL)
C*****INITIALIZE VARIABLE FLAG TYPES (1=CHAR, 2=LOGIC, 3=INTEG, 4=REAL)
      DO 1000 I=1,4
          TYPE(I)=.FALSE.
      1000 CONTINUE
C*****INITIALIZE END-OF-RECORD TYPE
      EOR=.FALSE.
C*****RESET STARTING POSITION FOR CHARACTER POINTER
      IC=IC - 1
C*****SEARCH FOR FIRST NON-BLANK CHARACTER
      2000 CONTINUE
C*****INCREMENT CHARACTER POINTER
      IC=IC + 1
C*****CHECK FOR END OF RECORD
      IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BLANK CHARACTER (STRING DELIMITER)
      IF (CARD(IC:IC) .EQ. ' ') GO TO 2000
C*****CHECK FOR BEGINNING OF COMMENT
      IF (CARD(IC:IC) .EQ. '$') GO TO 9100
C*****CHECK FOR COMMA CHARACTER (STRING DELIMITER)
      IF (CARD(IC:IC) .EQ. ',') GO TO 2000
C*****CHECK FOR QUOTE CHARACTER (CHARACTER STRING DELIMITER)
      IF (CARD(IC:IC) .EQ. '''') THEN
C*****SAVE STARTING POSITION OF CHARACTER STRING
          IS=IC + 1
C*****SEARCH FOR ANOTHER QUOTE
          IC=INDEX(CARD(IS:ILMAX), '''')
          IF (IC .EQ. 0) THEN
C*****QUOTE NOT FOUND SO CONTINUE SEARCH FOR BLANK TO TERMINATE
C*****CHARACTER STRING
              IC=IS - 1
          ELSE
C*****QUOTE FOUND
              IC=IS + IC - 1
          
```

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```

        GO TO 3100
    ENDIF
C*****SEARCH FOR END OF CHARACTER STRING ( ' SIGNIFIES BEGINNING AND
C*****END OF CHARACTER STRING)
    3000    CONTINUE
C*****INCREMENT CHARACTER POINTER
        IC=IC + 1
C*****CHECK FOR END OF RECORD
        IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BEGINNING OF COMMENT
        IF (CARD(IC:IC) .EQ. '$') GO TO 3100
C*****CHECK FOR BLANK TO TERMINATE CHARACTER STRING
        IF (CARD(IC:IC) .NE. ' ') GO TO 3000
    3100    CONTINUE
C*****END OF CHARACTER STRING FOUND
C*****COMPARE STRING LENGTH TO CHARACTER VARIABLE LENGTH
        IE=IC - 1
        IF (IE-IS+1 .GT. LENCVAL) GO TO 9300
C*****TRANSFER CHARACTER STRING
        CVAL=CARD(IS:IE)
C*****SET LENGTH OF CHARACTER STRING
        LENGTH=IE - IS + 1
C*****SET VARIABLE FLAG TYPE FOR CHARACTER VARIABLE FOUND
        TYPE(1)=.TRUE.
    ELSE
C*****SAVE STARTING POSITION FOR STRING
        IS=IC
C*****SEARCH FOR END OF STRING (BLANK OR , SIGNIFY END OF STRING)
    4000    CONTINUE
C*****INCREMENT CHARACTER POINTER
        IC=IC + 1
C*****CHECK FOR END OF RECORD
        IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BEGINNING OF COMMENT
        IF (CARD(IC:IC) .EQ. '$') GO TO 4100
C*****CHECK FOR COMMA CHARACTER
        IF (CARD(IC:IC) .EQ. ',') GO TO 4000
C*****CHECK FOR BLANK CHARACTER
        IF (CARD(IC:IC) .NE. ' ') GO TO 4000
    4100    CONTINUE
C*****END OF STRING FOUND
C*****COMPARE STRING LENGTH TO FORMAT LENGTH
        IE=IC - 1
        IF (IE-IS+1 .GT. IL) GO TO 9200
C*****RIGHT JUSTIFY STRING FOR INTERNAL FORMATTED READS
        TMPCRD=' '
        TMPCRD(IL+IS-IE:IL)=CARD(IS:IE)
C*****READ STRING WITH LOGICAL FORMAT (NOT USED IN GGSOR)
C        READ(TMPCRD,LFRMT,ERR=5000) LVAL
C        TYPE(2)=.TRUE.
C    5000    CONTINUE
C*****READ STRING WITH INTEGER FORMAT
C        READ(TMPCRD,IFRMT,ERR=6000) IVAL
C        TYPE(3)=.TRUE.
C    6000    CONTINUE
C*****READ STRING WITH REAL FORMAT
        READ(TMPCRD,RFRMT,ERR=7000) RVAL
        TYPE(4)=.TRUE.
C*****CHECK FOR DECIMAL POINT IN VALUE AND MAGNITUDE OF VALUE
        IF ((INDEX(TMPCRD, '.') .EQ. 0) .AND.
1          (ABS(RVAL) .LE. 1.0E10)) THEN
            IVAL=NINT (RVAL)

```



```

        TYPE(3)=.TRUE.
    ENDIF
    GO TO 8000
7000    CONTINUE
C*****STRING IS NOT LOGICAL, INTEGER, OR REAL SO ASSUMED TO BE CHAR
C*****COMPARE STRING LENGTH TO CHARACTER VARIABLE LENGTH
        IF (IE-IS +1 .GT. LENCVAL) GO TO 9300
C*****TRANSFER CHARACTER STRING
        CVAL=CARD(IS:IE)
C*****SET LENGTH OF CHARACTER STRING
        LENGTH=IE - IS + 1
C*****SET VARIABLE FLAG TYPE FOR CHARACTER VARIABLE FOUND
        TYPE(1)=.TRUE.
8000    CONTINUE
    ENDIF
C*****CHECK FOR BEGINNING OF COMMENT
        IF (CARD(IC:IC) .NE. '$') IC=IC + 1
        RETURN
9100    CONTINUE
C*****END OF RECORD ENCOUNTERED SEARCHING FOR VALUE POSITION
C*****SET END-OF-RECORD TYPE
        EOR=.TRUE.
        RETURN
9200    CONTINUE
C*****LENGTH OF STRING TOO LONG FOR EITHER CHARACTER STORAGE OR INTERNAL
C*****FORMATTED READ
        WRITE(6,9201) CARD, IL
        RETURN
9300    CONTINUE
C*****LENGTH OF STRING TOO LONG FOR CHARACTER VARIABLE
        WRITE(6,9301) CARD(IS:IE), LENCVAL
        RETURN
C*****FORMAT STATEMENTS
1001    FORMAT(' (I',I3,') ')
1002    FORMAT(' (E',I3,'.0) ')
1003    FORMAT(' (L',I3,') ')
9201    FORMAT(1X,'>>>>LENGTH OF STRING TOO LONG FOR EITHER CHARACTER ',
1        'STORAGE OR INTERNAL FORMATTED READ',
2        /1X,'>>>>',A,
3        /1X,'>>>>RESET PARAMETER IL IN RDSTRG TO ',
4        /1X,'>>>>A VALUE GREATER THAN ',I3,' TO ACCOUNT FOR ',
5        /1X,'>>>>LARGER STRING SIZE FOR VALUES ON INPUT FILE',/)
9301    FORMAT(1X,'>>>>LENGTH OF STRING TOO LONG FOR CHARACTER ',
1        'VARIABLE STORAGE',
2        /1X,'>>>>',A,
3        /1X,'>>>>RESET CORRESPONDING CHARACTER VARIABLE LENGTH ',
4        ' IN RDSTRG TO A VALUE',
5        /1X,'>>>>GREATER THAN ',I3,' TO ACCOUNT FOR ',
6        'LARGER STRING SIZE FOR VALUES ON INPUT FILE',/)
    END
    SUBROUTINE SEARCH (NVAR, CVAL, NAME, IPNT, IPOINT)
C*****LOCATE VARIABLE NAME CVAL USING BINARY SEARCH RETURNING IPOINT
C*****AS POSITION IN IPNT OF NAME (IPOINT=0 IF NOT LOCATED)
        CHARACTER*(*) CVAL, NAME(NVAR)
        DIMENSION IPNT(NVAR)
C
C
C*****SET LOWER LIMIT POINTER FOR SEARCH RANGE
        IL=1
C*****SET UPPER LIMIT POINTER FOR SEARCH RANGE
        IH=NVAR
C*****SET MIDPOINT POINTER FOR SEARCH RANGE

```

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      IM=IH / 2
C*****BEGINNING OF BINARY SEARCH LOOP
      1000 CONTINUE
C*****COMPARE SEARCH ID TO CURRENT MIDPOINT ID
      IF (CVAL .EQ. NAME(IPNT(IM))) GO TO 2000
C*****CHECK TO SEE IF MIDPOINT ID IS GREATER THAN SEARCH ID
      IF (CVAL .GT. NAME(IPNT(IM))) THEN
C*****SEARCH ID IS IN UPPER HALF OF SEARCH RANGE
C*****RESET LOWER LIMIT POINTER TO FORMER MIDPOINT
      IL=IM
C*****RESET MIDPOINT TO CURRENT INTERVAL
      IM=(IL+IH+1) / 2
      ELSE
C*****SEARCH ID IS IN LOWER HALF OF SEARCH RANGE
C*****RESET UPPER LIMIT POINTER TO FORMER MIDPOINT
      IH=IM
C*****RESET MIDPOINT TO CURRENT INTERVAL
      IM=(IL+IH) / 2
      ENDIF
      IF (IL+1 .EQ. IH) THEN
      IF ((CVAL .NE. NAME(IPNT(IL))) .AND.
1      (CVAL .NE. NAME(IPNT(IH)))) THEN
C*****VALUE NOT FOUND SO RETURN 0 FOR POINTER
      IPOINT=0
      RETURN
      ENDIF
      ENDIF
      GO TO 1000
      2000 CONTINUE
C*****VALUE FOUND SO RETURN MIDPOINT FOR POINTER
      IPOINT=IM
      RETURN
      END
      SUBROUTINE CSORT (NVAR, NAME, IPNT)
C*****SORT NVAR VALUES OF CHARACTER ARRAY NAME IN INCREASING ORDER
C*****USING POINTER ARRAY IPNT
      CHARACTER*(*) NAME(NVAR)
      DIMENSION IPNT(NVAR)
C
C
      N=NVAR
      L=N/2+1
      IR=N
      100 CONTINUE
      IF (L.LE.1) GO TO 700
      L=L-1
      LHOLD=IPNT(L)
      200 CONTINUE
      J=L
      300 CONTINUE
      I=J
      J=2*J
      IF (J-IR) 400, 500, 600
      400 CONTINUE
      IF (NAME(IPNT(J)) .LT. NAME(IPNT(J+1))) J=J+1
      500 CONTINUE
      IF (NAME(LHOLD) .GE. NAME(IPNT(J))) GO TO 600
      IPNT(I)=IPNT(J)
      GO TO 300
      600 CONTINUE
      IPNT(I)=LHOLD
      GO TO 100

```

```

700 CONTINUE
    LHOLD=IPNT(IR)
    IPNT(IR)=IPNT(1)
    IR=IR - 1
    IF (IR .GT. 1) GO TO 200
    IPNT(1)=LHOLD
    RETURN
    END
    SUBROUTINE SUBVEC
C*****SUBSTITUTE SAMPLE VECTOR VALUES INTO DEFAULT VALUE ARRAY
    PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1           MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2           MAXSPC=10, MAXTIM=12)
    COMMON /LHSBLK/ XLHS(MAXSMP)
    CHARACTER*7 NAME
    LOGICAL LDEFLT, LREAL
    COMMON /DEFLT1/ NAME(MAXVAR)
    COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1           NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2           ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3           LREAL(MAXVAL)
    COMMON /VALUES/ RVL(MAXVAL)
    DIMENSION IVL(MAXVAL)
    EQUIVALENCE (IVL, RVL)

C
C
C*****MAKE SAMPLE VECTOR SUBSTITUTIONS
    DO 1000 IVAL=1,NVAL
C*****CHECK FOR POSITIVE SAMPLE VECTOR SUBSTITUTION POSITION
    IF (ISMPPS(IVAL) .GT. 0) THEN
C*****CHECK FOR REAL VALUE
    IF (LREAL(IVAL)) THEN
C*****TRANSFER REAL VALUE
        RVL(IVAL)=XLHS(ISMPPS(IVAL))
    ELSE
C*****TRANSFER INTEGER VALUE
        IVL(IVAL)=NINT(XLHS(ISMPPS(IVAL)))
    ENDIF
    ENDIF
1000 CONTINUE
    RETURN
    END
    SUBROUTINE WRTPAR
C*****PRINT DEFAULT AND SAMPLE VECTOR SUBSTITUTION INFORMATION FOR
C*****BINNED AND DIRECT EXECUTIONS
    PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1           MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2           MAXSPC=10, MAXTIM=12)
    PARAMETER (MAXPR=132)
    CHARACTER*(MAXPR) RECOUT
    CHARACTER*7 NAME
    LOGICAL LDEFLT, LREAL
    COMMON /DEFLT1/ NAME(MAXVAR)
    COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1           NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2           ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3           LREAL(MAXVAL)
    COMMON /VALUES/ RVL(MAXVAL)
    DIMENSION IVL(MAXVAL)
    EQUIVALENCE (IVL, RVL)

C
C

```

Appendix C.1

```

C*****PRINT HEADER RECORD
      WRITE(6,1001)
C*****LOAD OUTPUT RECORD BEFORE PRINTING (10 OR FEWER VALUES PER RECORD)
      IVAL=0
C*****LOOP OVER VARIABLES, PRINTING IN SORTED ORDER
      DO 4000 IVR=1,NVAR
        IVAR=IPNT(IVR)
C*****START NEW RECORD FOR EACH VARIABLE
        WRITE(RECOUT,2001) NAME(IVAR)
C*****INITIALIZE VALUE POSITION FOR CURRENT VARIABLE
        IVAL=ISPOS(IVAR) - 1
C*****SET COLUMN POINTER
        IC=1
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (3RD DIMENSION)
        DO 3000 IDM3=1,IDIMEN(3,IVAR)
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (2ND DIMENSION)
          DO 2000 IDM2=1,IDIMEN(2,IVAR)
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (1ST DIMENSION)
            DO 1000 IDM1=1,IDIMEN(1,IVAR)
C*****INCREMENT VALUE POINTER
              IVAL=IVAL + 1
C*****INCREMENT COLUMN
              IC=IC + 11
C*****CHECK FOR DEFAULT AND SAMPLE VECTOR SUBSTITUTION
              IF (ISMPPS(IVAL) .GT. 0) THEN
C*****TRANSFER SAMPLE VECTOR POSITION TO OUTPUT RECORD
                WRITE(RECOUT(IC:IC+10),2002) ISMPPS(IVAL)
              ELSE IF (LDEFLT(IVAL)) THEN
C*****CHECK FOR REAL DEFAULT VALUE
                IF (LREAL(IVAL)) THEN
C*****TRANSFER REAL VALUE TO OUTPUT RECORD
                  WRITE(RECOUT(IC:IC+10),2003) RVL(IVAL)
                ELSE
C*****TRANSFER INTEGER VALUE TO OUTPUT RECORD
                  WRITE(RECOUT(IC:IC+10),2004) IVL(IVAL)
                ENDIF
              ELSE
C*****NO DEFAULT OR SAMPLE VECTOR SUBSTITUTION
                WRITE(RECOUT(IC:IC+10),2005)
              ENDIF
C*****CHECK FOR OUTPUT RECORD WITH MORE THAN 104 COLUMNS
              IF (IC .GT. 104) THEN
C*****PRINT OUTPUT RECORD
                WRITE(6,2010) RECOUT
C*****INITIALIZE OUTPUT RECORD
                RECOUT=' '
C*****RESET COLUMN POINTER
                IC=1
              ENDIF
            1000      CONTINUE
          2000      CONTINUE
        3000      CONTINUE
C*****IF INFORMATION IS STORED ON OUTPUT RECORD, PRINT OUTPUT RECORD
        IF (IC .GT. 1) WRITE(6,2010) RECOUT
      4000 CONTINUE
C*****START NEW PAGE
      WRITE(6,3001)
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT('1',/1X,130('*'),
        1      /1X,30('*'),5X,'DEFAULT INPUT AND SAMPLE VECTOR ',
        2      'SUBSTITUTION INFORMATION',5X,34('*'),

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      3      /1X,130(' '),/)
2001 FORMAT(1X,A9)
2002 FORMAT(' V-POS-',I3.3)
2003 FORMAT(1PE11.3)
2004 FORMAT(I11)
2005 FORMAT(' NO VALUE')
2010 FORMAT(A)
3001 FORMAT('1')
      END
      SUBROUTINE TRANS (CB1, CB2, CB3)
C*****TRANSFER VALUES FROM ARRAY RVAL TO COMMON BLOCKS CB1 AND CB2
C*****IN THIS ORDER
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3, NVCB4,
1          NVCB5, IDIMEN(3,MAXVAR), ISPOS(MAXVAR),
2          ISMPPS(MAXVAL), IPNT(MAXVAR), LDEFLT(MAXVAL),
3          LREAL(MAXVAL)
      COMMON /VALUES/ RVL(MAXVAL)
      DIMENSION IVL(MAXVAL)
      EQUIVALENCE (IVL, RVL)
      DIMENSION CB1(NVCB1), CB2(NVCB2), CB3(NVCB3)
C
C
C*****INITIALIZE VALUE COUNTER
      IVAL=0
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 1
      IF (NVCB1 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 1
      DO 1000 I=1,NVCB1
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB1(I)=RVL(IVAL)
1000    CONTINUE
      ENDIF
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 2
      IF (NVCB2 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 2
      DO 2000 I=1,NVCB2
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB2(I)=RVL(IVAL)
2000    CONTINUE
      ENDIF
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 3
      IF (NVCB3 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 3
      DO 3000 I=1,NVCB3
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB3(I)=RVL(IVAL)
3000    CONTINUE
      ENDIF
      RETURN
      END
      SUBROUTINE WRREL
C*****PRINT CONTENTS OF COMMON BLOCKS
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,

```

Appendix C.1

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1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFPVA(MAXSPC),
1          DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2          FCCI(MAXSPC), DFCV(MAXSPC), VBPUF(MAXSPC),
3          FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4          DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5          VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6          EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7          TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8          DT1, DT2, DTVB, PUFF, ELEV
C
C
WRITE(6,1001)
C*****PRINT COMMON BLOCK BASVAL ARRAY VARIABLES
WRITE(6,1002) 'BASVAL', 'BASE VALUES FOR PBSOR'
WRITE(6,1003) 'FCOR', 'FVES', 'DFVPA', 'DFCPA',
1          'FDCH', 'FEVSE', 'FCCI', 'DFCAV',
2          'VBPUF', 'FCONV'
DO 1000 K=1,NSPEC
WRITE(6,1004) FCOR(K), FVES(K), DFPVA(K), DFCPA(K),
1          FDCH(K), FEVSE(K), FCCI(K), DFCV(K),
2          VBPUF(K), FCONV(K)
1000 CONTINUE
WRITE(6,1003) 'FCONC', 'RBDF', 'DFSPRV', 'DFSPRC',
1          'FREVO'
DO 2000 K=1,NSPEC
WRITE(6,1004) FCONC(K), RBDF(K), DFSPRV(K), DFSPRC(K),
1          FREVO(K)
2000 CONTINUE
WRITE(6,1003) 'VALISS'
DO 3000 IISS=1,MAXISS
WRITE(6,1004) VALISS(IISS)
3000 CONTINUE
C*****PRINT COMMON BLOCK BASVAL SINGLE VARIABLES
WRITE(6,1003) 'FLTI1', 'FLTI2', 'NSPEC', 'FLV',
1          'FHPE', 'EVSE', 'FPLBY', 'TC11',
2          'TC12', 'TC21'
WRITE(6,1004) FLTI1, FLTI2, FLOAT(NSPEC), FLV,
1          FHPE, EVSE, FPLBY, TC11,
2          TC12, TC21
WRITE(6,1003) 'TC22', 'TB11', 'TB12', 'TB21',
1          'TB22', 'TBX1', 'TBX2', 'TBS2',
2          'TBR2', 'TW'
WRITE(6,1004) TC22, TB11, TB12, TB21,
1          TB22, TBX1, TBX2, TBS2,
2          TBR2, TW
WRITE(6,1003) 'T1', 'T2', 'DT1', 'DT2',
1          'DTVB', 'PUFF', 'ELEV'
WRITE(6,1004) T1, T2, DT1, DT2,
1          DTVB, PUFF, ELEV
RETURN
C*****FORMAT STATEMENTS
1001 FORMAT('1')
1002 FORMAT(/1X,130('='),
1          /1X,5('*'),' CONTENTS OF COMMON BLOCK ',A,' ',5('*'),
2          /7X,A,
3          /1X,130('='))
1003 FORMAT(/3X,10(A7,4X))
1004 FORMAT(1X,1P,10E11.3)
END
SUBROUTINE BINTRN (IBIN)

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```

C*****PERFORM BIN TRANSLATION
C =====
C PEACH BOTTOM BIN ATTRIBUTES AND THEIR CORRESPONDING OUTCOMES
C
C INDX(1): ACCIDENT SEQUENCES
C      1 = LOCA
C      2 = TRANSIENTS
C      3 = FAST TC
C      4 = TC-CV
C      5 = FAST STATION BLACKOUT
C      6 = SLOW STATION BLACKOUT
C      7 = VERY SLOW STATION BLACKOUT
C INDX(2): IN-VESSEL ZR OXIDATION
C      1 = HIGH
C      2 = LOW
C INDX(3): VESSEL CONDITIONS AT VESSEL BREACH
C      1 = HIGH PRESSURE, NO LOW PRESSURE INJECTION RECOVERY AFTER
VB
C      2 = LOW PRESSURE, NO LOW PRESSURE INJECTION RECOVERY AFTER VB
C      3 = HIGH PRESSURE, LOW PRESSURE INJECTION RECOVERY AFTER VB
C      4 = LOW PRESSURE, LOW PRESSURE INJECTION RECOVERY AFTER VB
C      5 = NO VESSEL BREACH
C      6 = NO CORE DAMAGE
C INDX(4): FRACTION OF CORE PARTICIPATING IN DIRECT CONT HEAT OR STEAM
EXPLOSION
C      1 = HIGH DCH, NO SE
C      2 = LOW DCH, NO SE
C      3 = NO DCH, HIGH SE
C      4 = NO DCH, LOW SE
C      5 = NO DCH, NO SE
C INDX(5): CONTAINMENT FAILURE MODE
C      1 = DRYWELL HEAD SEAL LEAK
C      2 = DRYWELL LEAK
C      3 = WETWELL LEAK
C      4 = DRYWELL HEAD RUPTURE
C      5 = DRYWELL RUPTURE
C      6 = SHELL MELT-THROUGH
C      7 = WETWELL VENTING
C      8 = WETWELL RUPTURE
C      9 = NO CONTAINMENT FAILURE
C INDX(6): CONTAINMENT FAILURE TIME
C      1 = EARLY (BEFORE CORE DAMAGE)
C      2 = INTERMEDIATE (NEAR VB)
C      3 = LATE (AFTER VB)
C INDX(7): DRYWELL SPRAYS
C      1 = NO SPRAYS
C      2 = EARLY SPRAYS ONLY
C      3 = LATE SPRAYS ONLY
C      4 = EARLY AND LATE SPRAYS
C INDX(8): MOLTEN CORE CONCRETE INTERACTION
C      1 = DRY DRYWELL FLOOR, CCI
C      2 = WATER OVER DEBRIS, CCI
C      3 = NO CCI, IE., COOLABLE DEBRIS BED
C INDX(9): SUPPRESSION POOL BYPASS BEFORE VB (LOCA OR STUCK OPEN SRV VAC
BREAK)
C      1 = NO POOL BYPASS
C      2 = SOME POOL BYPASS
C      3 = COMPLETE POOL BYPASS
C INDX(10): REACTOR BUILDING STATUS
C      1 = REACTOR BUILDING INTACT, BLOWOUT PANELS OPEN
C      2 = REACTOR BUILDING DESTROYED OR COMPLETELY BYPASSED, NO
RBDf

```

Appendix C.1

```

C =====
  PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1          MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2          MAXSPC=10, MAXTIM=12)
  CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
  COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
  LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRITNP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
  COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1          EXPERT, PRITNP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2          ECF, ICF, NCD
  COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1          STL(MAXSPC), STIL, STRVOL(MAXSPC),
2          ST1(MAXSPC), ST2(MAXSPC)
  COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1          DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2          FCCI(MAXSPC), DFCV(MAXSPC), VBPWF(MAXSPC),
3          FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4          DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5          VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6          EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7          TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8          DT1, DT2, DTVB, PUFF, ELEV
  COMMON /BINNED/ FCORO(MAXSPC,MAXCAS), FVESO(MAXSPC,MAXCAS),
1          DFVPAO(MAXSPC,MAXCAS), DFCPAO(MAXSPC,MAXCAS),
2          FDCHO(MAXSPC,MAXCAS), FEVSEO(MAXSPC,MAXCAS),
3          FCCIO(MAXSPC,MAXCAS), DFCVO(MAXSPC,MAXCAS),
4          VBPUFO(MAXSPC,MAXCAS), FCONVO(MAXSPC,MAXCAS),
5          FCONCO(MAXSPC,MAXCAS), RBDFO(MAXSPC,MAXCAS),
6          DFSPRVO(MAXSPC,MAXCAS), DFSPRCO(MAXSPC,MAXCAS),
7          FREVOO(MAXSPC,MAXCAS), FLTI1O(MAXCAS),
8          FLTI2O(MAXCAS), FHPEO(MAXCAS), EVSEO(MAXCAS),
9          FPLBYO(MAXCAS), TWO(MAXTIM), T1O(MAXTIM),
          DT1O(MAXTIM), DT2O(MAXTIM), DTVBO(MAXTIM),
A          PUFFO(MAXTIM)
  COMMON /BININD/ INDX(MAXBD)
C
C
C*****SET REFERENCE IN ASCII COLLATING SEQUENCE
  ICAM1=ICHAR('A') - 1
C*****ACCIDENT SEQUENCE TYPE (STCP)
  INDX(1)=ICHAR(BINARR(IBIN)(1:1)) - ICAM1
C*****ZR OXIDATION
  INDX(2)=ICHAR(BINARR(IBIN)(2:2)) - ICAM1
C*****VESSEL CONDITION AT VESSEL BREACH
  INDX(3)=ICHAR(BINARR(IBIN)(3:3)) - ICAM1
C*****FRACTION OF CORE PARTICIPATING IN HPME
  INDX(4)=ICHAR(BINARR(IBIN)(4:4)) - ICAM1
C*****CONTAINMENT FAILURE MODE
  INDX(5)=ICHAR(BINARR(IBIN)(5:5)) - ICAM1
C*****CONTAINMENT FAILURE TIME
  INDX(6)=ICHAR(BINARR(IBIN)(6:6)) - ICAM1
C*****DRYWELL SPRAY
  INDX(7)=ICHAR(BINARR(IBIN)(7:7)) - ICAM1
C*****MOLTEN CORE CONCRETE INTERACTION
  INDX(8)=ICHAR(BINARR(IBIN)(8:8)) - ICAM1
C*****POOL BYPASS BEFORE VESSEL BREACH
  INDX(9)=ICHAR(BINARR(IBIN)(9:9)) - ICAM1
C*****REACTOR BUILDING
  INDX(10)=ICHAR(BINARR(IBIN)(10:10)) - ICAM1
C*****SET WETWELL FAILURE LOGICAL FLAG

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      WWF=(INDX(5).EQ.3) .OR. (INDX(5).EQ.7) .OR. (INDX(5) .EQ. 8)
C*****SET NO CORE DAMAGE FLAG
      NCD=(INDX(3) .EQ. 6)
C*****SET NO VESSEL BREACH LOGICAL FLAG
      VB=(INDX(3) .LT. 5)
      NOCF=(INDX(5) .EQ. 9)
C*****EARLY CONTAINMENT FAILURE
      ECF=(INDX(6) .EQ. 1)
C*****INTERMEDIATE CF OR NEAR VB
      ICF=(INDX(6) .EQ. 2)
C*****COOLABLE DEBRIS BED
      CDB=(INDX(8) .EQ. 3)
C*****SET SUPPRESSION POOL TEMPERATURE
      SUBCL=(INDX(1).LE.3) .OR. (INDX(1).EQ.5)
C*****=====
C*****LOOP OVER SPECIES
      DO 500 ISP=1,NSPEC
C*****FCOR *****
      IF (INDX(2) .EQ.1) THEN
C*****HIGH ZR OXIDATION
      FCOR(ISP)=FCOR0(ISP,1)
      ELSE
C*****LOW ZR OXIDATION
      FCOR(ISP)=FCOR0(ISP,2)
      ENDIF
C*****FVES *****
      IF (INDX(1) .GE. 5) THEN
C*****STATION BLACKOUT SEQUENCES
      IF ((INDX(3) .EQ. 1) .OR. (INDX(3) .EQ. 3)) THEN
C*****HIGH PRESSURE AT VB
      FVES(ISP)=FVES0(ISP,1)
      ELSE
C*****LOW PRESSURE AT VB, OR NO VB
      FVES(ISP)=FVES0(ISP,2)
      ENDIF
      ELSE
C*****LOCA, ATWS, ... CRD FLOWS
      IF ((INDX(3) .EQ. 1) .OR. (INDX(3) .EQ. 3)) THEN
C*****HIGH PRESSURE
      FVES(ISP)=FVES0(ISP,3)
      ELSE
C*****LOW PRESSURE
      FVES(ISP)=FVES0(ISP,2)
      ENDIF
      ENDIF
C*****REVO *****
      IF (INDX(3) .EQ. 5) THEN
C*****NO VB, NO CORE DAMAGE, NO REVOLATILIZATION
      FREVO(ISP)=0.0
      ELSE IF ((INDX(3) .EQ. 3) .OR. (INDX(3) .EQ. 4)) THEN
C*****LPI AVAILABLE AFTER VB
      FREVO(ISP)=FREVO0(ISP,3)
      ELSE
C*****NO LPI AVAILABLE AFTER VB
      IF (INDX(7) .LE. 2) THEN
C*****NO LATE DW SPRAYS, HIGH DW TEMP
      FREVO(ISP)=FREVO0(ISP,1)
      ELSE
C*****LATE DW SPRAYS , LOW DW TEMP
      FREVO(ISP)=FREVO0(ISP,2)
      ENDIF
      ENDIF

```

Appendix C.1

```

*****CCI RELEASE *****
      IF (INDX(8) .EQ. 3) THEN
*****NO CCI, COOLABLE DEBRIS BED
          FCCI(ISP)=0.0
      ELSE IF (INDX(8) .EQ. 1) THEN
*****DRY DW FLOOR
          IF (INDX(2) .EQ. 1) THEN
*****HIGH ZR OXIDATION IE., LOW ZR CONTENT
              FCCI(ISP)=FCCI0(ISP,1)
          ELSE
*****LOW ZR OXIDATION. IE., HIGH ZR CONTENT
              FCCI(ISP)=FCCI0(ISP,3)
          ENDIF
      ELSE IF (INDX(8) .EQ. 2) THEN
*****WATER OVER DEBRIS AND CCI GOING ON
          IF (INDX(2) .EQ. 1) THEN
*****HIGH ZR OXIDATION IE., LOW ZR CONTENT
              FCCI(ISP)=FCCI0(ISP,2)
          ELSE
*****LOW ZR OXIDATION
              FCCI(ISP)=FCCI0(ISP,4)
          ENDIF
      ENDIF
*****POOL BYPASS FRACTION DURING IN-VESSEL RELEASES (LOCA OR STUCK
*****OPEN SRV TAIL PIPE VACUUM BREAKER)
      IF (INDX(9) .EQ. 1) THEN
*****NO POOL BYPASS
          FPLBY=0.0
      ELSE IF (INDX(9) .EQ. 2) THEN
*****SOME POOL BYPASS
          FPLBY=FPLBY0(1)
      ELSE
*****COMPLETE POOL BYPASS
          FPLBY=FPLBY0(2)
      ENDIF
*****FCONV AND FCONC *****
      IF (INDX(5) .EQ. 9) THEN
*****NO CONTAINMENT FAILURE
          FCONV(ISP)=FCONVO(ISP,7)
          FCONC(ISP)=FCONCO(ISP,7)
      ELSE IF (INDX(5) .LE. 3) THEN
*****DRYWELL OR WETWELL LEAK
          IF (INDX(6) .LE. 2) THEN
*****EARLY CONTAINMENT FAILURE OR CF NEAR VB
              IF (SUBCL) THEN
*****POOL SUBCOOLED
                  FCONV(ISP)=FCONVO(ISP,1)
                  FCONC(ISP)=FCONCO(ISP,1)
              ELSE
*****POOL SATURATED
                  FCONV(ISP)=FCONVO(ISP,2)
                  FCONC(ISP)=FCONCO(ISP,2)
              ENDIF
          ELSE
*****LATE DRYWELL OR WETWELL LEAK
              FCONV(ISP)=FCONVO(ISP,5)
              FCONC(ISP)=FCONCO(ISP,5)
          ENDIF
      ELSE IF ((INDX(5) .GT. 3) .AND. (INDX(5) .LT. 9)) THEN
*****DRYWELL RUPTURE, WETWELL RUPTURE, ETC.
          IF (INDX(6) .LE. 2) THEN
*****EARLY RUPTURE CASES

```

```

      IF (SUBCL) THEN
        FCONV(ISP)=FCONVO(ISP,3)
        FCONC(ISP)=FCONCO(ISP,3)
      ELSE
        FCONV(ISP)=FCONVO(ISP,4)
        FCONC(ISP)=FCONCO(ISP,4)
      ENDIF
    ELSE
      C*****LATE RUPTURE CASES
        FCONV(ISP)=FCONVO(ISP,6)
        FCONC(ISP)=FCONCO(ISP,6)
      ENDIF
    ENDIF
  C*****RBDF *****
    IF (INDX(10) .EQ. 2) THEN
      C*****REACTOR BUILDING DESTROYED
        RBDF(ISP)=1.0
      ELSE
        C*****REACTOR BUILDING INTACT
          IF ((INDX(5) .EQ. 2) .OR. (INDX(5) .EQ. 5)) THEN
            C*****DRYWELL RUPTURE OR DRYWELL LEAK
              IF (SUBCL) THEN
                C*****POOL SUBCOOLED
                  RBDF(ISP)=RBDF0(ISP,1)
                ELSE
                  RBDF(ISP)=RBDF0(ISP,2)
                ENDIF
              ELSE IF ((INDX(5) .EQ. 1) .OR. (INDX(5) .EQ. 4)) THEN
                C*****DRYWELL HEAD LEAK OR HEAD RUPTURE
                  IF (SUBCL) THEN
                    RBDF(ISP)=RBDF0(ISP,5)
                  ELSE
                    RBDF(ISP)=RBDF0(ISP,6)
                  ENDIF
                ELSE
                  C*****WETWELL RUPTURE, SHELL MELT-THROUGH, ETC. ASSUMES
                    FOR THESE CASES REACTOR BUILDING DF THE SAME
                      IF (SUBCL) THEN
                        RBDF(ISP)=RBDF0(ISP,3)
                      ELSE
                        RBDF(ISP)=RBDF0(ISP,4)
                      ENDIF
                    ENDIF
                  ENDIF
                ENDIF
              C*****FDCH OR STEAM EXPLOSION *****
                IF (INDX(4) .EQ. 5) THEN
                  FHPE=0.0
                  EVSE=0.0
                  FDCH(ISP)=0.0
                  FEVSE(ISP)=0.0
                ELSE IF (INDX(4) .LE. 2) THEN
                  C*****DCH OCCURS BUT NO STEAM EXPLOSION
                    FDCH(ISP)=FDCH0(ISP,1)
                    EVSE=0.0
                    FEVSE(ISP)=0.0
                    IF (INDX(4) .EQ. 1) THEN
                      FHPE=FDCH0(1)
                    ELSE
                      FHPE=FDCH0(2)
                    ENDIF
                  ELSE
                    C*****NO DCH, BUT STEAM EXPLOSION OCCURS

```

Appendix C.1

```

      FHPE=0.
      FEVSE(ISP)=FEVSEO(ISP,1)
      FDCH(ISP)=0.0
      IF (INDX(4) .EQ. 3) THEN
        EVSE=EVSEO(1)
      ELSE
        EVSE=EVSEO(2)
      ENDIF
    ENDIF
  C*****LATE IODINE RELEASE FROM POOL *****
    IF (SUBCL) THEN
      FLTI1=FLTI10(1)
    ELSE
      FLTI1=FLTI10(2)
    ENDIF
  C*****LATE IODINE RELEASE FROM DRYWELL FLOOR
    IF (INDX(8) .EQ. 1) THEN
  C*****DRY DRYWELL FLOOR
      FLTI2=FLTI20(1)
    ELSE IF (INDX(8) .EQ. 2) THEN
  C*****WATER OVER DEBRIS
      FLTI2=FLTI20(2)
    ELSE
  C*****NO CCI RELEASE
      FLTI2=0.0
    ENDIF
  C*****IN-VESSEL RELEASE POOL SCRUBBING
      DFVPA(ISP)=DFVPA0(ISP,1)
  C*****EX-VESSEL RELEASE POOL SCRUBBING
      DFCPA(ISP)=DFCPA0(ISP,1)
  C*****VARIABLES NOT SAMPLED BY EXPERT OPINION
  C*****VESSEL BREACH PUFF RELEASE: USE TB1
      VBPUF(ISP)=VBPUF0(ISP,1)
  C*****FRACTION OF FUEL LEAVING VESSEL AFTER VB
  C*****ASSUMED 1.0 UNLESS NO VB
      IF (INDX(3) .LE. 4) THEN
        FLV=1.0
      ELSE
  C*****NO VESSEL BREACH, NO CORE DAMAGE
        FLV=0.0
      ENDIF
  C*****DRYWELL SPRAY DF
      IF (INDX(7) .EQ. 1) THEN
  C*****NO SPRAYS
        DFSPRV(ISP)=1.0
        DFSPRC(ISP)=1.0
      ELSE IF (INDX(7) .EQ. 2) THEN
  C*****EARLY SPRAY ONLY
        DFSPRV(ISP)=DFSPRV0(ISP,1)
        DFSPRC(ISP)=1.0
      ELSE IF (INDX(7) .EQ. 3) THEN
  C*****LATE SPRAY ONLY
        DFSPRV(ISP)=1.0
        DFSPRC(ISP)=DFSPRC0(ISP,1)
      ELSE
  C*****EARLY AND LATE SPRAYS
        DFSPRV(ISP)=DFSPRV0(ISP,1)
        DFSPRC(ISP)=DFSPRC0(ISP,1)
      ENDIF
  C*****DRYWELL FLOOR WATER SCRUBBING OF CCI RELEASE
      IF (INDX(8) .GE. 2) THEN
  C*****WATER OVER DEBRIS

```

```

      DFCV(ISP)=DFCAV0(ISP,1)
    ELSE
C*****DRY FLOOR
      DFCV(ISP)=1.0
    ENDIF
    IF (NCD) THEN
      FCOR(ISP)=0.0
      FVES(ISP)=0.0
      FREVO(ISP)=0.0
      FCCI(ISP)=0.0
      FDCH(ISP)=0.0
      FEVSE(ISP)=0.0
      FLI1=0.0
      FLI2=0.0
    ENDIF
    500 CONTINUE
C*****WARNING TIME
    IF ((INDX(1) .LE. 3) .OR. (INDX(1) .EQ. 5)) THEN
C*****LOCA, FAST TRANSIENT, FAST TC, FAST SBO
      TW=TWO(1)
    ELSE IF (INDX(1) .EQ. 4) THEN
C*****TC-CV
      TW=TWO(2)
    ELSE IF (INDX(1) .EQ. 6) THEN
C*****SLOW STATION BLACKOUT
      TW=TWO(3)
    ELSE
C*****VERY SLOW SBO
      TW=TWO(4)
    ENDIF
C*****CONTAINMENT FAILURE TIME OR START OF FIRST RELEASE
    IF ((INDX(1) .LE. 3) .OR. (INDX(1) .EQ. 5)) THEN
C*****LOCA, FAST TRANSIENT, FAST TC, FAST SBO
      IF (ECF) THEN
C*****EARLY CONTAINMENT FAILURE
        T1=T10(1)
      ELSE IF (ICF) THEN
C*****CONTAINMENT FAILURE NEAR VB
        T1=T10(2)
      ELSE
C*****LATE CONTAINMENT FAILURE
        T1=T10(3)
      ENDIF
    ELSE IF (INDX(1) .EQ. 4) THEN
C*****TC-CV
      IF (ECF) THEN
C*****EARLY CONTAINMENT FAILURE
        T1=T10(4)
      ELSE IF (ICF) THEN
C*****INTERMEDIATE CONTAINMENT FAILURE
        T1=T10(5)
      ELSE
C*****LATE CONTAINMENT FAILURE
        T1=T10(6)
      ENDIF
    ELSE IF (INDX(1) .EQ. 6) THEN
C*****SLOW SBO
      IF (ECF) THEN
C*****EARLY CONTAINMENT FAILURE
        T1=T10(7)
      ELSE IF (ICF) THEN
C*****INTERMEDIATE CONTAINMENT FAILURE

```

Appendix C.1

```

                T1=T10(8)
            ELSE
C*****LATE CONTAINMENT FAILURE
                T1=T10(9)
            ENDIF
        ELSE
C*****VERY SLOW SBO
            IF (ECF) THEN
C*****EARLY CONTAINMENT FAILURE
                T1=T10(10)
            ELSE IF (ICF) THEN
C*****INTERMEDIATE CONTAINMENT FAILURE
                T1=T10(11)
            ELSE
C*****LATE CONTAINMENT FAILURE
                T1=T10(12)
            ENDIF
        ENDIF
C*****DURATION OF FIRST AND SECOND RELEASES
        IF (INDX(5) .EQ. 9) THEN
C*****NO CONTAINMENT FAILURE
            DT1=DT10(5)
            DT2=DT20(3)
        ELSE IF (INDX(5) .LE. 3) THEN
C*****DRYWELL OR WETWELL LEAK
            IF (SUBCL) THEN
C*****SUBCOOL, LEAK
                DT1=DT10(4)
                DT2=DT20(3)
            ELSE
C*****SATURATED, LEAK
                DT1=DT10(5)
                DT2=DT20(3)
            ENDIF
        ELSE
C*****GROSS CONTAINMENT FAILURE
            IF (ECF) THEN
C*****GROSS EARLY CF OR VENTING BEFORE CORE DAMAGE
                DT1=DT10(1)
                IF (INDX(4) .LE. 4) THEN
C*****DCH, EVSE
                    DT2=DT20(1)
                ELSE
C*****NO DCH, NO EVSE
                    DT2=DT20(2)
                ENDIF
            ELSE
C*****CF NEAR VB OR LATE
                IF (SUBCL) THEN
                    DT1=DT10(2)
                    DT2=DT20(2)
                ELSE
                    DT1=DT10(3)
                    DT2=DT20(2)
                ENDIF
            ENDIF
        ENDIF
C*****START OF SECOND RELEASE
        DTVB=DTVB0(1)
        IF (ECF .AND. (DT1 .LT. DTVB)) THEN
C*****FOR EARLY CF AND DT1 < DTVB
            T2=T1 + DTVB

```

3 of 4


```

ELSE
  T2=T1 + DT1
ENDIF
C*****SET FIRST RELEASE (PUFF) FRACTION
C***** USED ONLY FOR LATE CONTAINMENT FAILURE CASES
C***** SET DEFAULT TO 1.0
  PUFF = 1.0
  IF (INDX(6) .EQ. 3) THEN
    IF ((INDX(5) .GE. 4) .AND. (INDX(5) .LE. 8)) THEN
C*****LATE DRYWELL OR WETWELL RUPTURE OR VENTING
      PUFF=PUFF0(1)
    ELSE IF ((INDX(5) .LE. 3) .OR. (INDX(5) .EQ. 9)) THEN
C***** CONTAINMENT LEAKAGE CASES OR NO C.F.
      PUFF=PUFF0(2)
    ENDIF
  ENDIF
RETURN
END
SUBROUTINE EXPTAB
C*****SET VARIABLES IN COMMON BLOCK BINNED BY INTERPOLATION OF
C*****EXPERT OPINION TABLES
  PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
  COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1      DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2      FCCI(MAXSPC), DFCAV(MAXSPC), VBPUF(MAXSPC),
3      FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4      DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5      VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6      EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7      TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8      DT1, DT2, DTVB, PUFF, ELEV
  COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS), FVES0(MAXSPC,MAXCAS),
1      DFVPA0(MAXSPC,MAXCAS), DFCPA0(MAXSPC,MAXCAS),
2      FDCH0(MAXSPC,MAXCAS), FEVSE0(MAXSPC,MAXCAS),
3      FCCI0(MAXSPC,MAXCAS), DFCAV0(MAXSPC,MAXCAS),
4      VBPUF0(MAXSPC,MAXCAS), FCONV0(MAXSPC,MAXCAS),
5      FCONC0(MAXSPC,MAXCAS), RBDF0(MAXSPC,MAXCAS),
6      DFSPRV0(MAXSPC,MAXCAS), DFSPRC0(MAXSPC,MAXCAS),
7      FREVO0(MAXSPC,MAXCAS), FLTI10(MAXCAS),
8      FLTI20(MAXCAS), FHPE0(MAXCAS), EVSE0(MAXCAS),
9      FPLBY0(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
A      DT10(MAXTIM), DT20(MAXTIM), DTVB0(MAXTIM),
      PUFF0(MAXTIM)
  COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1      FVESL(MAXSPC,MAXLEV,MAXCAS),
2      FREVOL(MAXSPC,MAXLEV,MAXCAS),
3      FCCIL(MAXSPC,MAXLEV,MAXCAS),
4      FCONVL(MAXSPC,MAXLEV,MAXCAS),
5      FCONCL(MAXSPC,MAXLEV,MAXCAS),
6      FLTI1L(MAXLEV,MAXCAS), FLTI2L(MAXLEV,MAXCAS),
7      RBDFL(MAXSPC,MAXLEV,MAXCAS),
8      FDCHL(MAXSPC,MAXLEV,MAXCAS),
9      FEVSEL(MAXSPC,MAXLEV,MAXCAS),
A      DFVPAL(MAXSPC,MAXLEV,MAXCAS),
B      DFCPAL(MAXSPC,MAXLEV,MAXCAS),
C      DFCAVL(MAXSPC,MAXLEV,MAXCAS),
D      DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
E      DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
F      PRBLEV(MAXLEV)
  DATA I1 / 1 /

```

Appendix C.1

```

C
C
C*****SET VALUES FOR RELEASE FRACTIONS DURING IN-VESSEL RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(1), FCORL, FCORO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM VESSEL TO SUPPRESSION POOL
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(2), FVESL, FVESO,
1          PRBLEV)
C*****SET VALUES FOR REVOLATILIZATION RELEASE AFTER VESSEL BREACH
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(3), FREVOL, FREVOO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS DURING CCI RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(4), FCCIL, FCCIO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM CONTAINMENT TO ENVIRONMENT
C*****FOR IN-VESSEL RELEASE SOURCE TERMS
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(5), FCONVL, FCONVO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM CONTAINMENT TO ENVIRONMENT
C*****FOR EX-VESSEL RELEASE SOURCE TERMS
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(6), FCONCL, FCONCO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FOR LATE IODINE RELEASE FROM
C*****SUPPRESSION POOL
      CALL INTERP (I1, MAXLEV, MAXCAS, VALISS(7), FLTI1L, FLTI1O,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FOR LATE IODINE RELEASE FROM
C*****CAVITY WATER
      CALL INTERP (I1, MAXLEV, MAXCAS, VALISS(8), FLTI2L, FLTI2O,
1          PRBLEV)
C*****SET VALUES FOR REACTOR BUILDING DECONTAMINATION FACTOR
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(9), RBDL, RBDFO,
1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS DUE TO DIRECT CONTAINMENT HEATING
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(10), FDCHL, FDCHO,
1          PRBLEV)
C*****SET VALUES FOR SUPPRESSION POOL DF FOR IN-VESSEL RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(11), DFVPAL, DFVPAO,
1          PRBLEV)
C*****SET VALUES FOR SUPPRESSION POOL DF AFTER VESSEL BREACH
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(12), DFCVAL, DFCFAO,
1          PRBLEV)
C*****SET VALUES FOR CAVITY WATER DF FOR CCI RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(13), DCAVL, DCAVO,
1          PRBLEV)
C*****SET VALUES FOR CONTAINMENT SPRAYS DF FOR IN-VESSEL RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(14), DFSPRIL, DFSPRVO,
1          PRBLEV)
C*****SET VALUES FOR CONTAINMENT SPRAYS DF FOR EX-VESSEL RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(15), DFSPRCL, DFSPRCO,
1          PRBLEV)
C*****SET VALUES FOR EX-VESSEL STEAM EXPLOSION RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(16), FEVSL, FEVSEO,
1          PRBLEV)
      RETURN
      END
      SUBROUTINE INTERP (MAXSPC, MAXLEV, MAXCAS, PROB, RL, RO, PRBLEV)
C*****PERFORM INTERPOLATION IN SPECIFIED EXPERT OPINION TABLE
      DIMENSION RL(MAXSPC,MAXLEV,MAXCAS), RO(MAXSPC,MAXCAS),
1          PRBLEV(MAXLEV)
      LOGICAL FIRST
      DATA FIRST / .TRUE. /

```

```

C
C
      IF (FIRST) THEN
C*****DETERMINE NUMBER OF LEVELS
      DO 100 ILEV=2,MAXLEV
        IF (PRBLEV(ILEV) .LE. 0.0) THEN
          NLEV=ILEV - 1
          GO TO 200
        ENDIF
100    CONTINUE
        NLEV=MAXLEV
200    CONTINUE
        IF (NLEV .LE. 1) THEN
          WRITE(6,1002)
          STOP
        ENDIF
        FIRST=.FALSE.
      ENDIF
C*****VALIDATE PROBABILITY
      IF (PROB .LT. PRBLEV(1)) THEN
        WRITE(6,1001) PROB, (PRBLEV(I),I=1,NLEV)
        STOP
      ENDIF
C*****LOCATE PROBABILITY LEVELS TO INTERPOLATE BETWEEN
      DO 1000 ILEV=2,NLEV
        IF (PROB .LE. PRBLEV(ILEV)) THEN
          JLEV=ILEV
          GO TO 2000
        ENDIF
1000  CONTINUE
C*****PROBABILITY VALUE OUTSIDE OF TABLE RANGE
      WRITE(6,1001) PROB, (PRBLEV(I),I=1,NLEV)
      STOP
2000  CONTINUE
C*****LOOP OVER CASES
      DO 4000 ICAS=1,MAXCAS
C*****LOOP OVER SPECIES
        DO 3000 ISPEC=1,MAXSPC
C*****PERFORM INTERPOLATION FOR CURRENT SPECIES AND CASE
          IF ((RL(ISPEC,1,ICAS) .GT. 0.0) .AND.
1            (RL(ISPEC,NLEV,ICAS)/RL(ISPEC,1,ICAS) .GT. 10.)) THEN
C*****PERFORM LOGARITHMIC INTERPOLATION
            RO(ISPEC,ICAS)=10.*(LOG10(RL(ISPEC,JLEV-1,ICAS)) +
1              (PROB-PRBLEV(JLEV-1)) *
2              (LOG10(RL(ISPEC,JLEV,ICAS))-LOG10(RL(ISPEC,JLEV-1,ICAS))) /
3              (PRBLEV(JLEV)-PRBLEV(JLEV-1)))
          ELSE
C*****PERFORM LINEAR INTERPOLATION
            RO(ISPEC,ICAS)=RL(ISPEC,JLEV-1,ICAS) +
1              (PROB-PRBLEV(JLEV-1)) *
2              (RL(ISPEC,JLEV,ICAS)-RL(ISPEC,JLEV-1,ICAS)) /
3              (PRBLEV(JLEV)-PRBLEV(JLEV-1))
          ENDIF
3000  CONTINUE
4000  CONTINUE
      RETURN
C*****FORMAT STATEMENTS
1001  FORMAT(/1X,'>>>>PROBABILITY VALUE (' ,F5.2,') OUT OF RANGE FOR ',
1      'INTERPOLATION OF LEVELS',
2      /1X,'>>>>PRBLEV(I)=' ,20F6.3)
1002  FORMAT(/1X,'>>>>FEWER THAN 2 PROBABILITY LEVELS (PRBLEV) ',
1      'SPECIFIED')

```

Appendix C.1

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END
SUBROUTINE PBSORC (IOBS, IBIN)
C*****GENERATE THE XXSOR TYPE OF SOURCE TERM ESTIMATES
C*****ALL THE PARAMETER VALUES ARE SET BY SUBROUTINE BINTRN
C*****EQUATION FORMS ARE GENERAL AND APPLIED TO ALL CASES
C*****      - - - - OUTPUT - - -
C*****STCCI(ISP) = MOLTEN CORE CONCRETE INTERACTION RELEASE TERM
C*****STE(ISP)  = EARLY RELEASE FRACTION TO ENVIRONMENT
C*****STL(ISP)  = LATE OR TAIL RELEASE FRACTION TO ENVIRONMENT
C*****ST(ISP)   = TOTAL RELEASE FRACTION FOR SPECIES ISP
C*****          (EARLY + LATE)
C*****STIL      = LATE IODINE COMPONENT--TREATED AS GASEOUS
C*****          (E.G., ORGANIC) IODINE RELEASED FROM POOL; NO DF'S
APPLY
C*****STRVOL(ISP) = CS, I AND TE REVOLATILIZED FROM PRIMARY
C*****            SYSTEM AND DRYWELL: TREATED AS AEROSOL, DF'S FOR
C*****            SECONDARY CONTAINMENT APPLY, POOL DF'S APPLY TO
C*****            NO POOL BYPASS CASES
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1             MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2             MAXSPC=10, MAXTIM=12)
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC), STCCI(MAXSPC),
1             STL(MAXSPC), STIL, STRVOL(MAXSPC),
2             ST1(MAXSPC), ST2(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1             DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2             FCCI(MAXSPC), DFCV(MAXSPC), VBPWF(MAXSPC),
3             FCONV(MAXSPC), FCONC(MAXSPC), RBDF(MAXSPC),
4             DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5             VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6             EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7             TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8             DT1, DT2, DTVB, PUFF, ELEV
      COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS), FVES0(MAXSPC,MAXCAS),
1             DFVPA0(MAXSPC,MAXCAS), DFCPA0(MAXSPC,MAXCAS),
2             FDCH0(MAXSPC,MAXCAS), FEVSE0(MAXSPC,MAXCAS),
3             FCCI0(MAXSPC,MAXCAS), DFCV0(MAXSPC,MAXCAS),
4             VBPWF0(MAXSPC,MAXCAS), FCONV0(MAXSPC,MAXCAS),
5             FCONC0(MAXSPC,MAXCAS), RBDF0(MAXSPC,MAXCAS),
6             DFSPRV0(MAXSPC,MAXCAS), DFSPRC0(MAXSPC,MAXCAS),
7             FREVO0(MAXSPC,MAXCAS), FLTI10(MAXCAS),
8             FLTI20(MAXCAS), FHPE0(MAXCAS), EVSE0(MAXCAS),
9             FPLBY0(MAXCAS), TWO(MAXTIM), T10(MAXTIM),
A             DT10(MAXTIM), DT20(MAXTIM), DTVB0(MAXTIM),
             PUFF0(MAXTIM)
      COMMON /BININD/ INDX(MAXBD)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1             EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2             ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1             EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2             ECF, ICF, NCD
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      DIMENSION RFCCI(MAXSPC), RFDCH(MAXSPC), RV(MAXSPC),
1             RFEVSE(MAXSPC), RFBVB(MAXSPC)
C
C
C*****INITIALIZE THE SOURCE TERM ARRAYS
      DO 1000 ISP=1,NSPEC
          RFCCI(ISP)=0.0

```

```

RFDCH(ISP)=0.0
RV(ISP)=0.0
RFEVSE(ISP)=0.0
RFBVB(ISP)=0.0
ST(ISP)=0.0
STE(ISP)=0.0
STCCI(ISP)=0.0
STL(ISP)=0.0
STRVOL(ISP)=0.0
1000 CONTINUE
C*****IF NO CORE DAMAGE, SKIP CALCULATIONS
IF (NCD) GO TO 8900
CAVWI=0.0
POOLI=0.0
STIL=0.0
C*****SAVE I, CS, AND TE IN VESSEL FOR REVOLATILIZATION IN LATE RELEASES
DO 1200 ISP=2,4
RV(ISP)=FCOR(ISP) * (1.0-FVES(ISP))
1200 CONTINUE
C*****RELEASE FROM VESSEL PRIOR TO VESSEL BREACH
DO 2000 ISP=1,NSPEC
IF (ECF) THEN
IF (WWF) THEN
C*****FOR BYPASS FRACTION, GOES THRU DRYWELL THEN TO WETWELL
C*****THRU DOWNCOMERS
REL1=FPLBY / MAX (DFCPA(ISP), DFSPRV(ISP))
C*****FOR NO-BYPASS FRACTION, GOES THRU T-QUENCHER INTO POOL
REL2=(1.0-FPLBY) / DFVPA(ISP)
ELSE
C*****DRYWELL EARLY FAILURE
C*****FOR BYPASS FRACTION, NO POOL DF
REL1=FPLBY / DFSPRV(ISP)
C*****FOR NO-BYPASS FRACTION
REL2=(1.0-FPLBY) / MAX (DFSPRV(ISP), DFVPA(ISP))
ENDIF
ELSE
C*****NON-EARLY CONTAINMENT FAILURE
C*****RELEASE FRACTION THAT BYPASSES POOL T-QUENCHER THRU VENT
PIPE
C*****TWO DECONTAMINATION FACTORS FOR WETWELL FAILURE
REL1=FPLBY / MAX (DFCPA(ISP), DFSPRV(ISP))
C*****RELEASE FRACTION THAT GOES THRU SUPPRESSION POOL
REL2=(1.0-FPLBY) / MAX (DFVPA(ISP), DFSPRV(ISP))
ENDIF
C*****EARLY RELEASE FRACTION
STE(ISP)=FCOR(ISP) * FVES(ISP) * (REL1+REL2) * FCONV(ISP) /
1 RBDF(ISP)
RFBVB(ISP)=STE(ISP)
C*****SAVE IODINE IN POOL
IF (ISP.EQ. 2) THEN
POOLI=POOLI + FCOR(ISP)*FVES(ISP)*
1 MAX (0.0, (1.0-REL1-REL2))
ENDIF
2000 CONTINUE
IF (DIAG) THEN
WRITE(6,9001)
WRITE(6,9101)
WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)

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        WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4), POOLI,
1          CAVWI, STIL
    ENDIF
C*****IF NO VB, THEN NO PUFF, NO CCI, NO DCH SOURCE TERMS
    IF (.NOT. VB) GO TO 7500
C*****ADD VESSEL BREACH PUFF RELEASE TO EARLY SOURCE TERM
    DO 3000 ISP=1,NSPEC
C*****DECONTAMINATION FACTOR
    IF (WWF .OR. (.NOT. ECF) .OR. (.NOT. ICF)) THEN
C*****TWO DECONTAMINATION FACTORS FOR WETWELL FAILURE OR LATE CF
        RELF=1.0 / MAX (DFCPA(ISP), DFSPRC(ISP))
    ELSE
C*****ONE DECONTAMINATION FACTOR FOR EARLY DRYWELL FAILURE
        RELF=1.0 / DFSPRC(ISP)
    ENDIF
C*****EARLY RELEASE FRACTION
    STE(ISP)=STE(ISP) + VBPWF(ISP)*RELF*FCONC(ISP)/RBDF(ISP)
    STE(ISP)=MIN (STE(ISP), 1.0)
C*****SAVE IODINE IN POOL
    IF (ISP .EQ. 2) THEN
        POOLI=POOLI + VBPWF(ISP)*MAX (0.0, (1.0-RELF))
    ENDIF
3000 CONTINUE
    IF (DIAG) THEN
        WRITE(6,9001)
        WRITE(6,9201)
        WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
        WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
        WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
        WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
        WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
        WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4), POOLI,
1          CAVWI, STIL
    ENDIF
C*****ADD DIRECT CONTAINMENT HEATING RELEASE TO EARLY SOURCE TERM
    DO 4000 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO DIRECT CONTAINMENT HEATING
    RFDCH(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPWF(ISP))) * FLV *
1      FHPE * FDCH(ISP)
    IF (RFDCH(ISP) .GT. 0.0) THEN
C*****DECONTAMINATION FACTOR
    IF (WWF .OR. (.NOT. ECF) .OR. (.NOT. ICF)) THEN
C*****TWO DECONTAMINATION FACTORS FOR WETWELL FAILURE OR LATE CF
        RELF=1.0 / MAX (DFCPA(ISP), DFSPRC(ISP))
    ELSE
C*****ONE DECONTAMINATION FACTOR FOR EARLY DRYWELL FAILURE
        RELF=1.0 / DFSPRC(ISP)
    ENDIF
C*****EARLY RELEASE FRACTION
    STE(ISP)=STE(ISP) + RFDCH(ISP)*RELF*FCONC(ISP)/RBDF(ISP)
    STE(ISP)=MIN (STE(ISP), 1.0)
C*****SAVE IODINE IN POOL
    IF (ISP .EQ. 2) THEN
        POOLI=POOLI + RFDCH(ISP)*MAX (0.0, (1.0-RELF))
    ENDIF

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```

        ENDIF
4000 CONTINUE
    IF (DIAG) THEN
        WRITE(6,9001)
        WRITE(6,9301)
        WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
        WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
        WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
        WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
        WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
        WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4), POOLI,
1          CAVWI, STIL
    ENDIF
C*****ADD EX-VESSEL STEAM EXPLOSION
    DO 4500 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO DIRECT CONTAINMENT HEATING
        RFEVSE(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPUF(ISP))) * FLV *
1          EVSE * FEVSE(ISP)
        IF (RFEVSE(ISP) .GT. 0.0) THEN
C*****DECONTAMINATION FACTOR
            IF (WWF .OR. (.NOT. ECF) .OR. (.NOT. ICF)) THEN
C*****TWO DECONTAMINATION FACTORS FOR WETWELL FAILURE OR LATE
CF
                RELF=1.0 / MAX (DFCPA(ISP), DFSPRC(ISP))
            ELSE
C*****ONE DECONTAMINATION FACTOR FOR EARLY DRYWELL FAILURE
                RELF=1.0 / DFSPRC(ISP)
            ENDIF
C*****EARLY RELEASE FRACTION
                STE(ISP)=STE(ISP) + RFEVSE(ISP)*RELF*FCONC(ISP)/RBDF(ISP)
                STE(ISP)=MIN (STE(ISP), 1.0)
C*****SAVE IODINE IN POOL
                IF (ISP .EQ. 2) THEN
                    POOLI=POOLI + RFEVSE(ISP)*MAX (0.0, (1.0-RELF))
                ENDIF
            ENDIF
4500 CONTINUE
    IF (DIAG) THEN
        WRITE(6,9001)
        WRITE(6,9351)
        WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
        WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
        WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
        WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
        WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
        WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4), POOLI,
1          CAVWI, STIL
    ENDIF
C*****IF NO COOLABLE DEBRIS BED, NO CCI
    IF (.NOT. CDB) THEN
        IF (EVSE .GT. 0.0) THEN
            XCCI=1.0 - EVSE
        ELSE IF (FHPE .GT. 0.0) THEN
            XCCI=1.0 - FHPE
        ELSE
            XCCI=1.0
        ENDIF
    ENDIF

```

Appendix C.1

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      ENDIF
C*****CORE-CONCRETE INTERACTION RELEASES AND CAVITY SCRUBBING
      DO 5000 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO CORE-CONCRETE INTERACTIONS
          RFCCI(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPWF(ISP))) * FLV *
          1          XCCI * FCCI(ISP)
C*****DECONTAMINATION FACTOR
          IF (WWF) THEN
C*****THREE DECONTAMINATION FACTORS USED FOR WETWELL FAILURE
              RELF=1.0 / MAX (DFCAV(ISP), DFPCA(ISP), DFSPRC(ISP))
          ELSE
C*****TWO DECONTAMINATION FACTORS USED FOR DRYWELL FAILURE
              RELF=1.0 / MAX (DFCAV(ISP), DFSPRC(ISP))
          ENDIF
C*****CORE-CONCRETE RELEASE SOURCE TERM
          STCCI(ISP)=RFCCI(ISP) * RELF * FCONC(ISP) / RBDF(ISP)
C*****SAVE IODINE IN CAVITY WATER AND IN POOL
          IF (ISP.EQ. 2) THEN
              CAVWI=1.0 - 1.0/DFCAV(ISP)
              POOLI=POOLI + RFCCI(ISP)*MAX (0.0, (1.0-RELF-CAVWI))
              CAVWI=RFCCI(ISP) * CAVWI
          ENDIF
      5000      CONTINUE
      ENDIF
C*****REVOLATILIZATION RELEASE OF I, CS, AND TE
      DO 6000 ISP=2,4
C*****DECONTAMINATION FACTOR
          IF (WWF) THEN
C*****TWO DECONTAMINATION FACTORS USED FOR WETWELL FAILURE
              RELF=1.0 / MAX (DFPCA(ISP), DFSPRC(ISP))
          ELSE
C*****ONE DECONTAMINATION FACTORS USED FOR DRYWELL FAILURE
              RELF=1.0 / DFSPRC(ISP)
          ENDIF
C*****REVOLATILIZATION RELEASE FRACTION
          STRVOL(ISP)=FREVO(ISP) * RELF * RV(ISP) * FCONC(ISP) /
          1          RBDF(ISP)
C*****SAVE IODINE IN POOL
          IF (ISP.EQ. 2) THEN
              POOLI=POOLI + FREVO(ISP)*RV(ISP)*MAX (0.0, (1.0-RELF))
          ENDIF
      6000      CONTINUE
C*****CCI, RCS REVOLATILIZATION WERE SKIPPED IF VESSEL BREACH WAS
C*****PREVENTED, BUT LATE IODINE RELEASE FROM THE POOL CAN STILL OCCUR
      7500      CONTINUE
C*****LATE IODINE REVOLATILIZED FROM THE POOL, WHICH IS NOT SUBJECT TO
C*****ANY DF FOR THE CONTAINMENT AND REACTOR BUILDING, EXCEPT FOR
C*****NO CONTAINMENT FAILURE CASES. IF CONTAINMENT DOES NOT FAIL,
C*****FCONC(1) APPLIES TO LATE IODINE, WHICH IS ALWAYS CALCULATED,
C*****EVEN WHEN THERE IS NO VESSEL BREACH OR NO CCI.
          IF (WWF) THEN
              STIL2=FLTI2 * CAVWI / DFPCA(2)
              POOLI=POOLI + CAVWI*(1.0-1.0/DFPCA(2))
          ELSE
              STIL2=FLTI2 * CAVWI
          ENDIF
          STIL1=FLTI1 * POOLI
          STIL=STIL1 + STIL2
C*****IF NO CONTAINMENT FAILURE, VOLATILE IODINE SIMILAR TO NOBLE GASES
          IF (NOCF) STIL=STIL * FCONC(1)
          DO 8000 ISP=1,NSPEC
              STL(ISP)=STCCI(ISP) + STRVOL(ISP)

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      ST(ISP)=STE(ISP) + STL(ISP)
8000 CONTINUE
      ST(2)=ST(2) + STIL
      STL(2)=STL(2) + STIL
C*****END OF SOURCE TERM CALCULATION
8900 CONTINUE
C*****REALLOCATE RELEASE FRACTIONS
      DO 9000 ISP=1,NSPEC
        IF (ECF) THEN
C*****EARLY CONTAINMENT FAILURE
          ST1(ISP)=RFBVB(ISP)
          ST2(ISP)=ST(ISP) - ST1(ISP)
        ELSE IF (ICF) THEN
C*****INTERMEDIATE CONTAINMENT FAILURE
          ST1(ISP)=STE(ISP)
          ST2(ISP)=ST(ISP) - ST1(ISP)
        ELSE
C*****LATE OR NO CONTAINMENT FAILURE
          ST1(ISP)=PUFF * ST(ISP)
          ST2(ISP)=(1.0-PUFF) * ST(ISP)
        ENDIF
      9000 CONTINUE
C*****CALCULATE ENERGY RELEASE
      CALL ENERGY (E1, E2)
C*****CALCULATE ENERGY RELEASE RATES
      ER1=E1 / DT1
      ER2=E2 / DT2
      IF (DIAG) THEN
        WRITE(6,9001)
        WRITE(6,9401)
        WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
        WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
        WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
        WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
        WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
        WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4), POOLI,
1      CAVWI, STIL
        WRITE(6,4211) TW, T1, DT1, T2, DT2, ELEV, ER1, ER2
        WRITE(6,4212) (ST1(ISP),ISP=1,NSPEC)
        WRITE(6,4213) (ST2(ISP),ISP=1,NSPEC)
      ENDIF
      IF (CONSFL) THEN
C*****WRITE SOURCE TERM TO FILE
        WRITE(9,1003) IOBS, BINARR(IBIN)(1:NDM)
        WRITE(9,1004) TW, T1, DT1, T2, DT2, ELEV
        WRITE(9,1004) ER1, (ST1(ISP),ISP=1,NSPEC)
        WRITE(9,1004) ER2, (ST2(ISP),ISP=1,NSPEC)
      ENDIF
      RETURN
C*****FORMAT STATEMENTS
1003 FORMAT(14,2X,A)
1004 FORMAT(1P10E12.4)
4202 FORMAT(/5X,'STE:',1P,/(5X,10E10.2))
4203 FORMAT(5X,'STL:',1P,/(5X,10E10.2))
4204 FORMAT(5X,'ST:',1P,/(5X,10E10.2))
4205 FORMAT(5X,'RFBVE:',1P,/(5X,10E10.2))
4206 FORMAT(5X,'RFEVSE:',1P,/(5X,10E10.2))
4207 FORMAT(5X,'RFDCH:',1P,/(5X,10E10.2))
4208 FORMAT(5X,'RFCCI:',1P,/(5X,10E10.2))

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4209 FORMAT(5X,'STCCI:',1P,/(5X,10E10.2))
4210 FORMAT(5X,1P,'RVI = ',E10.2,5X,'RVCS = ',E10.2,5X,'RVTE = ',E10.2,
1      /5X,'STRVOL(2) = ',E10.2,5X,'STRVOL(3) = ',E10.2,
2      5X,'STRVOL(4) = ',E10.2,
3      /5X,'POOLI = ',E10.2,5X,'CAVWI = ',E10.2,5X,'STIL = ',E10.2)
4211 FORMAT(/5X,'SOURCE TERM INFORMATION:',
1      /5X,1P,'TW = ',E10.2,5X,'T1 = ',E10.2,5X,'DT1 = ',E10.2,5X,
2      'T2 = ',E10.2,5X,'DT2 = ',E10.2,
3      /5X,'ELEV = ',E10.2,5X,'ER1 = ',E10.2,5X,'ER2 = ',E10.2)
4212 FORMAT(5X,'ST1:',1P,/(5X,10E10.2))
4213 FORMAT(5X,'ST2:',1P,/(5X,10E10.2))
9001 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****')
9101 FORMAT(/10X,'===== PARAMETER VALUES UP TO VESSEL BREACH =====')
9201 FORMAT(/10X,'===== PARAMETER VALUES AFTER VESSEL BREACH =====')
9301 FORMAT(/10X,'===== PARAMETER VALUES AFTER DCH =====')
9351 FORMAT(/10X,'===== PARAMETER VALUES AFTER EVSE =====')
9401 FORMAT(5X,'===== PARAMETER VALUES AT END OF PBSORC =====')
      END
      SUBROUTINE ENERGY (EARLY, TAIL)
C*****ESTIMATE ENERGY RELEASES FOR BOTH EARLY PUFF AND LATE
C*****TAIL. DATA BASE ARE TAKEN FROM RESULTS OF STCP CALCULATIONS
C*****FOR PEACH BOTTOM : TC1, TC2, TC3, TB1, TB2, AND TBUX.
C*****TC11 : 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TC1-ATWS,LOW PRESS.
C*****TC12 : TOTAL ENERGY RELEASE (BTU) FOR TC1
C*****TC21 : 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TC2/TC3_ATWS,HIGH
PRESS.
C*****TC22 : TOTAL ENERGY RELEASE (BTU) FOR TC2/TC3
C*****TB11 : 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TB1-LONG SBO, LATE
CF
C*****TB12 : TOTAL ENERGY RELEASE (BTU) FOR TB1
C*****TB21 : 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TB2
C*****TB22 : TOTAL ENERGY RELEASE (BTU) FOR TB2
C*****TBX1 : 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TBUX
C*****TBX2 : TOTAL ENERGY RELEASE (BTU) FOR TBUX
C*****EARLY : CALCULATED 15 MINUTE PUFF ENERGY RELEASE (JOULES)
C*****
      FOR EARLY CONTAINMENT FAILURE ONLY
C*****TAIL : CALCULATED ENERGY RELEASE AFTER 15 MIN. (JOULES)
C*****RLATCF : CORRECTION FACTOR FOR LATE CONTAINMENT FAILURE
C*****
      (EQUAL TO RATIO OF TB22/TB12)
C*****SPRFAC : CONTAINMENT SPRAY FACTOR FOR BOTH EARLY AND TAIL
C*****
      ENERGY RELEASE (EQUAL TO RATIO OF TBS2/TBR2)
C*****
      TBS AND TBR ARE FROM GRAND GULF BMI-2139 REPORT.
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=250, MAXCAS=7,
1      MAXISS=20, MAXLEV=10, MAXVAR=100, MAXVAL=12000,
2      MAXSPC=10, MAXTIM=12)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL, DIAG,
1      EXPERT, PRTINP, WWF, SUBCL, BRKOPN, VB, CDB, NOCF,
2      ECF, ICF, NCD
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC), DFVPA(MAXSPC),
1      DFCPA(MAXSPC), FDCH(MAXSPC), FEVSE(MAXSPC),
2      FCCI(MAXSPC), DFCAV(MAXSPC), VBPUF(MAXSPC),
3      FCONV(MAXSPC), FCONC(MAXSPC), RBDP(MAXSPC),
4      DFSPRV(MAXSPC), DFSPRC(MAXSPC), FREVO(MAXSPC),
5      VALISS(MAXISS), FLTI1, FLTI2, NSPEC, FLV, FHPE,
6      EVSE, FPLBY, TC11, TC12, TC21, TC22, TB11, TB12,
7      TB21, TB22, TBX1, TBX2, TBS2, TBR2, TW, T1, T2,
8      DT1, DT2, DTVB, PUFF, ELEV
      COMMON /BININD/ INDX(MAXBD)

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C

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C
  RLATCF=TB22 / TB12
  SPRFAC=TBS2 / TBR2
  IF (INDX(5) .NE. 7) THEN
C*****CONTAINMENT FAILURE, ASSIGN SPRAY FACTORS
    IF (INDX(7) .EQ. 1) THEN
      SPRAYV=1.0
      SPRAYC=1.0
    ELSE IF (INDX(7) .EQ. 2) THEN
      SPRAYV=SPRFAC
      SPRAYC=1.0
    ELSE IF (INDX(7) .EQ. 3) THEN
      SPRAYV=1.0
      SPRAYC=SPRFAC
    ELSE IF (INDX(7) .EQ. 4) THEN
      SPRAYV=SPRFAC
      SPRAYC=SPRFAC
    ENDIF
    IF (INDX(1) .EQ. 4) THEN
C*****TC-CV: LIKE TC1 SEQUENCES
      EARLY=TC11 / SPRAYV
      TAIL=(TC12-TC11) / SPRAYC
    ELSE IF ((INDX(1) .LE. 3) .OR. (INDX(1) .EQ. 5)) THEN
C*****FAST SBO, FAST TC, FAST TRANSIENT, LOCA
C*****EARLY CONTAINMENT FAILURE, LIKE TC2
      EARLY=TC21 / SPRAYV
      TAIL=(TC22-TC21) / SPRAYC
    ELSE
C*****LIKE TB1/TB2 SEQUENCES
      EARLY=TB21 / SPRAYV
      TAIL=(TB22-TB21) / SPRAYC
C*****END OF INDX(1) ACCIDENT SEQUENCE BLOCK
    ENDIF
C*****CORRECTING ENERGY RELEASE FOR LATE CONTAINMENT FAILURE CASES
    IF ((.NOT. ECF) .OR. (.NOT. ICF)) THEN
      TAIL=TAIL / RLATCF
    ENDIF
    ELSE
C*****NO CONTAINMENT FAILURE
      EARLY=0.0
      TAIL=0.0
    ENDIF
C*****CONVERT BTU TO JOULES
    EARLY=1055. * EARLY
    TAIL=1055. * TAIL
    RETURN
  END

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APPENDIX C.2 PBSOR Data Base

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$ PBSOR DATA BASE : FEBRUARY 17, 1989
$ *****
$ ENERGY RELEASE RATE PARAMETERS BASED ON STCP VALUES
TC11 5.43E+07 $ 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TC1-ATWS, LOW
PRESS
TC12 1.53E+08 $ TOTAL ENERGY RELEASE (BTU) FOR TC1
TC21 1.10E+07 $ 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TC2/TC3-ATWS,
HI PRESS
TC22 2.69E+07 $ TOTAL ENERGY RELEASE (BTU) FOR TC2/TC3
TB11 7.21E+06 $ 15 MINUTES PUFF ENERGY RELEASE (BTU) FOR TB1-LONG SBO,
LATE CF
TB12 2.81E+07 $ TOTAL ENERGY RELEASE (BTU) FOR TB1
TB21 6.55E+06 $ 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TB2
TB22 8.91E+07 $ TOTAL ENERGY RELEASE (BTU) FOR TB2
TBX1 3.43E+07 $ 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TBUX
TBX2 3.69E+07 $ TOTAL ENERGY RELEASE (BTU) FOR TBUX
TBS2 2.80E+07 $ GRAND GULF BMI-2139 REPORT
TBR2 5.45E+06 $ GRAND GULF BMI-2139 REPORT
$ WARNING TIME (S) CORE DAMAGE (2 FT ABOVE BOTTOM OF ACTIVE FUEL)
TWO(1) 3960. $ LOCA, FAST SBO, FAST ATWS
TWO(2) 17280. $ TC-CV
TWO(3) 14400. $ SLOW SBO, BETWEEN BATTERY DEPLETION AND CORE DAMAGE
TWO(4) 28800. $ VERY SLOW SBO, BETWEEN BATTERY DEPLETION AND CORE
DAMAGE
$ START OF FIRST RELEASE (PUFF) TIME (S)
T10(1) 3960. $ FAST TC, FAST SBO, LOCA: EARLY BEFORE CORE DAMAGE
T10(2) 12960. $ FAST TC, FAST SBO, LOCA: NEAR VESSEL BREACH
T10(3) 21960. $ FAST TC, FAST SBO, LOCA: LATE
T10(4) 17280. $ TC-CV: EARLY
T10(5) 26280. $ TC-CV: NEAR VB
T10(6) 35280. $ TC-CV: LATE
T10(7) 18000. $ SLOW SBO: EARLY
T10(8) 27000. $ SLOW SBO: NEAR VB
T10(9) 36000. $ SLOW SBO: LATE
T10(10) 36000. $ VERY SLOW SBO: EARLY
T10(11) 41400. $ VERY SLOW SBO: NEAR VB
T10(12) 46800. $ VERY SLOW SBO: LATE
$ RELEASE DURATION FOR FIRST RELEASE (S)
DT10(1) 9000. $ CF RUPTURE OR VENTING BEFORE CORE DAMAGE
DT10(2) 180. $ CF RUPTURE NEAR VB OR LATE (SUBCOOLED)
DT10(3) 900. $ CF RUPTURE NEAR VB OR LATE (SATURATED)
DT10(4) 3600. $ ALL LEAKAGE (SUBCOOLED)
DT10(5) 9000. $ ALL LEAKAGE (SATURATED OR NO CF)
$ TIME BETWEEN CORE DAMAGE AND VB (USED FOR SECOND RELEASE TIME FROM
$ FIRST RELEASE IF CONTAINMENT FAILS EARLY AND DT1 < 9000 S
DTVBO(1) 9000.
$ RELEASE DURATION FOR SECOND RELEASE (S)
DT20(1) 3600. $ EARLY CF RUPTURE AND DCH OR EVSE OCCURS
DT20(2) 14400. $ (EARLY CF, NO DCH, NO EVSE) OR (RUPTURE NEAR VB) OR
$ (LATE RUPTURE)
DT20(3) 21600. $ LEAK OR NO CF
$ FIRST RELEASE (PUFF) FRACTION FOR LATE CONTAINMENT FAILURE
PUFFO(1) 0.90 $ LATE CONTAINMENT FAILURE
PUFFO(2) 0.50 $ LATE LEAK OR NO CONTAINMENT FAILURE
$ RELEASE ELEVATION (M)
ELEV 30.
$ *****
$ FHPE: FRACTION OF CORE PARTICIPATING IN DCH
FHPEO(1) 0.4 0.1
$ *****
$ EVSE: FRACTION OF CORE PARTICIPATING IN EX-VESSEL STEAM EXPLOSION
EVSEO(1) 0.2 0.05

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$*****
$ FPLBY: FRACTION OF POOL BYPASS DURING IN-VESSEL RELEASE DUE TO
EITHER
$          STUCK-OPEN SRV TAIL PIPE VACUUM BREAKER OR LOCA
FPLBYO(1)  0.39  1.0
$*****
$          PUFF RELEASE AT VESSEL BREACH: ONE SET FOR ALL => USE TB1
VBP UFO(1,1) 1.94E-02 1.73E-02 1.81E-02 7.33E-03 2.46E-05 0. 0. 0.
3.33E-04
$*****
$ THE FOLLOWING DATA BLOCKS WHICH HAVE VARIABLES ENDING WITH "O"
$ ARE MEDIAN DATA VALUES FROM EXPERT OPINION RESULTS FOR PEACH BOTTOM
$ UNLESS OTHERWISE NOTED
$*****
$ NUMBER OF CHEMICAL SPECIES (NG, I, CS, TE, SR, RU, LA, CE, BA)
NSPEC      9
$*****
$ FCORO : IN-VESSEL RELEASE FRACTION FROM CORE TO RPV ATMOS.
$ BWR CASE 1: HIGH ZR OXIDATION
FCORO(1,1)  .9   .74  .59  .15  6.4E-3  4.6E-3  1.0E-4  1.5E-4
8.6E-3
$ BWR CASE 2: LOW ZR OXIDATION
FCORO(1,2)  .90  .69  .59  .14  4.0E-3  2.0E-3  1.0E-4  1.5E-4
6.5E-3
$*****
$ RELEASE FRACTION FROM VESSEL INTO SUPPRESSION POOL
$ FVESO BWR CASE 1: TBUX (FAST, HIGH PRESSURE)
FVESO(1,1)  1.   .086 .033 .033 .033 .033 .033 .033 .033
$ FVESO BWR CASE 2: TBU (FAST, LOW PRESSURE)
FVESO(1,2)  1.   .41  .30  .27  .26  .26  .26  .26  .26
$ FVESO BWR CASE 3: TCUX (SLOW, HIGH PRESSURE, CRD)
FVESO(1,3)  1.   .28  .25  .10  .078 .078 .078 .078 .078
$*****
$*****
$ FCCIO: RELEASE FRACTIONS FROM MOLTEN CORE CONCRETE INTERACTION
$ FCCI BWR CASE 1: LOW ZR CONTENTS AND DRY CAVITY
FCCIO(1,1)  1.   1.   1.   .32 .052 5.6E-9 8.3E-4 1.6E-3 6.1E-2
$ FCCI BWR CASE 2: LOW ZR CONTENTS AND WATER OVER DEBRIS
FCCIO(1,2)  1.   1.   1.   .23 .027 1.7E-9 3.7E-4 7.3E-4 .032
$ FCCI BWR CASE 3: HIGH ZR CONTENTS AND DRY CAVITY
FCCIO(1,3)  1.   1.   1.   .36 .052 5.6E-9 8.3E-4 1.6E-3 .061
$ FCCI BWR CASE 4: HIGH ZR CONTENTS AND WATER OVER DEBRIS
FCCIO(1,4)  1.   1.   1.   .23 .027 1.7E-9 3.7E-4 7.3E-4 .032
$*****
$*****
$ FEVSE: BWR EX-VESSEL STEAM EXPLOSION RELEASE FRACTION (1 CASE ONLY)
FEVSEO(1,1) 1.   1.   1.   .043 .012 .020 .011 .011 .012
$*****
$*****
$ FDCH: DIRECT CONTAINMENT HEATING RELEASE
$ FDCH: BWR ONE CASE ONLY: FOR HIGH PRESSURE SEQUENCES
FDCHO(1,1)  1.   1.0  1.0  .043 .012 .020 .011 .011 .012
$*****
$ FLTI1: LATE IODINE RELEASE FROM SUPPRESSION POOL: IODINE ONLY
$ FLTI1 CASE 1: SUBCOOLED SUPPRESSION POOL
FLTI1O(1)  1.55E-3
$ FLTI1 CASE 2: SATURATED SUPPRESSION POOL
FLTI1O(2)  4.63E-3

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Appendix C.2

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$*****
*****
$ FLTI2: LATE IODINE RELEASE FROM CAVITY WATER: IODINE ONLY
$   FLTI2 CASE 1: DRY DW FLOOR
FLTI20(1) 1.
$   FLTI2 CASE 2: REPLENISHABLE WATER SUPPLY OVER DEBRIS
FLTI20(2) .435
$*****
$ FREVO0: REVOLATILIZATION RELEASE AFTER VESSEL BREACH: I, CS, AND TE
$ SET ALL OTHER NUCLIDE GROUPS TO ZERO
$   BWR CASE 1: STATION BLACKOUT AND HIGH DRYWELL TEMPERATURE
FREVO0(1,1) 1. .115 .051 0. 0. 0. 0. 0. 0.
$   BWR CASE 2: STATION BLACKOUT AND LOW DRYWELL TEMPERATURE
FREVO0(1,2) 1. .114 .050 0. 0. 0. 0. 0. 0.
$   BWR CASE 3: ATWS HIGH PRESSURE (TCUX) AND LOW PRESS. SYSTEMS
$   AVAILABLE FOR INJECTION AFTER VESSEL BREACH
FREVO0(1,3) 1. .03 .001 0. 0. 0. 0. 0. 0.
$*****
$ RBDF: REACTOR BUILDING DF FOR PEACH BOTTOM : ALL NINE GROUPS
$   PB CASE 1: DRYWELL RUPTURE AND SUPPRESSION POOL SUBCOOLED
RBDF0(1,1) 1. 2.3 2.3 2.62 2.62 2.62 2.62 2.62 2.62
$   PB CASE 2: DRYWELL RUPTURE AND SUPPRESSION POOL SATURATED
RBDF0(1,2) 1. 2.84 2.84 2.61 2.61 2.61 2.61 2.61 2.61
$   PB CASE 3: SHELL MELT-THROUGH AND SUPPRESSION POOL SUBCOOLED
RBDF0(1,3) 1. 2.96 2.96 3.45 3.45 3.45 3.45 3.45 3.45
$   PB CASE 4: SHELL MELT-THROUGH AND SUPPRESSION POOL SATURATED
RBDF0(1,4) 1. 4.05 4.05 4.02 4.02 4.02 4.02 4.02 4.02
$   PB CASE 5: DRYWELL HEAD SEAL LEAK AND SUPPRESSION POOL SUBCOOLED
RBDF0(1,5) 1. 1.35 1.35 1.35 1.35 1.35 1.35 1.35 1.35
$   PB CASE 6: DRYWELL HEAD SEAL LEAK AND SUPPRESSION POOL SATURATED
RBDF0(1,6) 1. 1.46 1.46 1.46 1.46 1.46 1.46 1.46 1.46
$*****
$ FCONV: CONTAINMENT RELEASE FRACTION BEFORE VESSEL BREACH
$   FCONV PB CASE 1: EARLY LEAK SUBCOOLED POOL
FCONVO(1,1) 1. .282 .282 .282 .282 .282 .282 .282 .282
$   FCONV PB CASE 2: EARLY LEAK SATURATED POOL
FCONVO(1,2) 1. .326 .326 .326 .326 .326 .326 .326 .326
$   FCONV PB CASE 3: EARLY RUPTURE SUBCOOLED POOL
FCONVO(1,3) 1. .724 .724 .717 .717 .717 .717 .717 .717
$   FCONV PB CASE 4: EARLY RUPTURE SATURATED POOL
FCONVO(1,4) 1. .756 .756 .739 .739 .739 .739 .739 .739
$   FCONV PB CASE 5: LATE LEAK
FCONVO(1,5) 1. .042 .042 .042 .042 .042 .042 .042 .042
$   FCONV PB CASE 6: LATE RUPTURE
FCONVO(1,6) 1. .067 .067 .067 .067 .067 .067 .067 .067
$   NO CONTAINMENT FAILURE CASE
FCONVO(1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
$*****
$ FCONC: CONTAINMENT RELEASE FRACTION AFTER VESSEL BREACH: ALL NINE
GROUPS
$   FCONC PB CASE 1: EARLY LEAK SUBCOOLED POOL
FCONCO(1,1) 1. .331 .331 .293 .293 .293 .293 .293 .293
$   FCONC PB CASE 2: EARLY LEAK SATURATED POOL
FCONCO(1,2) 1. .281 .281 .256 .256 .256 .256 .256 .256
$   FCONC PB CASE 3: EARLY RUPTURE SUBCOOLED POOL
FCONCO(1,3) 1. .755 .755 .729 .729 .729 .729 .729 .729
$   FCONC PB CASE 4: EARLY RUPTURE SATURATED POOL
FCONCO(1,4) 1. .752 .752 .708 .708 .708 .708 .708 .708
$   FCONC PB CASE 5: LATE LEAK
FCONCO(1,5) 1. .042 .042 .063 .049 .063 .049 .056 .056
$   FCONC PB CASE 6: LATE RUPTURE

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FCONCO(1,6) 1. .067 .067 .095 .085 .095 .085 .085 .085
$ NO CONTAINMENT FAILURE CASE
FCONCO(1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
$*****
*
$ SUPPRESSION POOL DF THROUGH SRV T-QUENCHERS: ONLY ONE CASE
$ MEDIAN VALUES FROM EXPERT OPINION TABLES
DFVPAO(1,1) 1. 81. 81. 81. 81. 81. 81. 81. 81.
$*****
***
$ SUPPRESSION POOL DF THROUGH DOWNCOMERS
$ MEDIAN VALUES FROM EXPERT OPINION TABLES
DFCPAO(1,1) 1. 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5
$*****
*
$ DRWELL SPRAYS DF MEDIAN VALUES FROM EXPERT OPINION TABLES
DFSPRVO(1,1) 1.0 11. 11. 11. 11. 11. 11. 11. 11.
DFSPRCO(1,1) 1.0 17. 17. 17. 17. 17. 17. 17. 17.
$
$*****
$ DFCAVO: DRYWELL FLOOR WATER DF: FOR PEACH BOTTOM WITH REPENISHABLE
$ WATER OVER DEBRIS CASE USES GRAND GULF TBS CASE
$ MEDIAN VALUES FROM EXPERT OPINION TABLES
DFCAVO(1,1) 1.0 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4.4
$=====
$ *****
$ PEACH BOTTOM LATIN HYPERCUBE SAMPLE INTERPOLATION DATA BASE
$ ALL VARIABLE ARRAYS END WITH "L" TO REPRESENT LHS VARIABLES
$ STANDARD ARRAYS HAVE THREE DIMENSIONS:
$ FIRST DIMENSION = RADIONUCLIDE GROUP 1 THROUGH 9
$ SECOND DIMENSION = CUMULATIVE PROBABILITY POINTS
$ THIRD DIMENSION = DIFFERENT CASES
$ NINE NUCLIDE GROUPS GOING ACROSS: NG,I,CS,TE,SR,RU,LA,CE,BA
$ NINE CUMULATIVE PROBABILITY POINTS GOING DOWN:
$ 0.,0.01,0.05,0.25,0.5,0.75,0.95,0.99,1.0
PRBLEV 0.0 0.01 0.05 0.25 0.50 0.75 0.95 0.99 1.0
$ EACH CASE CONSISTS OF A BLOCK OF DATA OF 9 BY 9
$ *****
$ FCORL : IN-VESSEL RELEASE FRACTION FROM CORE TO RPV ATMOS.
$ BWR CASE 1: HIGH ZR OXIDATION
FCORL(1,1,1) .05 .03 .02 0. 0. 0. 0. 0.
0.
FCORL(1,2,1) .073 .049 .033 3.0E-3 3.0E-5 0. 0. 0.
2.2E-4
FCORL(1,3,1) .17 .13 .07 .018 2.5E-4 0. 0. 0.
1.2E-3
FCORL(1,4,1) .56 .34 .26 .071 2.1E-3 5.0E-5 2.0E-5 2.0E-5
4.2E-3
FCORL(1,5,1) .9 .74 .59 .15 6.4E-3 4.6E-3 1.0E-4 1.5E-4
8.6E-3
FCORL(1,6,1) 1. .96 .89 .59 .018 .02 1.2E-3 3.0E-3
.03
FCORL(1,7,1) 1. 1. 1. .91 .52 .081 .021 .085
.52
FCORL(1,8,1) 1. 1. 1. .99 1. .14 .1 .51
1.
FCORL(1,9,1) 1. 1. 1. 1. 1. .27 .11 1.
1.
$ BWR CASE 2: LOW ZR OXIDATION

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FCORL(1,1,2) .02 6.0E-3 5.0E-3 0. 0. 0. 0. 0.
0.
FCORL(1,2,2) .033 6.6E-3 5.8E-3 2.9E-3 3.0E-5 0. 0. 0.
1.1E-4
FCORL(1,3,2) .084 9.2E-3 9.0E-3 7.3E-3 1.5E-4 0. 0. 0.
2.2E-4
FCORL(1,4,2) .41 .16 .088 .049 7.6E-4 5.0E-5 2.0E-5 2.0E-5
1.7E-3
FCORL(1,5,2) .90 .69 .59 .14 4.0E-3 2.0E-3 1.0E-4 1.5E-4
6.5E-3
FCORL(1,6,2) 1. .91 .83 .46 .013 .012 9.5E-4 2.5E-3
.027
FCORL(1,7,2) 1. 1. 1. .89 .52 .058 .021 .085
.52
FCORL(1,8,2) 1. 1. 1. .98 1. .14 .10 .51
1.
FCORL(1,9,2) 1. 1. 1. 1. 1. .27 .11 1.
1.
$*****
$ FVESL: FRACTION OF RADIONUCLIDE LEAVING VESSEL DURING IN-VESSEL
$ RELEASE PHASE
$ FVESL BWR CASE 1: TBUX (FAST, HIGH PRESSURE)
FVESL(1,1,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FVESL(1,2,1) 1. 2.0E-5 2.0E-5 1.0E-5 1.0E-5 1.0E-5 1.0E-5 1.0E-5
1.0E-5
FVESL(1,3,1) 1. 8.0E-5 8.0E-5 5.0E-5 5.0E-5 5.0E-5 5.0E-5 5.0E-5
5.0E-5
FVESL(1,4,1) 1. 9.6E-3 5.1E-3 1.9E-3 1.9E-3 1.9E-3 1.9E-3 1.9E-3
1.9E-3
FVESL(1,5,1) 1. .086 .033 .033 .033 .033 .033 .033 .033
FVESL(1,6,1) 1. .33 .32 .31 .25 .25 .25 .25 .25
FVESL(1,7,1) 1. .79 .79 .78 .77 .77 .77 .77 .77
FVESL(1,8,1) 1. .96 .96 .96 .95 .95 .95 .95 .95
FVESL(1,9,1) 1. 1. 1. 1. 1. 1. 1. 1. 1.
$ FVESL BWR CASE 2: TBU (FAST, LOW PRESSURE)
FVESL(1,1,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FVESL(1,2,2) 1. 5.9E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3
3.3E-3
FVESL(1,3,2) 1. .041 .023 .023 .023 .023 .023 .023 .023
FVESL(1,4,2) 1. .23 .14 .14 .13 .13 .13 .13 .13
FVESL(1,5,2) 1. .41 .30 .27 .26 .26 .26 .26 .26
FVESL(1,6,2) 1. .63 .60 .59 .58 .58 .58 .58 .58
FVESL(1,7,2) 1. .99 .99 .99 .99 .99 .99 .99 .99
FVESL(1,8,2) 1. 1. 1. 1. 1. 1. 1. 1. 1.
FVESL(1,9,2) 1. 1. 1. 1. 1. 1. 1. 1. 1.
$ FVESL BWR CASE 3: TCUX (SLOW, HIGH PRESSURE, CRD)
FVESL(1,1,3) 1. 0. 1.0E-5 0. 0. 0. 0. 0. 0.
FVESL(1,2,3) 1. 8.0E-5 8.0E-5 2.0E-5 2.0E-5 2.0E-5 2.0E-5 2.0E-5
2.0E-5
FVESL(1,3,3) 1. .018 7.6E-3 1.0E-4 1.0E-4 1.0E-4 1.0E-4 1.0E-4
1.0E-4
FVESL(1,4,3) 1. .089 .052 4.9E-3 4.8E-3 4.8E-3 4.8E-3 4.8E-3
4.8E-3
FVESL(1,5,3) 1. .28 .25 .10 .078 .078 .078 .078 .078
FVESL(1,6,3) 1. .75 .63 .39 .29 .29 .29 .29 .29
FVESL(1,7,3) 1. .95 .9 .7 .7 .7 .7 .7 .7
FVESL(1,8,3) 1. .99 .99 .88 .88 .88 .88 .88 .88
FVESL(1,9,3) 1. 1. 1. .98 .98 .98 .98 .98 .98
$*****
$ FCCIL: RELEASE FRACTIONS FROM MOLTEN CORE CONCRETE INTERACTION
$ FCCI PB CASE 1: LOW ZR CONTENTS AND DRY CAVITY

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FCCIL(1,1,1)	1.	1.	1.	4.4E-3	0.	1.0E-9	0.	0.	
3.0E-5									
FCCIL(1,2,1)	1.	1.	1.	1.2E-2	4.0E-5	1.0E-9	0.	0.	
8.0E-5									
FCCIL(1,3,1)	1.	1.	1.	6.6E-2	1.9E-4	1.2E-9	1.0E-5	2.0E-5	
2.1E-4									
FCCIL(1,4,1)	1.	1.	1.	.19	1.4E-3	2.4E-9	1.1E-4	1.3E-4	
1.3E-3									
FCCIL(1,5,1)	1.	1.	1.	.32	.052	5.6E-9	8.3E-4	1.6E-3	
6.1E-2									
FCCIL(1,6,1)	1.	1.	1.	.60	.62	5.0E-6	.013	.026	.45
FCCIL(1,7,1)	1.	1.	1.	.94	.95	7.3E-3	.086	.18	.88
FCCIL(1,8,1)	1.	1.	1.	.99	.99	9.7E-2	.10	.20	.98
FCCIL(1,9,1)	1.	1.	1.	1.	1.	0.25	.10	.20	1.
\$ FCCI PB CASE 2: LOW ZR CONTENTS AND WATER OVER DEBRIS									
FCCIL(1,1,2)	1.	1.	1.	1.2E-3	0.	1.0E-9	0.	0.	0.
FCCIL(1,2,2)	1.	1.	1.	4.3E-3	0.	1.0E-9	0.	0.	0.
FCCIL(1,3,2)	1.	1.	1.	.021	1.0E-5	1.1E-9	0.	0.	
1.0E-5									
FCCIL(1,4,2)	1.	1.	1.	.096	3.4E-4	1.3E-9	1.0E-5	2.0E-5	
4.2E-4									
FCCIL(1,5,2)	1.	1.	1.	.23	.027	1.7E-9	3.7E-4	7.3E-4	.032
FCCIL(1,6,2)	1.	1.	1.	.53	.59	1.0E-6	.012	.02	.41
FCCIL(1,7,2)	1.	1.	1.	.92	.94	2.5E-3	.084	.17	.87
FCCIL(1,8,2)	1.	1.	1.	.99	.99	5.8E-2	.099	.2	.98
FCCIL(1,9,2)	1.	1.	1.	1.	1.	0.15	.1	.2	1.
\$ FCCI PB CASE 3: HIGH ZR CONTENTS AND DRY CAVITY									
FCCIL(1,1,3)	1.	1.	1.	4.4E-3	0.	1.0E-9	0.	0.	
3.0E-5									
FCCIL(1,2,3)	1.	1.	1.	.012	4.0E-5	1.0E-9	0.	0.	
8.0E-5									
FCCIL(1,3,3)	1.	1.	1.	.066	1.9E-4	1.2E-9	1.0E-5	2.0E-5	
2.1E-4									
FCCIL(1,4,3)	1.	1.	1.	.19	1.4E-3	2.4E-9	1.1E-4	1.3E-4	
1.3E-3									
FCCIL(1,5,3)	1.	1.	1.	.36	.052	5.6E-9	8.3E-4	1.6E-3	.061
FCCIL(1,6,3)	1.	1.	1.	.69	.65	5.0E-6	.02	.031	.51
FCCIL(1,7,3)	1.	1.	1.	.96	.97	7.3E-3	.11	.18	.9
FCCIL(1,8,3)	1.	1.	1.	.99	1.	9.7E-2	.15	.2	.98
FCCIL(1,9,3)	1.	1.	1.	1.	1.	0.25	.16	.2	1.
\$ FCCI PB CASE 4: HIGH ZR CONTENTS AND WATER OVER DEBRIS									
FCCIL(1,1,4)	1.	1.	1.	1.2E-3	0.	1.0E-9	0.	0.	0.
FCCIL(1,2,4)	1.	1.	1.	4.3E-3	0.	1.0E-9	0.	0.	0.
FCCIL(1,3,4)	1.	1.	1.	.021	1.0E-5	1.1E-9	0.	0.	
1.0E-5									
FCCIL(1,4,4)	1.	1.	1.	.096	3.4E-4	1.3E-9	1.0E-5	2.0E-5	
4.2E-4									
FCCIL(1,5,4)	1.	1.	1.	.23	.027	1.7E-9	3.7E-4	7.3E-4	.032
FCCIL(1,6,4)	1.	1.	1.	.53	.59	1.0E-6	.012	.02	.41
FCCIL(1,7,4)	1.	1.	1.	.92	.94	2.5E-3	.084	.17	.87
FCCIL(1,8,4)	1.	1.	1.	.99	.99	5.8E-2	.099	.2	.98
FCCIL(1,9,4)	1.	1.	1.	1.	1.	0.15	.1	.2	1.

**									
\$ FDCH: BWR ONE CASE ONLY: FOR HIGH PRESSURE SEQUENCES									
\$ FIRST DIMENSION = RADIONUCLIDE GROUP									
\$ SECOND DIMENSION = PROBABILITY POINTS									
FDCHL(1,1,1)	1.	.063	.063	0.	0.	0.	0.	0.	0.
FDCHL(1,2,1)	1.	.15	.15	0.	0.	0.	0.	0.	0.
FDCHL(1,3,1)	1.	.50	.50	.001	.001	.001	.001	.001	.001

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FDCHL(1,4,1) 1. 1. 1. .003 .002 .007 .002 .002 .004
FDCHL(1,5,1) 1. 1. 1. .043 .012 .020 .011 .011 .012
FDCHL(1,6,1) 1. 1. 1. .600 .030 .063 .040 .040 .067
FDCHL(1,7,1) 1. 1. 1. .975 .751 .700 .087 .087 .863
FDCHL(1,8,1) 1. 1. 1. 1. .980 .900 .200 .280 .980
FDCHL(1,9,1) 1. 1. 1. 1. 1. .950 .230 .330 1.
$*****
$ FEVSE: BWR EX-VESSEL STEAM EXPLOSION RELEASE FRACTION (1 CASE ONLY)
FEVSEL(1,1,1) 1. .063 .063 0. 0. 0. 0. 0. 0.
FEVSEL(1,2,1) 1. .15 .15 0. 0. 0. 0. 0. 0.
FEVSEL(1,3,1) 1. .50 .50 .001 .001 .001 .001 .001 .001
FEVSEL(1,4,1) 1. 1. 1. .008 .002 .007 .002 .002 .004
FEVSEL(1,5,1) 1. 1. 1. .043 .012 .020 .011 .011 .012
FEVSEL(1,6,1) 1. 1. 1. .600 .030 .063 .040 .040 .067
FEVSEL(1,7,1) 1. 1. 1. .975 .751 .700 .087 .087 .863
FEVSEL(1,8,1) 1. 1. 1. 1. .980 .900 .200 .280 .980
FEVSEL(1,9,1) 1. 1. 1. 1. 1. .950 .230 .330 1.
$*****
$ FLTI1: LATE IODINE RELEASE FROM SUPPRESSION POOL: IODINE ONLY
$ THEREFORE, PROBABILITY GOING ACROSS
$ FIRST DIMENSION = PROBABILITY POINTS
$ SECOND DIMENSION = CASES
$ FLTI1 CASE 1: SUBCOOLED SUPPRESSION POOL
FLTI1L(1,1) 0. 0. 0. 5.00E-4 1.55E-3 .0278 .085 .097
.10
$ FLTI1 CASE 2: SATURATED SUPPRESSION POOL
FLTI1L(1,2) 0. 1.E-6 4.06E-5 9.36E-4 4.63E-3 .173 .759 .95 1.
$*****
$ FLTI2: LATE IODINE RELEASE FROM CAVITY WATER: IODINE ONLY
$ FLTI2 CASE 1: DRY DW FLOOR
FLTI2L(1,1) 1. 1. 1. 1. 1. 1. 1. 1.
$ FLTI2 CASE 2: REPLENISHABLE WATER SUPPLY OVER DEBRIS
FLTI2L(1,2) .004 .040 .109 .247 .435 .670 .936 .985 1.0
$*****
$ FREVOL: REVOLATILIZATION RELEASE AFTER VESSEL BREACH: I,CS AND TE
$ SET ALL OTHER NUCLIDE GROUPS TO ZERO
$ BWR CASE 1: STATION BLACKOUT AND HIGH DRYWELL TEMPERATURE
FREVL(1,1,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,2,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,3,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,4,1) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVL(1,5,1) 1. .115 .051 0. 0. 0. 0. 0. 0.
FREVL(1,6,1) 1. .306 .132 .024 0. 0. 0. 0. 0.
FREVL(1,7,1) 1. .557 .284 .224 0. 0. 0. 0. 0.
FREVL(1,8,1) 1. .800 .535 .413 0. 0. 0. 0. 0.
FREVL(1,9,1) 1. 1.00 .750 .800 0. 0. 0. 0. 0.
$ BWR CASE 2: STATION BLACKOUT AND LOW DRYWELL TEMPERATURE
FREVL(1,1,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,2,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,3,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,4,2) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVL(1,5,2) 1. .114 .050 0. 0. 0. 0. 0. 0.
FREVL(1,6,2) 1. .261 .122 .024 0. 0. 0. 0. 0.
FREVL(1,7,2) 1. .486 .236 .209 0. 0. 0. 0. 0.
FREVL(1,8,2) 1. .800 .438 .413 0. 0. 0. 0. 0.
FREVL(1,9,2) 1. 1.00 .750 .800 0. 0. 0. 0. 0.
$ BWR CASE 3: ATWS HIGH PRESSURE (TCUX) AND LOW PRESS. SYSTEMS
$ AVAILABLE FOR INJECTION AFTER VESSEL BREACH

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Appendix C.2

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FREVL(1,1,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,2,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,3,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,4,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVL(1,5,3) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVL(1,6,3) 1. .117 .061 .024 0. 0. 0. 0. 0.
FREVL(1,7,3) 1. .439 .200 .209 0. 0. 0. 0. 0.
FREVL(1,8,3) 1. .800 .287 .413 0. 0. 0. 0. 0.
FREVL(1,9,3) 1. 1.00 .750 .800 0. 0. 0. 0. 0.
$*****
*
$ RBDF: REACTOR BUILDING DF FOR PEACH BOTTOM : ALL NINE GROUPS
$ PB CASE 1: DRYWELL RUPTURE AND SUPPRESSION POOL SUBCOOLED
RBDFL(1,1,1) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,2,1) 1. 1.04 1.04 1.06 1.06 1.06 1.06 1.06 1.06
RBDFL(1,3,1) 1. 1.1 1.1 1.11 1.11 1.11 1.11 1.11 1.11
RBDFL(1,4,1) 1. 1.41 1.41 1.48 1.48 1.48 1.48 1.48 1.48
RBDFL(1,5,1) 1. 2.3 2.3 2.62 2.62 2.62 2.62 2.62 2.62
RBDFL(1,6,1) 1. 4.28 4.28 4.91 4.91 4.91 4.91 4.19 4.91
RBDFL(1,7,1) 1. 9.88 9.88 10.2 10.2 10.2 10.2 10.2 10.2
RBDFL(1,8,1) 1. 56. 56. 64. 64. 64. 64. 64. 64.
RBDFL(1,9,1) 1. 470. 470. 507. 507. 507. 507. 507. 507.
$ PB CASE 2: DRYWELL RUPTURE AND SUPPRESSION POOL SATURATED
RBDFL(1,1,2) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,2,2) 1. 1.04 1.04 1.06 10.6 1.06 1.06 1.06 1.06
RBDFL(1,3,2) 1. 1.14 1.14 1.13 1.13 1.13 1.13 1.13 1.13
RBDFL(1,4,2) 1. 1.67 1.67 1.56 1.56 1.56 1.56 1.56 1.56
RBDFL(1,5,2) 1. 2.84 2.84 2.61 2.61 2.61 2.61 2.61 2.61
RBDFL(1,6,2) 1. 4.94 4.94 5.48 5.48 5.48 5.48 5.48 5.48
RBDFL(1,7,2) 1. 10.9 10.9 12.8 12.8 12.8 12.8 12.8 12.8
RBDFL(1,8,2) 1. 77. 77. 82. 82. 82. 82. 82. 82.
RBDFL(1,9,2) 1. 428. 428. 461. 461. 461. 461. 461. 461.
$ PB CASE 3: SHELL MELT-THROUGH AND SUPPRESSION POOL SUBCOOLED
RBDFL(1,1,3) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,2,3) 1. 1.06 1.06 1.09 1.09 1.09 1.09 1.09 1.09
RBDFL(1,3,3) 1. 1.16 1.16 1.15 1.15 1.15 1.15 1.15 1.15
RBDFL(1,4,3) 1. 1.83 1.83 1.98 1.98 1.98 1.98 1.98 1.98
RBDFL(1,5,3) 1. 2.96 2.96 3.45 3.45 3.45 3.45 3.45 3.45
RBDFL(1,6,3) 1. 4.80 4.80 5.71 5.71 5.71 5.71 5.71 5.71
RBDFL(1,7,3) 1. 11.1 11.1 13.3 13.3 13.3 13.3 13.3 13.3
RBDFL(1,8,3) 1. 75. 75. 85. 85. 85. 85. 85. 85.
RBDFL(1,9,3) 1. 594. 594. 634. 634. 634. 634. 634. 634.
$ PB CASE 4: SHELL MELT-THROUGH AND SUPPRESSION POOL SATURATED
RBDFL(1,1,4) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,2,4) 1. 1.06 1.06 1.08 1.08 1.08 1.08 1.08 1.08
RBDFL(1,3,4) 1. 1.23 1.23 1.25 1.25 1.25 1.25 1.25 1.25
RBDFL(1,4,4) 1. 2.29 2.29 2.22 2.22 2.22 2.22 2.22 2.22
RBDFL(1,5,4) 1. 4.05 4.05 4.02 4.02 4.02 4.02 4.02 4.02
RBDFL(1,6,4) 1. 6.86 6.86 6.81 6.81 6.81 6.81 6.81 6.81
RBDFL(1,7,4) 1. 14.5 14.5 17.0 17.0 17.0 17.0 17.0 17.0
RBDFL(1,8,4) 1. 87.9 87.9 92.1 92.1 92.1 92.1 92.1 92.1
RBDFL(1,9,4) 1. 551. 551. 590. 590. 590. 590. 590. 590.
$ PB CASE 5: DRYWELL HEAD SEAL LEAK AND SUPPRESSION POOL SUBCOOLED
RBDFL(1,1,5) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,2,5) 1. 1. 1. 1. 1. 1. 1. 1. 1.
RBDFL(1,3,5) 1. 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02
RBDFL(1,4,5) 1. 1.10 1.10 1.10 1.10 1.10 1.10 1.10 1.10
RBDFL(1,5,5) 1. 1.35 1.35 1.40 1.40 1.40 1.40 1.40 1.40
RBDFL(1,6,5) 1. 1.73 1.73 1.88 1.88 1.88 1.88 1.88 1.88
RBDFL(1,7,5) 1. 6.65 6.65 6.65 6.65 6.65 6.65 6.65 6.65
RBDFL(1,8,5) 1. 9.63 9.63 9.63 9.63 9.63 9.63 9.63 9.63

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RBDL(1,9,5)	1.	36.	36.	36.	36.	36.	36.	36.	36.
\$ PB CASE 6: DRYWELL HEAD SEAL LEAK AND SUPPRESSION POOL SATURATED									
RBDL(1,1,6)	1.	1.	1.	1.	1.	1.	1.	1.	1.
RBDL(1,2,6)	1.	1.	1.	1.	1.	1.	1.	1.	1.
RBDL(1,3,6)	1.	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
RBDL(1,4,6)	1.	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
RBDL(1,5,6)	1.	1.46	1.46	1.48	1.48	1.48	1.48	1.48	1.48
RBDL(1,6,6)	1.	2.17	2.17	2.57	2.57	2.57	2.57	2.57	2.57
RBDL(1,7,6)	1.	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65
RBDL(1,8,6)	1.	9.63	9.63	9.63	9.63	9.63	9.63	9.63	9.63
RBDL(1,9,6)	1.	36.	36.	36.	36.	36.	36.	36.	36.

**									
\$ FCONV: CONTAINMENT RELEASE FRACTION BEFORE VESSEL BREACH: ALL NINE GROUPS									
\$ FCONVL PB CASE 1: EARLY LEAK, SUBCOOLED POOL									
FCONVL(1,1,1)	1.	.002	.002	.002	.002	.002	.002	.002	.002
FCONVL(1,2,1)	1.	.008	.008	.008	.008	.008	.008	.008	.008
FCONVL(1,3,1)	1.	.026	.026	.026	.026	.026	.026	.026	.026
FCONVL(1,4,1)	1.	.144	.144	.144	.144	.144	.144	.144	.144
FCONVL(1,5,1)	1.	.282	.282	.282	.282	.282	.282	.282	.282
FCONVL(1,6,1)	1.	.495	.495	.495	.495	.495	.495	.495	.495
FCONVL(1,7,1)	1.	.712	.712	.712	.712	.712	.712	.712	.712
FCONVL(1,8,1)	1.	.797	.797	.797	.797	.797	.797	.797	.797
FCONVL(1,9,1)	1.	.999	.999	.999	.999	.999	.999	.999	.999
\$ FCONVL PB CASE 2: EARLY LEAK, SATURATED POOL									
FCONVL(1,1,2)	1.	.006	.006	.006	.006	.006	.006	.006	.006
FCONVL(1,2,2)	1.	.017	.017	.017	.017	.017	.017	.017	.017
FCONVL(1,3,2)	1.	.051	.051	.051	.051	.051	.051	.051	.051
FCONVL(1,4,2)	1.	.178	.178	.178	.178	.178	.178	.178	.178
FCONVL(1,5,2)	1.	.326	.326	.326	.326	.326	.326	.326	.326
FCONVL(1,6,2)	1.	.525	.525	.525	.525	.525	.525	.525	.525
FCONVL(1,7,2)	1.	.739	.739	.739	.739	.739	.739	.739	.739
FCONVL(1,8,2)	1.	.874	.874	.874	.874	.874	.874	.874	.874
FCONVL(1,9,2)	1.	.999	.999	.999	.999	.999	.999	.999	.999
\$ FCONVL PB CASE 3: EARLY RUPTURE, SUBCOOLED POOL									
FCONVL(1,1,3)	1.	.010	.010	.010	.010	.010	.010	.010	.010
FCONVL(1,2,3)	1.	.100	.100	.100	.100	.100	.100	.100	.100
FCONVL(1,3,3)	1.	.224	.224	.224	.224	.224	.224	.224	.224
FCONVL(1,4,3)	1.	.501	.501	.501	.501	.501	.501	.501	.501
FCONVL(1,5,3)	1.	.724	.724	.717	.717	.717	.717	.717	.717
FCONVL(1,6,3)	1.	.874	.874	.852	.852	.852	.852	.852	.852
FCONVL(1,7,3)	1.	.982	.982	.982	.982	.982	.982	.982	.982
FCONVL(1,8,3)	1.	.994	.994	.994	.994	.994	.994	.994	.994
FCONVL(1,9,3)	1.	1.	1.	1.	1.	1.	1.	1.	1.
\$ FCONVL PB CASE 4: EARLY RUPTURE, SATURATED POOL									
FCONVL(1,1,4)	1.	.026	.026	.026	.026	.026	.026	.026	.026
FCONVL(1,2,4)	1.	.160	.160	.160	.160	.160	.160	.160	.160
FCONVL(1,3,4)	1.	.281	.281	.281	.281	.281	.281	.281	.281
FCONVL(1,4,4)	1.	.540	.540	.540	.540	.540	.540	.540	.540
FCONVL(1,5,4)	1.	.756	.756	.739	.739	.739	.739	.739	.739
FCONVL(1,6,4)	1.	.911	.911	.899	.899	.899	.899	.899	.899
FCONVL(1,7,4)	1.	.986	.986	.986	.986	.986	.986	.986	.986
FCONVL(1,8,4)	1.	.997	.997	.997	.997	.997	.997	.997	.997
FCONVL(1,9,4)	1.	1.	1.	1.	1.	1.	1.	1.	1.
\$ FCONVL PB CASE 5: LATE LEAK									
FCONVL(1,1,5)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONVL(1,2,5)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONVL(1,3,5)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONVL(1,4,5)	1.	.006	.006	.006	.006	.006	.006	.006	.006
FCONVL(1,5,5)	1.	.042	.042	.042	.042	.042	.042	.042	.042
FCONVL(1,6,5)	1.	.098	.098	.098	.098	.098	.098	.098	.098

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FCONVL(1,7,5) 1. .173 .173 .173 .173 .173 .173 .173 .173
FCONVL(1,8,5) 1. .250 .250 .250 .250 .250 .250 .250 .250
FCONVL(1,9,5) 1. .329 .329 .329 .329 .329 .329 .329 .329
$ FCONVL PB CASE 6: LATE RUPTURE
FCONVL(1,1,6) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,2,6) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,3,6) 1. .001 .001 .001 .001 .001 .001 .001 .001
FCONVL(1,4,6) 1. .014 .014 .014 .014 .014 .014 .014 .014
FCONVL(1,5,6) 1. .067 .067 .067 .067 .067 .067 .067 .067
FCONVL(1,6,6) 1. .170 .170 .170 .170 .170 .170 .170 .170
FCONVL(1,7,6) 1. .273 .273 .273 .273 .273 .273 .273 .273
FCONVL(1,8,6) 1. .314 .314 .314 .314 .314 .314 .314 .314
FCONVL(1,9,6) 1. .339 .339 .339 .339 .339 .339 .339 .339
$ FCONVL: NO CONTAINMENT FAILURE CASE
FCONVL(1,1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,2,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,3,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,4,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,5,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,6,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,7,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,8,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
FCONVL(1,9,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
1.0E-6
$*****
**
$ FCONC: CONTAINMENT RELEASE FRACTION AFTER VESSEL BREACH: ALL NINE
GROUPS
$ FCONCL PB CASE 1: EARLY LEAK, SUBCOOLED POOL
FCONCL(1,1,1) 1. .002 .002 .002 .002 .002 .002 .002 .002
FCONCL(1,2,1) 1. .008 .008 .008 .008 .008 .008 .008 .008
FCONCL(1,3,1) 1. .026 .026 .022 .022 .022 .022 .022 .022
FCONCL(1,4,1) 1. .145 .145 .111 .111 .111 .111 .111 .111
FCONCL(1,5,1) 1. .331 .331 .293 .293 .293 .293 .293 .293
FCONCL(1,6,1) 1. .546 .546 .531 .531 .531 .531 .531 .531
FCONCL(1,7,1) 1. .783 .783 .783 .783 .783 .783 .783 .783
FCONCL(1,8,1) 1. .895 .895 .895 .895 .895 .895 .895 .895
FCONCL(1,9,1) 1. .996 .996 .996 .996 .996 .996 .996 .996
$ FCONCL PB CASE 2: EARLY LEAK, SATURATED POOL
FCONCL(1,1,2) 1. .006 .006 .006 .006 .006 .006 .006 .006
FCONCL(1,2,2) 1. .017 .017 .014 .014 .014 .014 .014 .014
FCONCL(1,3,2) 1. .051 .051 .036 .036 .036 .036 .036 .036
FCONCL(1,4,2) 1. .161 .161 .133 .133 .133 .133 .133 .133
FCONCL(1,5,2) 1. .281 .281 .256 .256 .256 .256 .256 .256
FCONCL(1,6,2) 1. .477 .477 .445 .445 .445 .445 .445 .445
FCONCL(1,7,2) 1. .730 .730 .730 .730 .730 .730 .730 .730
FCONCL(1,8,2) 1. .865 .865 .865 .865 .865 .865 .865 .865
FCONCL(1,9,2) 1. .997 .997 .997 .997 .997 .997 .997 .997
$ FCONCL PB CASE 3: EARLY RUPTURE, SUBCOOLED POOL
FCONCL(1,1,3) 1. .010 .010 .010 .010 .010 .010 .010 .010
FCONCL(1,2,3) 1. .100 .100 .040 .040 .040 .040 .040 .040
FCONCL(1,3,3) 1. .225 .225 .163 .163 .163 .163 .163 .163
FCONCL(1,4,3) 1. .528 .528 .468 .468 .468 .468 .468 .468

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FCONCL(1,5,3)	1.	.755	.755	.729	.729	.729	.729	.729	.729
FCONCL(1,6,3)	1.	.898	.898	.878	.878	.878	.878	.878	.878
FCONCL(1,7,3)	1.	.991	.991	.991	.991	.991	.991	.991	.991
FCONCL(1,8,3)	1.	.998	.998	.998	.998	.998	.998	.998	.998
FCONCL(1,9,3)	1.	1.	1.	1.	1.	1.	1.	1.	1.
\$ FCONCL PB CASE 4: EARLY RUPTURE, SATURATED POOL									
FCONCL(1,1,4)	1.	.026	.026	.011	.011	.011	.011	.011	.011
FCONCL(1,2,4)	1.	.160	.160	.041	.041	.041	.041	.041	.041
FCONCL(1,3,4)	1.	.276	.276	.161	.161	.161	.161	.161	.161
FCONCL(1,4,4)	1.	.535	.535	.480	.480	.480	.480	.480	.480
FCONCL(1,5,4)	1.	.752	.752	.708	.708	.708	.708	.708	.708
FCONCL(1,6,4)	1.	.901	.901	.886	.886	.886	.886	.886	.886
FCONCL(1,7,4)	1.	.978	.978	.978	.978	.978	.978	.978	.978
FCONCL(1,8,4)	1.	.996	.996	.996	.996	.996	.996	.996	.996
FCONCL(1,9,4)	1.	1.	1.	1.	1.	1.	1.	1.	1.
\$ FCONCL PB CASE 5: LATE LEAK									
FCONCL(1,1,5)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONCL(1,2,5)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONCL(1,3,5)	1.	0.	0.	.001	.001	.001	.001	.001	.001
FCONCL(1,4,5)	1.	.006	.006	.014	.009	.014	.009	.009	.009
FCONCL(1,5,5)	1.	.042	.042	.063	.049	.063	.049	.056	.056
FCONCL(1,6,5)	1.	.098	.098	.121	.104	.121	.104	.117	.117
FCONCL(1,7,5)	1.	.173	.173	.273	.235	.273	.235	.256	.256
FCONCL(1,8,5)	1.	.250	.250	.449	.421	.449	.421	.441	.441
FCONCL(1,9,5)	1.	.329	.329	.541	.494	.541	.494	.495	.495
\$ FCONCL PB CASE 6: LATE RUPTURE									
FCONCL(1,1,6)	1.	0.	0.	0.	0.	0.	0.	0.	0.
FCONCL(1,2,6)	1.	0.	0.	.001	.001	.001	.001	.001	.001
FCONCL(1,3,6)	1.	.001	.001	.003	.003	.003	.003	.003	.003
FCONCL(1,4,6)	1.	.014	.014	.032	.019	.032	.019	.019	.019
FCONCL(1,5,6)	1.	.067	.067	.095	.085	.095	.085	.085	.085
FCONCL(1,6,6)	1.	.170	.170	.212	.190	.212	.190	.190	.190
FCONCL(1,7,6)	1.	.273	.273	.755	.750	.755	.750	.750	.750
FCONCL(1,8,6)	1.	.314	.314	.911	.911	.911	.911	.911	.911
FCONCL(1,9,6)	1.	.339	.339	.947	.947	.947	.947	.947	.947
\$ FCONCL: NO CONTAINMENT FAILURE CASE									
FCONCL(1,1,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,2,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,3,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,4,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,5,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,6,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,7,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,8,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
FCONCL(1,9,7)	0.005	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6	1.0E-6
\$*****									
**									
\$ DFVPA: SUPPRESSION POOL DF DURING IN-VESSEL RELEASE									
\$ PB ONE CASE: NUREG/CR-4551									
DFVPAL(1,1,1)	1.	1.	1.	1.	1.	1.	1.	1.	1.
DFVPAL(1,2,1)	1.	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
DFVPAL(1,3,1)	1.	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
DFVPAL(1,4,1)	1.	45.	45.	45.	45.	45.	45.	45.	45.

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```

DFVPAL(1,5,1)  1.    81.   81.   81.   81.   81.   81.   81.   81.
DFVPAL(1,6,1)  1.   140.  140.  140.  140.  140.  140.  140.  140.
DFVPAL(1,7,1)  1.  1200. 1200. 1200. 1200. 1200. 1200. 1200. 1200.
DFVPAL(1,8,1)  1.  3700. 3700. 3700. 3700. 3700. 3700. 3700. 3700.
DFVPAL(1,9,1)  1.  5000. 5000. 5000. 5000. 5000. 5000. 5000. 5000.
$*****
**
$ DFCPA: SUPPRESSION POOL DF THRU VENT PIPES
$   PB ONE CASE: NUREG/CR-4551
DFCPAL(1,1,1)  1.    1.    1.    1.    1.    1.    1.    1.    1.
DFCPAL(1,2,1)  1.   1.04  1.04  1.04  1.04  1.04  1.04  1.04  1.04
DFCPAL(1,3,1)  1.   1.2   1.2   1.2   1.2   1.2   1.2   1.2   1.2
DFCPAL(1,4,1)  1.   5.6   5.6   5.6   5.6   5.6   5.6   5.6   5.6
DFCPAL(1,5,1)  1.   9.5   9.5   9.5   9.5   9.5   9.5   9.5   9.5
DFCPAL(1,6,1)  1.  16.   16.   16.   16.   16.   16.   16.   16.
DFCPAL(1,7,1)  1.  50.   50.   50.   50.   50.   50.   50.   50.
DFCPAL(1,8,1)  1.  87.   87.   87.   87.   87.   87.   87.   87.
DFCPAL(1,9,1)  1. 100.  100.  100.  100.  100.  100.  100.  100.
$*****
*****
$ DFCV:  CAVITY WATER DF FOR CCI RELEASE
$   PB ONE CASE:  WET CAVITY SIMILAR TO BMI-2139 GG TBS
$               (DRAFT NUREG/CR-4551)
DFCAVL(1,1,1)  1.0  1.0   1.0   1.0   1.0   1.0   1.0   1.0   1.0
DFCAVL(1,2,1)  1.0  1.0   1.0   1.0   1.0   1.0   1.0   1.0   1.0
DFCAVL(1,3,1)  1.0  1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1
DFCAVL(1,4,1)  1.0  2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0
DFCAVL(1,5,1)  1.0  4.4   4.4   4.4   4.4   4.4   4.4   4.4   4.4
DFCAVL(1,6,1)  1.0 11.   11.   11.   11.   11.   11.   11.   11.
DFCAVL(1,7,1)  1.0 41.   41.   41.   41.   41.   41.   41.   41.
DFCAVL(1,8,1)  1.0 65.   65.   65.   65.   65.   65.   65.   65.
DFCAVL(1,9,1)  1.0 73.   73.   73.   73.   73.   73.   73.   73.
$*****
*****
$ DFSPRV:  SPRAY DF FOR IN-VESSEL RELEASES
$   DFSPRV PB CASE 1 DRAFT NUREG/CR-4551 (SURRY)
DFSPRVL(1,1,1)  1.0  1.0   1.0   1.0   1.0   1.0   1.0   1.0   1.0
DFSPRVL(1,2,1)  1.0  1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1
DFSPRVL(1,3,1)  1.0  1.3   1.3   1.3   1.3   1.3   1.3   1.3   1.3
DFSPRVL(1,4,1)  1.0  4.2   4.2   4.2   4.2   4.2   4.2   4.2   4.2
DFSPRVL(1,5,1)  1.0 11.   11.   11.   11.   11.   11.   11.   11.
DFSPRVL(1,6,1)  1.0 29.   29.   29.   29.   29.   29.   29.   29.
DFSPRVL(1,7,1)  1.0 78.   78.   78.   78.   78.   78.   78.   78.
DFSPRVL(1,8,1)  1.0 95.   95.   95.   95.   95.   95.   95.   95.

```

Appendix C.2

```

DFSPRVL(1,9,1)  1.0  100.  100.  100.  100.  100.  100.  100.
100.
$*****
*****
$  DFSPRC:  SPRAY DF FOR CCI RELEASES
$      DFSPRC PB CASE 1 DRAFT NUREG/CR-4551 (SURRY)
DFSPRCL(1,1,1)  1.0  1.0  1.0  1.0  1.0  1.0  1.0  1.0  1.0
DFSPRCL(1,2,1)  1.0  1.1  1.1  1.1  1.1  1.1  1.1  1.1  1.1
DFSPRCL(1,3,1)  1.0  1.5  1.5  1.5  1.5  1.5  1.5  1.5  1.5
DFSPRCL(1,4,1)  1.0  7.8  7.8  7.8  7.8  7.8  7.8  7.8  7.8
DFSPRCL(1,5,1)  1.0  17.  17.  17.  17.  17.  17.  17.  17.
DFSPRCL(1,6,1)  1.0  29.  29.  29.  29.  29.  29.  29.  29.
DFSPRCL(1,7,1)  1.0  480. 480. 480. 480. 480. 480. 480.
480.
DFSPRCL(1,8,1)  1.0  860. 860. 860. 860. 860. 860. 860.
860.
DFSPRCL(1,9,1)  1.0  1000. 1000. 1000. 1000. 1000. 1000.
1000.

```


APPENDIX C.3 Other Input Files for the Sample Problem

PBSOR Execution Title, Options, and Input Files Identification
(Unit Number 5)

```

BINNED    $ EXECUTION MODE SWITCH (MUST BE FIRST KEYWORD; 2ND LINE MUST BE TITLE)
LLH WITH AS BASE CASE KEYWORD INPUT FOR PBSOR
$ EXECUTION OPTIONS
$PRTINP    $ ECHO INPUT
CONSFL     $ KEEP CONSEQUENCE INPUT DATA
$SUMWGT    $ PRODUCE REDUCED DIMENSION FILE
$KPBYRUN   $ USE OBSERVATION SPECIFIC BINS
REPORTB    $ PRINT BIN TRANSLATION RESULTS
DIAG       $ PRINT INTERMEDIATE DIAGNOSTIC VALUES
EXPERT     $ EXPERT OPINION TABLES
$ FILE ASSIGNMENTS
DEFAULT    MEDIAN.DAT          $ DEFAULT PARAMETER VALUES FILE
BINFILE    MEDIAN.KEP          $ BIN DEFINITIONS
VECPOS     PB_VECPOS.DAT       $ SAMPLE VECTOR POSITIONS
SAMPLE    1  2  LHS.DAT      $ SAMPLE VECTOR FILE, 1 SAMPLE STARTING WITH SAMPLE 2

```

Appendix C.3

PBSOR Accident Progression Bins Data for Sample Problem (file Name: MEDIAN.KEP)

PEACH BOTTOM ACCIDENT SEQUENCES: LHS TEST 2/15/89

10 8

AAAAAAAAABA

BAACCBAAAA

CAAEDCAACA

DAAAEAAABA

EAFAFBAABA

DAAAGAAABE

FAAAHAAABA

GAAAHAAAAA

PBSOR Vector Position Data for Sample Problem
(file name: PB_VECPOS.DAT)

```
$  
$ PEACH BOTTOM LATIN HYPERCUBE SAMPLE VECTOR POSTIIONS FILE,  
$ USED TO DEFINE LOCATION OF SOURCE TERM ISSUE INFORMATION  
$ IN LHS SAMPLE  
$ (1) FCOR, (2) FVES, (3) FREVO, (4) FCCI, (5) FCONV, (6) FCONC,  
$ (7) FLTI1, (8) FLTI2, (9) RBDF, (10) FDCH, (11) DFVPA, (12) DF CPA,  
$ (13) DFCAV, (14) DFSPRV, (15) DFSPRC, (16) FEVSE  
$  
  VALISS  1 2 3 4 5 6 7 7 8 9 10 10 11 12 12 13
```

Appendix C.3

PBSOR LHS Data for Sample Problem (file name: LHS.DAT)

1	15	0.823	0.091	0.810	0.637	0.995	0.785	0.662	0.830	0.672	0.150
0.042	0.766	0.743	0.984	0.397							
2	15	0.736	0.343	0.009	0.842	0.330	0.651	0.703	0.061	0.169	0.344
0.011	0.739	0.282	0.133	0.425							
3	15	0.805	0.006	0.554	0.666	0.558	0.006	0.926	0.944	0.452	0.780
0.167	0.546	0.096	0.754	0.872							
4	15	0.222	0.768	0.833	0.827	0.610	0.484	0.014	0.896	0.684	0.421
0.412	0.938	0.964	0.244	0.826							
5	15	0.170	0.953	0.629	0.692	0.178	0.068	0.029	0.028	0.457	0.015
0.490	0.749	0.188	0.370	0.046							
6	15	0.440	0.651	0.830	0.007	0.461	0.454	0.384	0.177	0.989	0.503
0.376	0.798	0.351	0.376	0.204							
7	15	0.778	0.768	0.532	0.133	0.487	0.364	0.522	0.456	0.172	0.038
0.123	0.998	0.794	0.586	0.073							
8	15	0.681	0.824	0.156	0.817	0.648	0.303	0.901	0.452	0.171	0.208
0.456	0.781	0.334	0.922	0.575							
9	15	0.147	0.224	0.358	0.055	0.478	0.109	0.029	0.794	0.710	0.848
0.112	0.603	0.508	0.503	0.307							
10	15	0.123	0.956	0.902	0.034	0.965	0.650	0.628	0.265	0.918	0.342
0.670	0.035	0.851	0.086	0.723							

APPENDIX C.4 PBSOR Procedure File

```
$ SET DEFAULT [JDJOHNS.PBSOR]
$ ASSIGN PBSOR.INP FOR005
$ ASSIGN PBSOR.OUT FOR006
$ ASSIGN PBSOR.CFL FOR009
$ RUN PBSOR
```

LLH WITH AS BASE CASE KEYWORD INPUT FOR PBSOR

	10	9	8	1						
2	AAAAAAABA									
3.9600E+03	3.9600E+03	3.6000E+03	1.2960E+04	2.1600E+04	3.0000E+01					
3.2236E+06	9.9412E-01	1.0582E-02	5.6681E-03	1.5913E-03	3.8836E-05	4.2836E-05	2.5481E-06	6.3578E-06	6.4468E-05	
2.4492E+05	5.8828E-03	1.4042E-02	3.2750E-02	7.7969E-02	1.8645E-01	1.4194E-04	1.1475E-02	2.3774E-02	1.4628E-01	
2	BAACCBAAAA									
3.9600E+03	1.2960E+04	3.6000E+03	1.6560E+04	2.1600E+04	3.0000E+01					
3.2236E+06	1.0000E+00	1.7618E-03	2.4508E-03	4.9641E-04	3.6184E-05	8.9755E-05	3.2741E-05	3.2832E-05	7.0311E-05	
2.4492E+05	0.0000E+00	6.0659E-03	4.9452E-03	1.3072E-02	3.1452E-02	5.8068E-06	1.9296E-03	4.0048E-03	2.4667E-02	
2	CAAEDCAACA									
3.9600E+03	2.1960E+04	1.8000E+02	2.2140E+04	1.4400E+04	3.0000E+01					
6.4472E+07	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
3.6738E+05	1.0000E+00	8.8988E-03	1.4842E-02	5.1257E-02	1.0990E-01	2.5360E-05	6.7422E-03	1.3993E-02	8.6199E-02	
2	DAAAEAAABA									
1.7280E+04	1.7280E+04	9.0000E+03	2.6280E+04	3.6000E+03	3.0000E+01					
6.3652E+06	9.9412E-01	3.1357E-02	1.6796E-02	4.7380E-03	1.1563E-04	1.2755E-04	7.5870E-06	1.8930E-05	1.9195E-04	
9.1221E+06	5.8828E-03	3.5053E-02	5.3965E-02	1.3414E-01	3.2079E-01	2.4421E-04	1.9742E-02	4.0903E-02	2.5168E-01	
2	EAAAFBAABA									
3.9600E+03	1.2960E+04	1.8000E+02	1.3140E+04	1.4400E+04	3.0000E+01					
6.4472E+07	1.0000E+00	4.0841E-03	5.7971E-03	1.0730E-03	7.3186E-05	1.8899E-04	6.4714E-05	6.5343E-05	1.5505E-04	
3.6738E+05	0.0000E+00	1.6795E-02	4.7432E-02	1.3019E-01	3.1324E-01	5.7832E-05	1.9217E-02	3.9885E-02	2.4566E-01	
2	DAAAGAAABB									
1.7280E+04	1.7280E+04	9.0000E+03	2.6280E+04	3.6000E+03	3.0000E+01					
0.0000E+00	9.9412E-01	6.1888E-03	3.3150E-03	9.2390E-04	2.2548E-05	2.4871E-05	1.4794E-06	3.6913E-06	3.7430E-05	
0.0000E+00	5.8828E-03	3.2196E-02	1.4645E-02	2.3419E-02	5.4080E-02	2.2276E-04	3.3887E-03	6.9516E-03	4.2520E-02	
2	FAAAHAAABA									
1.4400E+04	1.8000E+04	9.0000E+03	2.7000E+04	3.6000E+03	3.0000E+01					
7.6781E+05	9.9412E-01	1.1551E-03	4.3229E-04	2.3949E-04	7.3496E-06	8.1067E-06	4.8222E-07	1.2032E-06	1.2200E-05	
7.6295E+06	5.8828E-03	1.5662E-02	1.1506E-02	1.8153E-02	4.1918E-02	1.7267E-04	2.6266E-03	5.3883E-03	3.2958E-02	
2	GAAAHAAAAA									
2.8800E+04	3.6000E+04	9.0000E+03	4.5000E+04	3.6000E+03	3.0000E+01					
7.6781E+05	9.9412E-01	3.0281E-04	1.1333E-04	6.2782E-05	1.9267E-06	2.1252E-06	1.2642E-07	3.1542E-07	3.1984E-06	
7.6295E+06	5.8828E-03	1.5917E-02	1.1506E-02	1.8153E-02	4.1918E-02	1.7267E-04	2.6266E-03	5.3883E-03	3.2958E-02	

APPENDIX D GGSOR FILES

APPENDIX D.1 GGSOR FORTRAN LISTING

```
PROGRAM GGSOR
C*****ADAPTATION OF RELTRAC INPUT PROCESSOR FOR USE IN GGSOR
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
      1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
C
C
C*****READ KEYWORDS AND RELATED INFORMATION FROM UNIT 5.
C*****KEYWORDS DETERMINE OPERATION OF RELCLC:
C***** (1) BINNED INPUT WITH SAMPLING
C***** (2) BINNED INPUT WITHOUT SAMPLING
C***** (3) DIRECT INPUT WITH SAMPLING
C***** (4) DIRECT INPUT WITHOUT SAMPLING
      CALL INPUT
C*****CHECK FOR BINNED EXECUTION
      IF (BINNED) THEN
C*****CHECK FOR SAMPLING EXECUTION
      IF (SAMPLE) THEN
C*****BINNED INPUT WITH SAMPLING
      CALL BINSMP
      ELSE
C*****BINNED INPUT WITHOUT SAMPLING
      CALL BIN
      ENDIF
      ELSE
C*****CHECK FOR SAMPLING EXECUTION
      IF (SAMPLE) THEN
C*****DIRECT INPUT WITH SAMPLING
      CALL DIRSMP
      ELSE
C*****DIRECT INPUT WITHOUT SAMPLING
      CALL DIR
      ENDIF
      ENDIF
      STOP
      END
      SUBROUTINE INPUT
C*****PROCESS KEYWORD INPUT ON UNIT 5
      PARAMETER (MAXLEN=101)
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
```


Appendix D.1

```

1    EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
    CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
    COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
    CHARACTER*80 FILNAM
    CHARACTER*80 DEFFIL, SAMFIL, VECFIL
    COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL
    CHARACTER CARD*(MAXLEN), CVAL*(MAXLEN), KEYWRD*20
C*****SET LOGICAL TYPES FOR FREE FORMAT SUBROUTINE RDSTRG
    LOGICAL EOR, LVAL, TYPE(4)

C
C
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
    IC=1
C*****READ RECORD
    READ(5,1001) CARD
C*****READ MODE SWITCH
    CALL RDSTRG (CARD, IC, KEYWRD, LVAL, IVAL, RVAL,
KLNTH, TYPE,
1          EOR)
C*****CHECK FOR BINNED OR DIRECT EXECUTION
    IF (KEYWRD(1:KLNTH) .EQ. 'BINNED') THEN
C*****SET BINNED EXECUTION TYPE
        BINNED=.TRUE.
    ELSE IF (KEYWRD(1:KLNTH) .EQ. 'DIRECT') THEN
C*****SET DIRECT EXECUTION TYPE
        BINNED=.FALSE.
    ELSE
C*****MODE SWITCH WAS NEITHER BINNED NOR DIRECT SO PRINT
        ERROR MESSAGE
        WRITE(6,5030)
        STOP
    ENDIF
C*****SET DEFAULT VALUES
    SAMPLE=.FALSE.
    NOCALC=.FALSE.
    PRTINP=.FALSE.
    NOBS=1
    REPRTB=.FALSE.
    BYRUN=.FALSE.
    CONSFL=.FALSE.
    DIAG=.FALSE.
    EXPERT=.FALSE.
C*****INITIALIZE NUMBER OF BINS
    NBIN=0
C*****READ TITLE
    READ(5,1001) TITLE
C*****PRINT MESSAGE FOR EXECUTION TYPE AND TITLE
    WRITE(6,1003) KEYWRD(1:KLNTH), TITLE
    WRITE(6,1002) CARD
    WRITE(6,1002) TITLE
C*****PROCESS KEYWORDS
    666 CONTINUE
C*****READ RECORD
    READ(5,1001,END=6000) CARD
    WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
    IC=1
    500 CONTINUE
C*****READ CHARACTER STRING FOR COMPARISON AGAINST KEYWORDS

```

Appendix D.1

```

      CALL RDSTRG (CARD, IC, KEYWRD, LVAL, IVAL, RVAL,
KLNGTH, TYPE,
      1      EOR)
C*****CHECK FOR END-OF-RECORD
      IF (EOR) GO TO 666
C*****CHECK CHARACTER STRING AGAINST KEYWORDS
      IF (KEYWRD(1:KLNGTH) .EQ. 'SAMPLE') THEN
C*****SET SAMPLE TYPE TO .TRUE.
      SAMPLE=.TRUE.
C*****OBTAIN SAMPLE INFORMATION
C*****OBTAIN NUMBER OF SAMPLE VECTORS TO BE EXECUTED
      CALL RDSTRG (CARD, IC, CVAL, LVAL, NOBS, RVAL,
LENGTH, TYPE,
      1      EOR)
C*****CHECK FOR INTEGER VALUE
      IF (TYPE(3)) THEN
C*****OBTAIN SAMPLE VECTOR NUMBER TO BEGIN EXECUTION
      CALL RDSTRG (CARD, IC, CVAL, LVAL, NSTART, RVAL,
LENGTH,
      1      TYPE, EOR)
C*****CHECK FOR INTEGER VALUE
      IF (TYPE(3)) THEN
C*****OBTAIN NAME OF FILE CONTAINING SAMPLE VECTORS
      CALL RDSTRG (CARD, IC, FILNAM, LVAL, IVAL,
RVAL, LENGTH,
      1      TYPE, EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (TYPE(1)) THEN
C*****CHARACTER VALUE FOUND, OPEN SAMPLE VECTOR
FILE
      OPEN(3, FILE=FILNAM, STATUS='OLD',
ERR=8000, READONLY)
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9200
      ENDIF
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9100
      ENDIF
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9100
      ENDIF
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'NORUN') THEN
C*****SET TYPE FOR VALIDATION OF INPUT ONLY, NO EXECUTION
      NOCALC=.TRUE.
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'DEFAULT') THEN
C*****READ NAME OF FILE CONTAINING DEFAULT VALUES
      CALL RDSTRG (CARD, IC, DEFFIL, LVAL, IVAL, RVAL,
LENGTH, TYPE,
      1      EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (.NOT. TYPE(1)) GO TO 9100
      ELSE IF (KEYWRD(1:KLNGTH) .EQ. 'VECPOS') THEN
C*****READ NAME OF FILE CONTAINING SAMPLE VECTOR POSTION
INFORMATION
      CALL RDSTRG (CARD, IC, SAMFIL, LVAL, IVAL, RVAL,
LENGTH, TYPE,
      1      EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (.NOT. TYPE(1)) GO TO 9100

```

Appendix D.1

```

      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'BINFILE') THEN
C*****READ A BIN ARRAY FILE
C*****CHECK FOR BINNED EXECUTION
      IF (BINNED) THEN
C*****READ NAME OF FILE CONTAINING BIN INFORMATION
      CALL RDSTRG (CARD, IC, FILNAM, LVAL, IVAL, RVAL,
LENGTH,
      1, TYPE, EOR)
C*****CHECK FOR CHARACTER VALUE
      IF (TYPE(1)) THEN
C*****CHARACTER VALUE FOUND SO OPEN BIN FILE
      OPEN(4, FILE=FILNAM, STATUS='OLD', ERR=8000,
READONLY)
      ELSE
C*****PRINT ERROR MESSAGE
      GO TO 9200
      ENDIF
      ELSE
C*****NO BINS USED FOR DIRECT EXECUTION, PRINT ERROR
MESSAGE
      GO TO 9300
      ENDIF
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'PRTINP') THEN
C*****SET CONTROL FLAG PRTINP
      PRTINP=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'REPORTB') THEN
C*****SET CONTROL FLAG REPORTB
      REPRTB=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'KPBYRUN') THEN
C*****SET CONTROL FLAG KPBYRUN
      BYRUN=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'CONSFL') THEN
C*****SET CONTROL FLAG CONSFL
      CONSFL=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'DIAG') THEN
C*****SET DIAGNOSTIC PRINT CONTROL FLAG DIAG
      DIAG=.TRUE.
      ELSE IF (KEYWRD(1:KLNTH) .EQ. 'EXPERT') THEN
C*****SET EXPERT OPINION CONTROL FLAG EXPERT
      EXPERT=.TRUE.
      ELSE
C*****INVALID KEYWORD, PRINT ERROR MESSAGE
      WRITE(6,5020) KEYWRD(1:KLNTH)
      NOCALC=.TRUE.
      ENDIF
      GO TO 500
      6000 CONTINUE
C*****VALIDATE COMBINATION OF FLAGS
      IF (EXPERT .AND. ((.NOT. BINNED) .OR. (.NOT. SAMPLE)))
THEN
      WRITE(6,6001)
      S'OP
      ENDIF
      IF (NOCALC) STOP
C*****PRINT CONTROL INFORMATION
      IF (SAMPLE) WRITE(6,5025) NOBS, NSTART
C*****CALCULATE TOTAL NUMBER OF SOURCE TERMS FOR
BINNED/SAMPLED EXECUTION
      IF (BINNED .AND. BYRUN) THEN
C*****READ BIN FILE TO DETERMINE TOTAL NUMBER OF SOURCE
TERMS

```

Appendix D.1

```

        NTOT=0
        NSAMPL=NSTART + NOBS - 1
        DO 7000 IOBS=1,NSAMPL
            READ(4,1001) BTITLE
            READ(4,*) NDM, NBIN
            IF (IOBS .GE. NSTART) NTOT=NTOT + NBIN
            IF (NBIN .GT. 0) READ(4,1001)
        (BINARR(1)(1:NDM),I=1,NBIN)
        7000    CONTINUE
            REWIND 4
        ENDIF
        RETURN
C*****FILE OPEN ERROR
        8000    WRITE(6,5022) FILNAM, KEYWRD(1:KLENGTH)
            NOCALC=.TRUE.
            GO TO 500
        9100    CONTINUE
C*****PRINT ERROR MESSAGE FOR WRONG TYPE OF VARIABLE
            WRITE(6,9101) KEYWRD(1:KLENGTH)
            NOCALC=.TRUE.
            GO TO 500
        9200    CONTINUE
C*****PRINT ERROR MESSAGE FOR NO FILE NAME
            WRITE(6,9201) KEYWRD(1:KLENGTH)
            NOCALC=.TRUE.
            GO TO 500
        9300    CONTINUE
C*****PRINT ERROR MESSAGE FOR BINNED KEYWORD USED FOR DIRECT
EXECUTION
            WRITE(6,9301) KEYWRD(1:KLENGTH)
            NOCALC=.TRUE.
            GO TO 500
        9500    CONTINUE
C*****PRINT ERROR MESSAGE FOR INVALID EVENT NAME FOR OFFSET
CONTROL
            WRITE(6,9501) KEYWRD(1:KLENGTH), CVAL(1:LENGTH)
            NOCALC=.TRUE.
            GO TO 500
C*****FORMAT STATEMENTS
        1001    FORMAT(A)
        1002    FORMAT(11X,A)
        1003    FORMAT(/1X,130(' '),
            1      /1X,48(' '),5X,'GGSOR ',A,'
EXECUTION',5X,48(' '),
            2      /1X,20(' '),5X,A,5X,20(' '),
            3      /1X,130(' '),/)
        1004    FORMAT(1X,A)
        5020    FORMAT(1X,'>>>>UNRECOGNIZED KEYWORD (' ,A,')',/)
        5022    FORMAT(1X,'>>>>OPEN ERROR ON FILE ',A,' FOR KEYWORD
',A,/)
        5025    FORMAT(/1X,'THE INPUT WILL BE SAMPLED WITH ',I4,
            1      ' SAMPLE VECTOR(S) STARTING WITH SAMPLE VECTOR
',I4,/)
        5030    FORMAT(1X,'>>>>UNRECOGNIZED MODE SWITCH',/)
        6001    FORMAT(1X,'>>>>BINNED AND SAMPLE FLAGS MUST BE
SPECIFIED ',
            1      ' TO USE EXPERT OPINION TABLES')
        9101    FORMAT(1X,'>>>>VALUE(S) FOLLOWING KEYWORD ',A,'
INVALID',/)
        9201    FORMAT(1X,'>>>>NO FILE NAME FOUND FOLLOWING KEYWORD
',A,/)

```

Appendix D.1

```

9301 FORMAT(1X,'>>>>INVALID KEYWORD (' ,A,') SPECIFIED FOR
DIRECT ',
      1      'EXECUTION',/)
9501 FORMAT(1X,'>>>>UNABLE TO LOCATE EVENT NAME ' ,A, '
DURING ',
      1      'PROCESSING OF KEYWORD ' ,A,/)
      END
      SUBROUTINE DIR
C*****IMPLEMENTS GGSOR RUNS WHICH INVOLVE DIRECT INPUT
WITHOUT
C*****SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1      MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2      MAXSPC=10, MAXTIM=10)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAL, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
      1      NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
      2      ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
      3      LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1      EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
      1      EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
      1      STL(MAXSPC), STIL, STRVOL(MAXSPC),
      2      ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
      1      DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
      2      FCCI(MAXSPC), DFCVAV(MAXSPC),
VBPUF(MAXSPC),
      3      FCONV(MAXSPC), FCONC(MAXSPC),
DFSPRV(MAXSPC),
      4      DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
      5      FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
      6      FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
      7      FTLPL, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
      8      TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
      9      ELEV, PUFF

```

Appendix D.1

```

COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS),
FVSE0(MAXSPC,MAXCAS),
1 DFVPA0(MAXSPC,MAXCAS),
DFCPA0(MAXSPC,MAXCAS),
2 FDCH0(MAXSPC,MAXCAS),
FEVSE0(MAXSPC,MAXCAS),
3 FCCI0(MAXSPC,MAXCAS),
DFCAV0(MAXSPC,MAXCAS),
4 VBPUFO(MAXSPC,MAXCAS),
FCONV0(MAXSPC,MAXCAS),
5 FCONCO(MAXSPC,MAXCAS),
DFSPRV0(MAXSPC,MAXCAS),
6 DFSPRCO(MAXSPC,MAXCAS),
FREVO0(MAXSPC,MAXCAS),
7 FLTI10(MAXCAS), FLTI20(MAXCAS),
FHPE0(MAXCAS),
8 EVSE0(MAXCAS), FPLBY0(3), TWO(MAXTIM),
9 T10(MAXTIM), DT10(MAXTIM),
DT20(MAXTIM),
A PUFFO(MAXTIM)
COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1 FVESL(MAXSPC,MAXLEV,MAXCAS),
2 FREVOL(MAXSPC,MAXLEV,MAXCAS),
3 FCCIL(MAXSPC,MAXLEV,MAXCAS),
4 FCONVL(MAXSPC,MAXLEV,MAXCAS),
5 FCONCL(MAXSPC,MAXLEV,MAXCAS),
6 FLTI1L(MAXLEV,MAXCAS),
FLTI2L(MAXLEV,MAXCAS),
7 FDCHL(MAXSPC,MAXLEV,MAXCAS),
8 FEVSEL(MAXSPC,MAXLEV,MAXCAS),
9 DFVPAL(MAXSPC,MAXLEV,MAXCAS),
A DFCPAL(MAXSPC,MAXLEV,MAXCAS),
B DFCAVL(MAXSPC,MAXLEV,MAXCAS),
C DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
D DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
E PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)
DATA IOBS / 1 / , IBIN / 1 /

C
C
C*****SET NUMBER OF SAMPLE VALUES
NVART=1
XLHS(1)=0.0
C*****DEFINE VARIABLE NAMES FOR DEFAULT INPUT
CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM
FILE DEFFIL
CALL SETDEF
C*****PRINT DEFAULT VALUE INFORMATION
IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR
ENCOUNTERED
C*****DURING READING OF INPUT DATA
IF (NOCALC) THEN
C*****PRINT MESSAGE
WRITE(6,1010)
STOP
ENDIF
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****PRINT CONTENTS OF COMMON BLOCKS

```

Appendix D.1

```

      IF (REPRTB) CALL WRREL
C*****SET TOTAL NUMBER OF SOURCE TERMS
      NTOT=1
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
      IF (CONSFL) WRITE(9,1006) TITLE, NDM, NSPEC, NTOT,
NOBS
C*****PERFORM SOURCE TERM CALCULATIONS
      CALL GGSORC (IOBS, IBIN)
C*****PRINT PROCESSING SUMMARY
      WRITE(6,2003)
      RETURN
C*****FORMAT STATEMENTS
      1006 FORMAT(1X,A,/1X,4I10)
      1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION
OF INPUT')
      2003 FORMAT(/1X,'SINGLE DIRECT EXECUTION PROCESSED')
      END
      SUBROUTINE DIRSMP
C*****IMPLEMENTS GGSOR RUNS WHICH INVOLVE DIRECT INPUT WITH
C*****SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
      1          NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
      2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
      3          LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1  EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
      1  EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
      1          STL(MAXSPC), STIL, STRVOL(MAXSPC),
      2          ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
      1          DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
      2          FCCI(MAXSPC), DFCAV(MAXSPC),
VBPUF(MAXSPC),
      3          FCONV(MAXSPC), FCONC(MAXSPC),
DFSFRV(MAXSPC),
      4          DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),

```

Appendix D.1

```

5          FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
6          FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
7          FTLF, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
8          TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
9          ELEV, PUFF
COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS),
FVSE0(MAXSPC,MAXCAS),
1          DFVPA0(MAXSPC,MAXCAS),
DFCPA0(MAXSPC,MAXCAS),
2          FDCHO(MAXSPC,MAXCAS),
FEVSE0(MAXSPC,MAXCAS),
3          FCCIO(MAXSPC,MAXCAS),
DFCAVO(MAXSPC,MAXCAS),
4          VBPUFO(MAXSPC,MAXCAS),
FCONVO(MAXSPC,MAXCAS),
5          FCONCO(MAXSPC,MAXCAS),
DFSPRVO(MAXSPC,MAXCAS),
6          DFSPRCO(MAXSPC,MAXCAS),
FREVO0(MAXSPC,MAXCAS),
7          FLTI10(MAXCAS), FLTI20(MAXCAS),
FHPE0(MAXCAS),
8          EVSE0(MAXCAS), FPLBY0(3), TWO(MAXTIM),
9          T10(MAXTIM), DT10(MAXTIM),
DT20(MAXTIM),
A          PUFF0(MAXTIM)
COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1          FVESL(MAXSPC,MAXLEV,MAXCAS),
2          FREVOL(MAXSPC,MAXLEV,MAXCAS),
3          FCCIL(MAXSPC,MAXLEV,MAXCAS),
4          FCONVL(MAXSPC,MAXLEV,MAXCAS),
5          FCONCL(MAXSPC,MAXLEV,MAXCAS),
6          FLTI1L(MAXLEV,MAXCAS),
FLTI2L(MAXLEV,MAXCAS),
7          FDCHL(MAXSPC,MAXLEV,MAXCAS),
8          FEVSEL(MAXSPC,MAXLEV,MAXCAS),
9          DFVPAL(MAXSPC,MAXLEV,MAXCAS),
A          DFCPAL(MAXSPC,MAXLEV,MAXCAS),
B          DFCAVL(MAXSPC,MAXLEV,MAXCAS),
C          DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
D          DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
E          PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)
C
C
C*****DEFINE VARIABLE NAMES AND POSITION INFORMATION FOR
DEFAULT
C*****INPUT AND SAMPLE VECTOR SUBSTITUTION
CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM
FILE DEFFIL
CALL SETDEF
C*****SET SAMPLE VECTOR POSITIONS
CALL VECPOS
C*****PRINT DEFAULT VALUE AND SAMPLE VECTOR POSITION
INFORMATION
IF (PRTINP) CALL WRTPAR

```


Appendix D.1

```

C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR
ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
          WRITE(6,1010)
          STOP
      ENDIF
C*****SKIP TO STARTING SAMPLE VECTOR
      IF (NSTART .NE. 1) THEN
          DO 1000 ISKIP=1,NSTART-1
              READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
1000      CONTINUE
          ENDIF
C*****SET TOTAL NUMBER OF SOURCE TERMS
          NTOT=NOBS
C*****PROCESS SAMPLE VECTORS
          DO 2000 IOBS=1,NOBS
C*****READ CURRENT SAMPLE VECTOR
              READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
C*****SET NUMBER OF SAMPLE VALUES
              NVART=NLHS
C*****TRANSFER SAMPLE VECTOR VALUES TO DEFAULT ARRAY
              CALL SUBVEC
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
              CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****PRINT CONTENTS OF COMMON BLOCKS
              IF (REPRTB) CALL WRREL
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
              IF (CONSFL .AND. (IOBS .EQ. 1))
1                  WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****PERFORM SOURCE TERM CALCULATIONS
              CALL GGSORC (IOBS+NSTART-1, IBIN)
2000      CONTINUE
C*****PRINT PROCESSING SUMMARY
              IF (NOBS .EQ. 1) THEN
                  WRITE(6,2003) NOBS
              ELSE
                  WRITE(6,2004) NSTART, NSTART+NOBS-1, NOBS
              ENDIF
              RETURN
C*****FORMAT STATEMENTS
1006      FORMAT(1X,A,/1X,4I10)
1010      FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION
OF INPUT')
2003      FORMAT(/1X,I5,' SAMPLE VECTOR PROCESSED')
2004      FORMAT(/1X,'SAMPLE VECTORS ',I4,' THRU ',I5,
1          ' WERE PROCESSED (TOTAL OF ',I5,')')
          END
          SUBROUTINE BIN
C*****IMPLEMENTS GGSOR RUNS WHICH INVOLVE BINNED INPUT
WITHOUT
C*****SAMPLING
          PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
1              MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2              MAXSPC=10, MAXTIM=10)
          CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
          COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
          COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT

```

Appendix D.1

```

CHARACTER*7 NAME
LOGICAL LDEFLT, LREAL
COMMON /DEFLT1/ NAME(MAXVAR)
COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
1 NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
2 ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
3 LREAL(MAXVAL)
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
1 EXPERT, PRTINP, NOCF, SUBCL, CDB, TPCDB, BRKOPN,
VB, ECF, ICF
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
1 EXPERT, PRTINP, NOCF, SUBCL, CDB, TPCDB, BRKOPN,
VB, ECF, ICF
COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
1 STL(MAXSPC), STIL, STRVOL(MAXSPC),
2 ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
1 DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
2 FCCI(MAXSPC), DFCAV(MAXSPC),
VBPUF(MAXSPC),
3 FCONV(MAXSPC), FCONC(MAXSPC),
DFSPRV(MAXSPC),
4 DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
5 FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
6 FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
7 FTLPL, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
8 TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
9 ELEV, PUFF
COMMON /BINNED/ FCORO(MAXSPC,MAXCAS),
FVSEO(MAXSPC,MAXCAS),
1 DFVPA0(MAXSPC,MAXCAS),
DFCPA0(MAXSPC,MAXCAS),
2 FDCHO(MAXSPC,MAXCAS),
FEVSE0(MAXSPC,MAXCAS),
3 FCCIO(MAXSPC,MAXCAS),
DFCAV0(MAXSPC,MAXCAS),
4 VBPUF0(MAXSPC,MAXCAS),
FCONV0(MAXSPC,MAXCAS),
5 FCONC0(MAXSPC,MAXCAS),
DFSPRV0(MAXSPC,MAXCAS),
6 DFSPRC0(MAXSPC,MAXCAS),
FREVO0(MAXSPC,MAXCAS),
7 FLTI10(MAXCAS), FLTI20(MAXCAS),
FHPE0(MAXCAS),
8 EVSE0(MAXCAS), FPLBY0(3), TWO(MAXTIM),
9 T10(MAXTIM), DT10(MAXTIM),
DT20(MAXTIM),
A PUFF0(MAXTIM)

```

Appendix D.1

```

COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1              FVESL(MAXSPC,MAXLEV,MAXCAS),
2              FREVOL(MAXSPC,MAXLEV,MAXCAS),
3              FCCIL(MAXSPC,MAXLEV,MAXCAS),
4              FCONVL(MAXSPC,MAXLEV,MAXCAS),
5              FCONCL(MAXSPC,MAXLEV,MAXCAS),
6              FLT1L(MAXLEV,MAXCAS),
FLT12L(MAXLEV,MAXCAS),
7              FDCHL(MAXSPC,MAXLEV,MAXCAS),
8              FEVSEL(MAXSPC,MAXLEV,MAXCAS),
9              DFVPAL(MAXSPC,MAXLEV,MAXCAS),
A              DFCPAL(MAXSPC,MAXLEV,MAXCAS),
B              DFCAVL(MAXSPC,MAXLEV,MAXCAS),
C              DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
D              DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
E              PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)
DATA IOBS / 1 /

C
C
C*****DEFINE VARIABLE NAMES FOR DEFAULT INPUT
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM
FILE DEFFIL
      CALL SETDEF
C*****PRINT DEFAULT VALUE INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR
ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
        WRITE(6,1010)
        STOP
      ENDIF
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
      CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****ONE SET OF BIN DEFINITIONS IS USED
      READ(4,1001) BTITLE
      READ(4,*) NDM, NBIN
C*****SET NUMBER OF SAMPLE VALUES EQUAL TO VALUE OF BIN
DIMENSION
      NVART=NDM
      IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
        WRITE(6,1011) NBIN, MAXBIN, NBIN
        STOP
      ENDIF
      IF (NBIN .GT. 0) READ(4,1002)
      (BINARR(I)(1:NDM),I=1,NBIN)
      WRITE(6,1003) BTITLE, NBIN, (I,
BINARR(I)(1:NDM),I=1,NBIN)
      WRITE(6,1004)
C*****SET TOTAL NUMBER OF SOURCE TERMS
      NTOT=NBIN
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
      IF (CONSFL) WRITE(9,1006) TITLE, NDM, NSPEC, NTOT,
NOBS
C*****LOOP OVER INDIVIDUAL BINS
      DO 1000 IBIN=1,NBIN

```

Appendix D.1

```

C*****TRANSLATE CURRENT BIN ID TO PARAMETERS FOR USE IN
RELCLC
      CALL BINTRN (IBIN)
C*****PRINT CONTENTS OF COMMON BLOCKS
      IF (REPRTB) CALL WRREL
C*****PERFORM SOURCE TERM CALCULATIONS
      CALL GGSORC (IOBS, IBIN)
      1000 CONTINUE
C*****PRINT NUMBER OF BINS PROCESSED
      WRITE(6,2003) NBIN
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT(A)
      1002 FORMAT(1X,A)
      1003 FORMAT(/1X,130('='),
1          //1X,'BINNING INFORMATION',
2          /1X,A,
3          //1X,'THE FOLLOWING ',I7,' BIN(S) ARE TO BE
PROCESSED:',
4          //(1X,I7,'-',A))
      1004 FORMAT(/1X,130('='),/)
      1006 FORMAT(1X,A,/1X,4I10)
      1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION
OF INPUT')
      1011 FORMAT(/1X,'>>>>NUMBER OF BINS (',I7,') READ FROM
FILE IS ',
1          'LARGER THAN ALLOWED DIMENSION (',I7,')',
2          /1X,'>>>>INCREASE PARAMETER MAXBIN TO AT LEAST
',I7,
3          /1X,'>>>>EXECUTION TERMINATED')
      2003 FORMAT(/1X,I7,' BIN(S) PROCESSED')
      END
      SUBROUTINE BINSMP
C*****IMPLEMENTS GGSOR RUNS WHICH INVOLVE BINNED INPUT WITH
SAMPLING
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2          MAXSPC=10, MAXTIM=10)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
1          NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
3          LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
1          EXPERT, PRITNP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
1          EXPERT, PRITNP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF

```

Appendix D.1

```

COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
1 STL(MAXSPC), STIL, STRVOL(MAXSPC),
2 ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
1 DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
2 FCCI(MAXSPC), DFCAV(MAXSPC),
VBPUF(MAXSPC),
3 FCONV(MAXSPC), FCONC(MAXSPC),
DFSPRV(MAXSPC),
4 DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
5 FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
6 FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
7 FTLPL, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
8 TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
9 ELEV, PUFF
COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS),
FVES0(MAXSPC,MAXCAS),
1 DFVPA0(MAXSPC,MAXCAS),
DFCPA0(MAXSPC,MAXCAS),
2 FDCH0(MAXSPC,MAXCAS),
FEVSE0(MAXSPC,MAXCAS),
3 FCCI0(MAXSPC,MAXCAS),
DFCAV0(MAXSPC,MAXCAS),
4 VBPUF0(MAXSPC,MAXCAS),
FCONV0(MAXSPC,MAXCAS),
5 FCONC0(MAXSPC,MAXCAS),
DFSPRV0(MAXSPC,MAXCAS),
6 DFSPRC0(MAXSPC,MAXCAS),
FREVO0(MAXSPC,MAXCAS),
7 FLTI10(MAXCAS), FLTI20(MAXCAS),
FHPE0(MAXCAS),
8 EVSE0(MAXCAS), FPLBY0(3), TWO(MAXTIM),
9 T10(MAXTIM), DT10(MAXTIM),
DT20(MAXTIM),
A PUFF0(MAXTIM)
COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
1 FVESL(MAXSPC,MAXLEV,MAXCAS),
2 FREVOL(MAXSPC,MAXLEV,MAXCAS),
3 FCCIL(MAXSPC,MAXLEV,MAXCAS),
4 FCONVL(MAXSPC,MAXLEV,MAXCAS),
5 FCONCL(MAXSPC,MAXLEV,MAXCAS),
6 FLTI1L(MAXLEV,MAXCAS),
FLT12L(MAXLEV,MAXCAS),
7 FDCHL(MAXSPC,MAXLEV,MAXCAS),
8 FEVSEL(MAXSPC,MAXLEV,MAXCAS),
9 DFVPAL(MAXSPC,MAXLEV,MAXCAS),
A DFCPAL(MAXSPC,MAXLEV,MAXCAS),
B DFCAVL(MAXSPC,MAXLEV,MAXCAS),
C DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
D DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
E PRBLEV(MAXLEV)
COMMON /LHSBLK/ XLHS(MAXSMP)

```

Appendix D.1

```

C
C
C*****DEFINE VARIABLE NAMES AND POSITION INFORMATION FOR
DEFAULT
C*****INPUT AND SAMPLE VECTOR SUBSTITUTION
      CALL DEFINE
C*****SET DEFAULT VALUE ARRAY BY READING DEFAULT INPUT FROM
FILE DEFFIL
      CALL SETDEF
C*****SET SAMPLE VECTOR POSITIONS
      CALL VECPOS
C*****PRINT DEFAULT VALUE AND SAMPLE VECTOR POSITION
INFORMATION
      IF (PRTINP) CALL WRTPAR
C*****TERMINATE EXECUTION IF ONLY VALIDATING INPUT OR ERROR
ENCOUNTERED
C*****DURING READING OF INPUT DATA
      IF (NOCALC) THEN
C*****PRINT MESSAGE
        WRITE(6,1010)
        STOP
      ENDIF
      IF (.NOT. BYRUN) THEN
C*****READ SET OF BINS WHICH WILL BE USED FOR ALL SAMPLES
        READ(4,1001) BTITLE
        READ(4,*) NDM, NBIN
        IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,1011) NBIN, MAXBIN, NBIN
          STOP
        ENDIF
        IF (NBIN .GT. 0) READ(4,1002)
        (BINARR(I)(1:NDM),I=1,NBIN)
        WRITE(6,1003) IOBS, BTITLE, NBIN,
          1      (I, BINARR(I)(1:NDM),I=1,NBIN)
        WRITE(6,1004)
C*****SET TOTAL NUMBER OF SOURCE TERMS
        NTOT=NBIN * NOBS
      ENDIF
C*****CHECK FOR STARTING SAMPLE VECTOR
      IF (NSTART .NE. 1) THEN
C*****SKIP TO STARTING SAMPLE VECTOR
        DO 1000 ISKIP=1,NSTART-1
C*****READ SAMPLE VECTOR VALUES
          READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
          IF (BYRUN) THEN
C*****READ BIN DEFINITIONS FOR CURRENT SAMPLE
VECTOR
            READ(4,1001) BTITLE
            READ(4,*) NDM, NBIN
            IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
              WRITE(6,1011) NBIN, ISKIP, MAXBIN, NBIN
              STOP
            ENDIF
            IF (NBIN .GT. 0) READ(4,1002)
          1      (BINARR(I)(1:NDM),I=1,NBIN)
            ENDIF
          1000  CONTINUE
        ENDIF
C*****PROCESS SAMPLE VECTOR

```

Appendix D.1

```

DO 3000 IOBS=1,NOBS
C*****READ CURRENT SAMPLE VECTOR VALUES
      READ(3,*) IOBSD, NLHS, (XLHS(I),I=1,NLHS)
C*****VALIDATE NUMBER OF SAMPLE VECTOR VALUES
      IF (NLHS .GT. MAXSMP) THEN
        WRITE(6,1005) NLHS, MAXSMP
        STOP
      ENDIF
C*****TRANSFER SAMPLE VECTOR VALUES
      CALL SUBVEC
C*****TRANSFER DEFAULT VALUE ARRAY TO COMMON BLOCK VALUES
      CALL TRANS (FCOR(1), FCOR0(1,1), FCORL(1,1,1))
C*****WRITE HEADER TO CONSEQUENCE DATA FILE
      IF (CONSFL .AND. (IOBS .EQ. 1))
        1      WRITE(9,1006) TITLE, NDM, NSPEC, NTOT, NOBS
C*****USE EXPERT OPINION TABLES
      IF (EXPERT) CALL EXPTAB
C*****CHECK FOR SEPARATE BIN DEFINITIONS FOR EACH SAMPLE
      IF (BYRUN) THEN
C*****READ SET OF BINS FOR CURRENT SAMPLE
        READ(4,1001) BTITLE
        READ(4,*) NDM, NBIN
        IF (NBIN .GT. MAXBIN) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,1011) NBIN, NSTART+IOBS-1, MAXBIN,
NBIN
          STOP
        ENDIF
        IF (NBIN .GT. 0) READ(4,1002)
        (BINARR(I))(1:NDM),I=1,NBIN)
        WRITE(6,1003) IOBS, BTITLE, NBIN,
        1      (I, BINARR(I)(1:NDM),I=1,NBIN)
        WRITE(6,1004)
      ENDIF
C*****SET NUMBER OF LHS VARIABLES PLUS NUMBER OF BIN
DEFINITIONS
      NVART=NLHS + NDM
C*****LOOP OVER INDIVIDUAL BINS
      DO 2000 IBIN=1,NBIN
C*****TRANSLATE CURRENT BIN ID TO PARAMETERS FOR USE
IN RELCLC
        CALL BINTRN (IBIN)
C*****PRINT CONTENTS OF COMMON BLOCKS
        IF (REPRTB) CALL WRREL
C*****PERFORM SOURCE TERM CALCULATIONS
        CALL GGSORC (IOBS+NSTART-1, IBIN)
      2000    CONTINUE
C*****PRINT NUMBER OF BINS PROCESSED FOR CURRENT SAMPLE
VECTOR
        WRITE(6,2003) NBIN, IOBS+NSTART-1
      3000    CONTINUE
      RETURN
C*****FORMAT STATEMENTS
      1001    FORMAT(A)
      1002    FORMAT(1X,A)
      1003    FORMAT(/1X,130('='),
        1      /1X,'BINNING INFORMATION FOR SAMPLE VECTOR
',I4,
        2      /1X,A,
        3      /1X,'THE FOLLOWING ',I7,' BIN(S) ARE TO BE
PROCESSED:',

```

Appendix D.1

```

      4          //(1X,I7,'-',A))
1004 FORMAT(/1X,130('='),/)
1005 FORMAT(/1X,'>>>>NUMBER OF SAMPLE VECTOR VALUES (' ,I4,
      1          ') READ FROM UNIT 3 EXCEEDS ',
      2          /1X,'>>>>MAXIMUM NUMBER ALLOWED
(MAXSMP=' ,I4,')',
      3          /1X,'>>>>EXECUTION TERMINATED')
1006 FORMAT(1X,A,/1X,4I10)
1010 FORMAT(/1X,'EXECUTION TERMINATED FOLLOWING VALIDATION
OF INPUT')
1011 FORMAT(/1X,'>>>>NUMBER OF BINS (' ,I7,') READ FROM
UNIT 4, ',
      1          'SAMPLE VECTOR ' ,I4,
      2          ', IS LARGER THAN ALLOWED DIMENSION (' ,I7,')',
      3          /1X,'>>>>INCREASE PARAMETER MAXBIN TO AT LEAST
' ,I7,
      4          /1X,'>>>>EXECUTION TERMINATED')
2003 FORMAT(/1X,I7,' BIN(S) PROCESSED FOR SAMPLE VECTOR
' ,I4)
      END
      SUBROUTINE DEFINE
C*****DEFINE NAMES AND DIMENSIONS OF VARIABLES TO BE SET
THROUGH
C*****DEFAULT INPUT AND SAMPLE VECTOR SUBSTITUTION
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
      1          NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
      2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
      3          LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1          EXPERT, PRINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
      1          EXPERT, PRINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
C*****DEFINE VARIABLE NAMES AND CORRESPONDING DIMENSIONS TO
BE SET
C*****THROUGH DEFAULT AND SAMPLE VECTOR SUBSTITUTION FOR
BINNED
C*****EXECUTION. VARIABLE NAMES AND DIMENSIONS CORRESPOND
EXACTLY
C*****TO ORDER OF VARIABLES IN COMMON BLOCKS:
C***** (1) BASVAL, (2) BINNED, AND (3) EXPERT
C*****AS IF THESE COMMON BLOCKS ARE CONCATENTATED.
      DATA NAME /
      1          'FCOR', 'FVES', 'DFVPA', 'DFCPA',
      2          'FEVSE', 'FDCH', 'FCCI', 'DFCAV',
      3          'VBPUF', 'FCONV', 'FCONC',
      4          'DFSFRV', 'DFSFR', 'FREVO', 'VALISS',

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Appendix D.1

```

5  'FLT11', 'FLT12', 'NSPEC', 'FLV', 'FHPE', 'EVSE',
'WFAC',
6  'PFAC', 'FPLBYE', 'FPLBYP', 'FPLBYD', 'FPLBYC',
'FTLPH',
7  'FTLPL', 'FTLP', 'TC11', 'TC12', 'TB11', 'TB12',
'TB21',
8  'TB22', 'TBS1', 'TBS2', 'TBR1', 'TBR2',
9  'TW', 'T1', 'T2', 'DT1', 'DT2', 'DTCDB', 'ELEV',
'PUFF',
A  'FCORO', 'FVESO', 'DFVPAO',
B  'DFCPAO', 'FDCHO', 'FEVSEO',
C  'FCCIO', 'DFCAVO', 'VBPUFO',
D  'FCONVO', 'FCONCO',
E  'DFSPRVO', 'DFSPRCO', 'FREVOO', 'FLT110',
F  'FLT120', 'FHPEO', 'EVSEO', 'FPLBYO',
G  'TWO', 'T10', 'DT10', 'DT20', 'PUFFO',
H  'FCORL', 'FVESL',
I  'FREVOL', 'FCCIL',
J  'FCONVL', 'FCONCL',
K  'FLT11L', 'FLT12L',
L  'FDCHL', 'FEVSEL',
M  'DFVPAL', 'DFCPAL',
N  'DFCAVL', 'DFSPRVL',
O  'DFSPRCL', 'PRBLEV',
P  12* ' ' /
C*****DEFINE 3 DIMENSIONS FOR EACH OF THE VARIABLES
DATA IDIMEN /
1  MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
2  MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
3  MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1,
4  MAXSPC,1,1, MAXSPC,1,1, MAXSPC,1,1, MAXISS,1,1,
5  1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
6  1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
7  1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
8  1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
9  1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1, 1,1,1,
1,1,1,
A  MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
B  MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
C  MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
D  MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
E  MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1, MAXSPC,MAXCAS,1,
MAXCAS,1,1,
F  MAXCAS,1,1, MAXCAS,1,1, MAXCAS,1,1, 3,1,1,
G  MAXTIM,1,1, MAXTIM,1,1, MAXTIM,1,1, MAXTIM,1,1,
MAXTIM,1,1,
H  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
I  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
J  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
K  MAXLEV,MAXCAS,1, MAXLEV,MAXCAS,1,
L  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
M  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
N  MAXSPC,MAXLEV,MAXCAS, MAXSPC,MAXLEV,MAXCAS,
O  MAXSPC,MAXLEV,MAXCAS, MAXLEV,1,1,
P  36*0 /
C*****DEFINE NUMBERS OF VALUES IN COMMON BLOCKS:
C***** (1) BASVAL, (2) BINNED, AND (3) EXPERT
DATA NVCB1 / 193 /, NVCB2 / 1205 /, NVCB3 / 10570 /,
NVCB4 / 0 /,
1  NVCB5 / 0 /
C

```

Appendix D.1

```

C
C*****INITIALIZE MAXIMUM LENGTH OF VARIABLE NAMES
      NCHAR=7
C*****SET DEFAULT TYPES TO .FALSE.
      DO 1000 I=1,MAXVAL
        LDEFLT(I)=.FALSE.
      1000 CONTINUE
C*****INITIALIZE NUMBER OF VARIABLES
      NVAR=0
C*****INITIALIZE TOTAL NUMBER OF VALUES
      NVAL=1
C*****SET POSITION INFORMATION
      DO 2000 IVAR=1,MAXVAR
C*****CHECK FOR BLANK VARIABLE NAME
        IF (NAME(IVAR) .EQ. ' ') GO TO 3000
C*****INCREMENT NUMBER OF VARIABLES
        NVAR=NVAR + 1
C*****SAVE STARTING POSITION OF CURRENT VARIABLE
        ISPOS(NVAR)=NVAL
C*****CHECK FOR NON-ZERO DIMENSIONS
        IF ((IDIMEN(1,NVAR) .LE. 0) .OR. (IDIMEN(2,NVAR)
        .LE. 0) .OR.
          1 (IDIMEN(3,NVAR) .LE. 0)) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,1001) NAME(IVAR), (IDIMEN(I,NVAR),I=1,3)
          NOCALC=.TRUE.
        ENDIF
C*****INCREMENT TOTAL NUMBER OF VALUES
        NVAL=NVAL +
        IDIMEN(1,NVAR)*IDIMEN(2,NVAR)*IDIMEN(3,NVAR)
      2000 CONTINUE
      3000 CONTINUE
C*****SET TOTAL NUMBER OF VALUES
      NVAL=NVAL - 1
C*****VALIDATE TOTAL NUMBER OF VALUES AGAINST MAXIMUM
      DIMENSION
        IF (NVAL .GT. MAXVAL) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,3001) NVAL, MAXVAL, NVAL
          NOCALC=.TRUE.
        ENDIF
C*****VALIDATE TOTAL NUMBER OF VALUES AGAINST SUM OF VALUES
      IN
C*****DEFAULTED COMMON BLOCKS
        IF (NVAL .NE. NVCB1+NVCB2+NVCB3+NVCB4+NVCB5) THEN
C*****PRINT ERROR MESSAGE
          WRITE(6,3002) NVAL, NVCB1+NVCB2+NVCB3+NVCB4+NVCB5
          NOCALC=.TRUE.
        ENDIF
C*****SET ASCII CODE FOR CHARACTERS I AND N
        ICI=ICHAR('I')
        ICN=ICHAR('N')
C*****INITIALIZE VALUE POINTER
        IVAL=1
C*****SET VARIABLE TYPES
        DO 5000 IVAR=1,NVAR
C*****INITIALIZE POINTER ARRAY
          IPNT(IVAR)=IVAR
C*****SET ASCII CODE FOR FIRST CHARACTER OF VARIABLE NAME
          IC=ICHAR(NAME(IVAR)(1:1))
C*****COMPARE ASCII CODE TO I THRU N RANGE (INTEGER
      VARIABLE)

```

Appendix D.1

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      IF ((IC .GE. ICI) .AND. (IC .LE. ICN)) THEN
C*****SET REAL VARIABLE FLAG TO .FALSE. (INTEGER
VARIABLE)
      LREAL(IVAL)=.FALSE.
      ELSE
C*****SET REAL VARIABLE FLAG TO .TRUE. (REAL VARIABLE)
      LREAL(IVAL)=.TRUE.
      ENDIF
C*****SET ALL TYPES FOR CURRENT VARIABLE
      IFIRST=IVAL
      ILAST=IVAL - 1 +
IDIMEN(1,IVAR)*IDIMEN(2,IVAR)*IDIMEN(3,IVAR)
      DO 4000 I=IFIRST,ILAST
        LREAL(I)=LREAL(IVAL)
      4000 CONTINUE
C*****RESET VALUE POINTER
      IVAL=ILAST + 1
      5000 CONTINUE
C*****ALL INFORMATION FOR VARIABLES THAT MAY BE SET THROUGH
DEFAULT
C*****AND VECTOR POSITION HAS BEEN SAVED
C*****SORT LIST OF VARIABLE NAMES USING POINTER IPNT TO
FACILITATE
C*****SEARCHING
      CALL CSORT (NVAR, NAME, IPNT)
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT(1X,'>>>>DIMENSIONS FOR VARIABLE ',A,' MUST BE
GREATER ',
1      'THAN 0',
2      /1X,'>>>>DIMENSION 1 =',I5,', DIMENSION 2 =',I5,
3      ', DIMENSION 3 =',I5,
4      /1X,'>>>>CHECK VARIABLE DEFINITIONS IN
SUBROUTINE DEFINE',/)
      3001 FORMAT(1X,'>>>>NUMBER OF VARIABLES (NVAR=',I5,')
EXCEEDS ',
1      'DIMENSION (MAXVAR=',I5,')',
2      /1X,'>>>>CHECK VARIABLE DEFINITIONS IN
SUBROUTINE DEFINE ',
3      'AND/OR',
4      /1X,'>>>>RESET PARAMETER MAXVAR TO AT LEAST
',I5,/)
      3002 FORMAT(1X,'>>>>NUMBER OF VALUES WHICH CAN BE SET
THROUGH ',
1      'DEFAULT AND VECTOR SUBSTITUTION (',I5,')',
2      /1X,'>>>>SHOULD BE EQUAL TO THE TOTAL NUMBER OF
VALUES ',
3      'IN THE COMMON BLOCKS TO BE SET ',
4      /1X,'>>>>(NVCB1+NVCB2+NVCB3+NVCB4+NVCB5=',I5,')

5      '-- SUBROUTINE DEFINE',/)
      END
      SUBROUTINE SETDEF
C*****SET DEFAULT VALUES BY READING VARIABLE NAMES AND
CORRESPONDING
C*****VALUES FROM FILE DESIGNATED FOR DEFAULT VALUES
(DEFFIL)
      PARAMETER (MAXLEN=101, MAXVLN=20)
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,

```

Appendix D.1

```

1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2          MAXSPC=10, MAXTIM=10)
  CHARACTER*7 NAME
  LOGICAL LDEFLT, LREAL
  COMMON /DEFLT1/ NAME(MAXVAR)
  COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
1          NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
3          LREAL(MAXVAL)
  LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
  COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
  CHARACTER*80 DEFFIL, SAMFIL, VECFIL
  COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL
  CHARACTER*(MAXLEN) CARD
  CHARACTER*(MAXVLN) CVAL, TMPVAL
  DIMENSION INDX(3)
  LOGICAL EOR, TYPE(4), LVAL
  CHARACTER*10 IFRMT
  COMMON /VALUES/ RVL(MAXVAL)
  DIMENSION IVL(MAXVAL)
  EQUIVALENCE (IVL, RVL)

C
C
C*****PRINT HEADER MESSAGE
  IF (PRTINP) WRITE(6,1003) DEFFIL
C*****WRITE INTEGER FORMAT FOR READING VARIABLE ARRAY
INDICES
  WRITE(IFRMT,1004) MAXVLN
C*****INITIALIZE CURRENT VALUE POSITION
  IVPOS=-1
C*****OPEN DEFAULT FILE
  OPEN(1, FILE=DEFFIL, STATUS='OLD', READONLY, ERR=9100)
  1000 CONTINUE
C*****READ RECORD
  READ(1,1001,END=8000) CARD
C*****PRINT RECORD
  IF (PRTINP) WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
  IC=1
  2000 CONTINUE
C*****READ NEXT VALUE ON RECORD
  CALL RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL, LENGTH,
TYPE, EOR)
C*****CHECK FOR END-OF-RECORD
  IF (EOR) GO TO 1000
C*****CHECK FOR CHARACTER VALUE (VARIABLE NAME)
  IF (TYPE(1)) THEN
C*****INITIALIZE ARRAY SPECIFICATIONS
    INDX(1)=1
    INDX(2)=1
    INDX(3)=1
C*****CHARACTER VALUE (VARIABLE NAME) FOUND

```

Appendix D.1

```

C*****CHECK FOR LEFT PARENTHESIS IN VARIABLE NAME
      ILPAR=INDEX(CVAL, '(')
      IF (ILPAR.NE. 0) THEN
C*****FOUND LEFT PARENTHESIS, CHECK FOR RIGHT
PARENTHESIS
      IRPAR=INDEX(CVAL, ')')
      IF (IRPAR.NE. 0) THEN
C*****FOUND RIGHT PARENTHESIS, CHECK FOR COMMA
      ICOMMA=INDEX(CVAL, ',')
      IF (ICOMMA.NE. 0) THEN
C*****FOUND COMMA, DETERMINE FIRST ARRAY INDEX
      IS=ILPAR + 1
      IE=ICOMMA
      IND=1
3000      CONTINUE
      IE=IE - 1
      IF (CVAL(IE:IE).EQ. ' ') GO TO 3000
      IF (IE.GE. IS) THEN
C*****SET CURRENT ARRAY INDEX
      TMPVAL=' '
      TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
      READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
      ELSE
C*****INVALID ARRAY INDEX
      WRITE(6,3001) IND, CVAL(1:LENGTH)
      NOCALC=.TRUE.
      ENDIF
C*****CHECK FOR FINAL ARRAY INDEX FOUND
      IF (ICOMMA.GT. 0) THEN
      IS=ICOMMA + 1
C*****LOCATE NEXT COMMA
      ICOMMA=INDEX(CVAL(IS:LENGTH), ',')
      IF (ICOMMA.GT. 0) THEN
      ICOMMA=IS + ICOMMA - 1
      IE=ICOMMA
      ELSE
      IE=IRPAR
      ENDIF
C*****INCREMENT COUNTER FOR CURRENT ARRAY
INDEX
      IND=IND + 1
      IF (IND.GT. 3) THEN
C*****MORE THAN 3 ARRAY INDICES
      WRITE(6,3002) CVAL(1:LENGTH)
      IVPOS=-1
      NOCALC=.TRUE.
      GO TO 2000
      ENDIF
      GO TO 3000
      ENDIF
      ELSE
C*****NO COMMA FOUND, ONLY ONE ARRAY INDEX
      IS=ILPAR + 1
      IE=IRPAR
      IND=1
4000      CONTINUE
      IE=IE - 1
      IF (CVAL(IE:IE).EQ. ' ') GO TO 4000
      IF (IE.GE. IS) THEN
C*****SET SINGLE ARRAY INDEX
      TMPVAL=' '

```

Appendix D.1

```

                                TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
                                READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
                                ELSE
C*****INVALID ARRAY INDEX
                                WRITE(6,4001) CVAL(1:LENGTH)
                                NOCALC=.TRUE.
                                ENDIF
                                ENDIF
C*****BLANK OUT ARRAY INDEX PORTION OF VARIABLE
NAME
                                CVAL(ILPAR:MAXVLN)='
                                ELSE
C*****ERROR IN ARRAY INDEX SPECIFICATION
                                WRITE(6,4001) CVAL(1:LENGTH)
                                NOCALC=.TRUE.
                                ENDIF
                                ENDIF
C*****SEARCH FOR VARIABLE NAME
                                CALL SEARCH (NVAR, CVAL(1:LENGTH), NAME, IPNT,
IPOINT)
C*****CHECK FOR VARIABLE NAME FOUND
                                IF (IPOINT .GT. 0) THEN
C*****VARIABLE NAME FOUND, VALIDATE ARRAY INDICES
                                IF ((INDX(1) .GE. 1) .AND. (INDX(2) .GE. 1)
.AND.
1                                (INDX(3) .GE. 1) .AND.
2                                (INDX(1) .LE. IDIMEN(1,IPNT(IPOINT))) .AND.
3                                (INDX(2) .LE. IDIMEN(2,IPNT(IPOINT))) .AND.
4                                (INDX(3) .LE. IDIMEN(3,IPNT(IPOINT)))) THEN
C*****VALID ARRAY INDICES, SET CURRENT VALUE
POSITION
                                IVPOS=ISPOS(IPNT(IPOINT)) + INDX(1) +
1                                (INDX(2)-1)*IDIMEN(1,IPNT(IPOINT)) +
2                                (INDX(3)-1)*IDIMEN(1,IPNT(IPOINT))*
3                                IDIMEN(2,IPNT(IPOINT)) - 1
                                ELSE
C*****INVALID ARRAY INDICES
                                WRITE(6,4002) NAME(IPNT(IPOINT)),
1                                (I, INDX(I),
IDIMEN(I,IPNT(IPOINT))),I=1,3)
C*****SET INVALID VALUE POSITION
                                IVPOS=-1
                                NOCALC=.TRUE.
                                ENDIF
                                ELSE
C*****VARIABLE NAME NOT FOUND
                                WRITE(6,4003) CVAL(1:LENGTH)
C*****SET INVALID VALUE POSITION
                                IVPOS=-1
                                NOCALC=.TRUE.
                                ENDIF
                                ELSE IF (TYPE(3)) THEN
C*****CHECK FOR VALID VALUE POSITION
                                IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING
CURRENT VARIABLE
                                IP=IPNT(IPOINT)
                                IPNXTV=ISPOS(IP) +
IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
                                IF (IVPOS .LT. IPNXTV) THEN

```

Appendix D.1

```

C*****INTEGER VALUE FOUND SO CHECK FOR INTEGER
VARIABLE TYPE
      IF (.NOT. LREAL(IVPOS)) THEN
C*****INTEGER VARIABLE SO TRANSFER INTEGER VALUE
      IVL(IVPOS)=IVAL
C*****SET DEFAULT FLAG
      LDEFLT(IVPOS)=.TRUE.
      ELSE
C*****REAL VARIABLE, PRINT ERROR MESSAGE
      WRITE(6,4004) NAME(IPNT(IPOINT)), IVAL
      NOCALC=.TRUE.
      ENDIF
      ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
      WRITE(6,4006) NAME(IPNT(IPOINT)),
1          (IDIMEN(I,IPNT(IPOINT)),I=1,3)
      NOCALC=.TRUE.
      ENDIF
C*****INCREMENT VALUE POSITION
      IVPOS=IVPOS + 1
      ENDIF
      ELSE IF (TYPE(4)) THEN
C*****CHECK FOR VALID VALUE POSITION
      IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING
CURRENT VARIABLE
      IP=IPNT(IPOINT)
      IPNXTV=ISPOS(IP) +
IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
      IF (IVPOS .LT. IPNXTV) THEN
C*****REAL VALUE FOUND SO CHECK FOR REAL VARIABLE
TYPE
      IF (LREAL(IVPOS)) THEN
C*****REAL VARIABLE SO TRANSFER REAL VALUE
      RVL(IVPOS)=RVAL
C*****SET DEFAULT FLAG
      LDEFLT(IVPOS)=.TRUE.
      ELSE
C*****INTEGER VARIABLE, PRINT ERROR MESSAGE
      WRITE(6,4005) NAME(IPNT(IPOINT)), RVAL
      NOCALC=.TRUE.
      ENDIF
      ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
      WRITE(6,4006) NAME(IPNT(IPOINT)),
1          (IDIMEN(I,IPNT(IPOINT)),I=1,3)
      NOCALC=.TRUE.
      ENDIF
C*****INCREMENT VALUE POSITION
      IVPOS=IVPOS + 1
      ENDIF
      ENDIF
      GO TO 2000
8000 CONTINUE
C*****CLOSE DEFAULT FILE
      CLOSE (1)
      RETURN
9100 CONTINUE
C*****ERROR IN OPENING DEFAULT FILE
      WRITE(6,9101) DEFFIL

```

Appendix D.1

```

      STOP
9200 CONTINUE
C*****ERROR IN READING ARRAY INDEX
      WRITE(6,9201)
      NOCALC=.TRUE.
      GO TO 1000
C*****FORMAT STATEMENTS
1001 FORMAT(A)
1002 FORMAT(11X,A)
1003 FORMAT('1',/1X,130(''),
1      /1X,53(''),5X,'DEFAULT INPUT',5X,54(''),
2      /1X,17(''),5X,'FILE =',A,5X,17(''),
3      /1X,130(''),/)
1004 FORMAT('(I',I2,',')')
3001 FORMAT(1X,'>>>>DEFAULT VARIABLE ARRAY INDEX ',I1,'
FOR ',
1      'VARIABLE ',A,' IS INVALID',/)
3002 FORMAT(1X,'>>>>MORE THAN 3 ARRAY INDICES GIVEN FOR
VARIABLE ',A,
1      'ON DEFAULT FILE')
4001 FORMAT(1X,'>>>>DEFAULT VARIABLE ARRAY INDEX FOR ',
1      'VARIABLE ',A,' IS INVALID',/)
4002 FORMAT(1X,'>>>>ARRAY INDICES FOR DEFAULT VARIABLE
',A,
1      ' ARE OUT OF RANGE:'
2      /(1X,'>>>> INDEX',I2,' =',I5,', VALID RANGE = 1
TO ',I5,/:))
4003 FORMAT(1X,'>>>>DEFAULT VARIABLE NAME ',A,
1      ' NOT FOUND IN DEFAULT VARIABLE LIST',/)
4004 FORMAT(1X,'>>>>ATTEMPT TO DEFAULT REAL VARIABLE ('',A,
1      ') TO INTEGER VALUE ('',I10,',')',/)
4005 FORMAT(1X,'>>>>ATTEMPT TO DEFAULT INTEGER VARIABLE
('',A,
1      ') TO REAL VALUE ('',1PE10.3,',')',/)
4006 FORMAT(1X,'>>>>INVALID ARRAY POSITION ENCOUNTERED
WHILE ',
1      'SETTING DEFAULT VALUES FOR VARIABLE--',
2      A,'('',I2,',',',I2,',',',I2,',')')
8001 FORMAT('1')
9101 FORMAT(1X,'>>>>ERROR OPENING DEFAULT FILE ',A,/)
9201 FORMAT(1X,'>>>>ERROR IN READING PREVIOUS ARRAY
INDEX')
      END
      SUBROUTINE VECPOS
C*****SET SAMPLE VECTOR POSITIONS BY READING VARIABLE NAMES
AND
C*****CORRESPONDING SAMPLE VECTOR POSITIONS FROM FILE
DESIGNATED
C*****FOR SAMPLE VECTOR POSITIONS (SAMFIL)
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
1      MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2      MAXSPC=10, MAXTIM=10)
      PARAMETER (MAXLEN=101, MAXVLN=20)
      CHARACTER*7 NAME
      LOGICAL LDEFLT, LREAL
      COMMON /DEFLT1/ NAME(MAXVAR)
      COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
1      NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),

```


Appendix D.1

```

      2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
      3          LREAL(MAXVAL)
      LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
      1      EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
      1      EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPCDB, BRKOPN,
VB, ECF, ICF
      CHARACTER*80 DEFFIL, SAMFIL, VECFIL
      COMMON /FILBLK/ DEFFIL, SAMFIL, VECFIL
      CHARACTER*(MAXLEN) CARD
      CHARACTER*(MAXVLN) CVAL, TMPVAL
      CHARACTER*10 IFRMT
      DIMENSION INDX(3)
      LOGICAL EOR, TYPE(4), LVAL
C
C
C*****PRINT HEADER MESSAGE
      IF (PRTINP) WRITE(6,1003) SAMFIL
C*****WRITE INTEGER FORMAT FOR READING VARIABLE ARRAY
INDICES
      WRITE(IFRMT,1004) MAXVLN
C*****INITIALIZE CURRENT VALUE POSITION
      IVPOS=-1
C*****OPEN SAMPLE VECTOR POSITION FILE
      OPEN(1, FILE=SAMFIL, STATUS='OLD', READONLY, ERR=9100)
      1000 CONTINUE
C*****READ RECORD
      READ(1,1001,END=9000) CARD
C*****PRINT RECORD
      IF (PRTINP) WRITE(6,1002) CARD
C*****INITIALIZE COLUMN POINTER FOR CURRENT RECORD
      IC=1
      2000 CONTINUE
C*****READ NEXT VALUE ON RECORD
      CALL RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL, LENGTH,
TYPE, EOR)
C*****CHECK FOR END-OF-RECORD
      IF (EOR) GO TO 1000
C*****CHECK FOR CHARACTER VALUE (VARIABLE NAME)
      IF (TYPE(1)) THEN
C*****INITIALIZE ARRAY SPECIFICATIONS
          INDX(1)=1
          INDX(2)=1
          INDX(3)=1
C*****CHARACTER VALUE (VARIABLE NAME) FOUND
C*****CHECK FOR LEFT PARENTHESIS IN VARIABLE NAME
          ILPAR=INDEX(CVAL, '(')
          IF (ILPAR.NE. 0) THEN
C*****FOUND LEFT PARENTHESIS, CHECK FOR RIGHT
PARENTHESIS
              IRPAR=INDEX(CVAL, ')')
              IF (IRPAR.NE. 0) THEN
C*****FOUND RIGHT PARENTHESIS, CHECK FOR COMMA
                  ICOMMA=INDEX(CVAL, ',')
                  IF (ICOMMA.NE. 0) THEN
C*****FOUND COMMA, DETERMINE FIRST ARRAY INDEX
                      IS=ILPAR + 1

```

Appendix D.1

```

        IE=ICOMMA
        IND=1
3000      CONTINUE
        IE=IE - 1
        IF (CVAL(IE:IE) .EQ. ' ') GO TO 3000
        IF (IE .GE. IS) THEN
C*****SET CURRENT ARRAY INDEX
            TMPVAL=' '
            TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
            READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
        ELSE
C*****INVALID ARRAY INDEX
            WRITE(6,3001) IND, CVAL(1:LENGTH)
            NOCALC=.TRUE.
        ENDIF
C*****CHECK FOR FINAL ARRAY INDEX FOUND
        IF (ICOMMA .GT. 0) THEN
            IS=ICOMMA + 1
C*****LOCATE NEXT COMMA
            ICOMMA=INDEX(CVAL(IS:LENGTH), ',')
            IF (ICOMMA .GT. 0) THEN
                ICOMMA=IS + ICOMMA - 1
                IE=ICOMMA
            ELSE
                IE=IRPAR
            ENDIF
C*****INCREMENT COUNTER FOR CURRENT ARRAY INDEX
            IND=IND + 1
            IF (IND .GT. 3) THEN
C*****MORE THAN 3 ARRAY INDICES
                WRITE(6,3002) CVAL(1:LENGTH)
                IVPOS=-1
                NOCALC=.TRUE.
                GO TO 2000
            ENDIF
            GO TO 3000
        ENDIF
    ELSE
C*****NO COMMA FOUND, ONLY ONE ARRAY INDEX
        IS=ILPAR + 1
        IE=IRPAR
        IND=1
4000      CONTINUE
        IE=IE - 1
        IF (CVAL(IE:IE) .EQ. ' ') GO TO 4000
        IF (IE .GE. IS) THEN
C*****SET SINGLE ARRAY INDEX
            TMPVAL=' '
            TMPVAL(MAXVLN+IS-IE:MAXVLN)=CVAL(IS:IE)
            READ(TMPVAL,IFRMT,ERR=9200) INDX(IND)
        ELSE
C*****INVALID ARRAY INDEX
            WRITE(6,4001) CVAL(1:LENGTH)
            NOCALC=.TRUE.
        ENDIF
    ENDIF
C*****BLANK OUT ARRAY INDEX PORTION OF VARIABLE NAME
        CVAL(ILPAR:MAXVLN)='
    ELSE
C*****ERROR IN ARRAY INDEX SPECIFICATION

```

Appendix D.1

```

        WRITE(6,4001) CVAL(1:LENGTH)
        NOCALC=.TRUE.
    ENDIF
    ENDIF
C*****SEARCH FOR VARIABLE NAME
    CALL SEARCH (NVAR, CVAL(1:LENGTH), NAME, IPNT,
    IPOINT)
C*****CHECK FOR VARIABLE NAME FOUND
    IF (IPOINT .GT. 0) THEN
C*****VARIABLE NAME FOUND, VALIDATE ARRAY INDICES
        IF ((INDX(1) .GE. 1) .AND. (INDX(2) .GE. 1)
        .AND.
            1          (INDX(2) .GE. 1) .AND.
            2          (INDX(1) .LE. IDIMEN(1,IPNT(IPOINT))) .AND.
            3          (INDX(2) .LE. IDIMEN(2,IPNT(IPOINT))) .AND.
            4          (INDX(3) .LE. IDIMEN(3,IPNT(IPOINT))) THEN
C*****VALID ARRAY INDICES, SET CURRENT VALUE
        POSITION
            IVPOS=ISPOS(IPNT(IPOINT)) + INDX(1) +
            1          (INDX(2)-1)*IDIMEN(1,IPNT(IPOINT)) +
            2          (INDX(3)-1)*IDIMEN(1,IPNT(IPOINT))*
            3          IDIMEN(2,IPNT(IPOINT)) - 1
        ELSE
C*****INVALID ARRAY INDICES
            WRITE(6,4002) CVAL(1:LENGTH),
            1          (I, INDX(I),
            IDIMEN(I,IPNT(IPOINT))),I=1,3)
C*****SET INVALID VALUE POSITION
            IVPOS=-1
            NOCALC=.TRUE.
        ENDIF
    ELSE
C*****VARIABLE NAME NOT FOUND
        WRITE(6,4003) CVAL(1:LENGTH)
        NOCALC=.TRUE.
    ENDIF
    ELSE IF (TYPE(3)) THEN
C*****CHECK FOR VALID VALUE POSITION
        IF (IVPOS .GE. 0) THEN
C*****SET STARTING POSITION OF VARIABLE FOLLOWING
        CURRENT VARIABLE
            IP=IPNT(IPOINT)
            IPNXTV=ISPOS(IP) +
            IDIMEN(1,IP)*IDIMEN(2,IP)*IDIMEN(3,IP)
C*****CHECK FOR VALID ARRAY POSITION
            IF (IVPOS .LT. IPNXTV) THEN
C*****TRANSFER INTEGER VALUE TO SAMPLE VECTOR
        POSITION
            ISMPPS(IVPOS)=IVAL
        ELSE
C*****INVALID ARRAY POSITION, PRINT ERROR MESSAGE
            WRITE(6,4006) NAME(IPNT(IPOINT)),
            1          (IDIMEN(I,IPNT(IPOINT))),I=1,2)
            NOCALC=.TRUE.
        ENDIF
C*****INCREMENT VALUE POSITION
            IVPOS=IVPOS + 1
        ENDIF
    ELSE IF (TYPE(4)) THEN
C*****REAL VALUE TYPE, INVALID FOR SAMPLE VECTOR POSITION
        WRITE(6,4004) RVAL, NAME(IPNT(IPOINT))

```

Appendix D.1

```

        NOCALC=.TRUE.
    ENDIF
    GO TO 2000
9000 CONTINUE
C*****CLOSE SAMPLE VECTOR POSITION FILE
    CLOSE (1)
    RETURN
9100 CONTINUE
C*****ERROR IN OPENING SAMPLE VECTOR POSITION FILE
    WRITE(6,9101) SAMFIL
    STOP
9200 CONTINUE
C*****ERROR IN READING ARRAY INDEX
    WRITE(6,9201)
    NOCALC=.TRUE.
    GO TO 1000
C*****FORMAT STATEMENTS
1001 FORMAT(A)
1002 FORMAT(11X,A)
1003 FORMAT('1',/1X,130(' '),
1      /1X,46(' '),5X,'SAMPLE VECTOR POSITION
INPUT',5X,46(' '),
2      /1X,17(' '),5X,'FILE =',A,5X,17(' '),
3      /1X,130(' '),/)
1004 FORMAT('(I',I2,',')')
3001 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE ARRAY
INDEX ',
1      I1,' FOR VARIABLE ',A,' IS INVALID',/)
3002 FORMAT(1X,'>>>>MORE THAN 3 ARRAY INDICES GIVEN FOR
VARIABLE ',A,
1      'ON SAMPLE VECTOR POSITION FILE')
4001 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE ARRAY
INDEX ',
1      'FOR VARIABLE ',A,' IS INVALID',/)
4002 FORMAT(1X,'>>>>ARRAY INDICES FOR SAMPLE VECTOR
POSITION ',
1      'VARIABLE ',A,' ARE OUT OF RANGE:',
2      /(1X,'>>>> INDEX',I2,' =',I5,' , VALID RANGE = 1
TO ',I5,/:))
4003 FORMAT(1X,'>>>>SAMPLE VECTOR POSITION VARIABLE NAME
',A,
1      ' NOT FOUND IN DEFAULT VARIABLE LIST',/)
4004 FORMAT(1X,'>>>>ATTEMPT TO USE REAL VALUE
(' ,1PE10.2,') TO ',
1      'SPECIFY SAMPLE VECTOR POSITION FOR VARIABLE
',A,/)
4006 FORMAT(1X,'>>>>INVALID ARRAY POSITION ENCOUNTERED
WHILE ',
1      'SETTING DEFAULT VALUES FOR VARIABLE--',
2      A,'( ',I2,', ',I2,', ',I2,',')')
9101 FORMAT(1X,'>>>>ERROR OPENING SAMPLE VECTOR POSITION
FILE ',A,/)
9201 FORMAT(1X,'>>>>ERROR IN READING PREVIOUS ARRAY
INDEX')
END
SUBROUTINE RDSTRG (CARD, IC, CVAL, LVAL, IVAL, RVAL,
1      LENGTH, TYPE, EOR)
C*****CONVERTS A RECORD STRING TO A CHARACTER VALUE, A
LOGICAL VALUE,
C*****A REAL VALUE, AND AN INTEGER VALUE
    PARAMETER (IL=100)
    CHARACTER*(*) CARD, CVAL

```

Appendix D.1

```

      CHARACTER*(IL) TMPCRD
      CHARACTER*8 IFRMT, LFRMT, RFRMT
      LOGICAL EOR, FIRST, LVAL, TYPE(4)
      DATA FIRST / .TRUE. /

C
C
C*****CHECK FOR FIRST TIME INTO ROUTINE
      IF (FIRST) THEN
C*****WRITE INTEGER AND REAL FORMATS
          WRITE(IFRMT,1001) IL
          WRITE(RFRMT,1002) IL
          WRITE(LFRMT,1003) IL
C*****RESET INITIALLIZATION TYPE
          FIRST=.FALSE.
      ENDIF
C*****SET LENGTH OF INCOMING RECORD
          ILMAX=LEN(CARD)
C*****SET LENGTH OF CHARACTER VARIABLE
          LENCVAL=LEN(CVAL)
C*****INITIALIZE VARIABLE FLAG TYPES (1=CHAR, 2=LOGIC,
3=INTEG, 4=REAL)
          DO 1000 I=1,4
              TYPE(I)=.FALSE.
          1000 CONTINUE
C*****INITIALIZE END-OF-RECORD TYPE
          EOR=.FALSE.
C*****RESET STARTING POSITION FOR CHARACTER POINTER
          IC=IC - 1
C*****SEARCH FOR FIRST NON-BLANK CHARACTER
          2000 CONTINUE
C*****INCREMENT CHARACTER POINTER
          IC=IC + 1
C*****CHECK FOR END OF RECORD
          IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BLANK CHARACTER (STRING DELIMITER)
          IF (CARD(IC:IC) .EQ. ' ') GO TO 2000
C*****CHECK FOR BEGINNING OF COMMENT
          IF (CARD(IC:IC) .EQ. '$') GO TO 9100
C*****CHECK FOR COMMA CHARACTER (STRING DELIMITER)
          IF (CARD(IC:IC) .EQ. ',') GO TO 2000
C*****CHECK FOR QUOTE CHARACTER (CHARACTER STRING DELIMITER)
          IF (CARD(IC:IC) .EQ. '''') THEN
C*****SAVE STARTING POSITION OF CHARACTER STRING
              IS=IC + 1
C*****SEARCH FOR ANOTHER QUOTE
              IC=INDEX(CARD(IS:ILMAX), '''')
              IF (IC .EQ. 0) THEN
C*****QUOTE NOT FOUND SO CONTINUE SEARCH FOR BLANK TO
TERMINATE
C*****CHARACTER STRING
                  IC=IS - 1
              ELSE
C*****QUOTE FOUND
                  IC=IS + IC - 1
                  GO TO 3100
              ENDIF
C*****SEARCH FOR END OF CHARACTER STRING (' SIGNIFIES
BEGINNING AND
C*****END OF CHARACTER STRING)
          3000 CONTINUE
C*****INCREMENT CHARACTER POINTER

```

Appendix D.1

```

      IC=IC + 1
C*****CHECK FOR END OF RECORD
      IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BEGINNING OF COMMENT
      IF (CARD(IC:IC) .EQ. '$') GO TO 3100
C*****CHECK FOR BLANK TO TERMINATE CHARACTER STRING
      IF (CARD(IC:IC) .NE. ' ') GO TO 3000
      3100 CONTINUE
C*****END OF CHARACTER STRING FOUND
C*****COMPARE STRING LENGTH TO CHARACTER VARIABLE LENGTH
      IE=IC - 1
      IF (IE-IS+1 .GT. LENCVAL) GO TO 9300
C*****TRANSFER CHARACTER STRING
      CVAL=CARD(IS:IE)
C*****SET LENGTH OF CHARACTER STRING
      LENGTH=IE - IS + 1
C*****SET VARIABLE FLAG TYPE FOR CHARACTER VARIABLE FOUND
      TYPE(1)=.TRUE.
      ELSE
C*****SAVE STARTING POSITION FOR STRING
      IS=IC
C*****SEARCH FOR END OF STRING (BLANK OR , SIGNIFY END OF
STRING)
      4000 CONTINUE
C*****INCREMENT CHARACTER POINTER
      IC=IC + 1
C*****CHECK FOR END OF RECORD
      IF (IC .GT. ILMAX) GO TO 9100
C*****CHECK FOR BEGINNING OF COMMENT
      IF (CARD(IC:IC) .EQ. '$') GO TO 4100
C*****CHECK FOR COMMA CHARACTER
      IF (CARD(IC:IC) .EQ. ',') GO TO 4000
C*****CHECK FOR BLANK CHARACTER
      IF (CARD(IC:IC) .NE. ' ') GO TO 4000
      4100 CONTINUE
C*****END OF STRING FOUND
C*****COMPARE STRING LENGTH TO FORMAT LENGTH
      IE=IC - 1
      IF (IE-IS+1 .GT. IL) GO TO 9200
C*****RIGHT JUSTIFY STRING FOR INTERNAL FORMATTED READS
      TMPCRD=' '
      TMPCRD(IL+IS-IE:IL)=CARD(IS:IE)
C*****READ STRING WITH LOGICAL FORMAT (NOT USED IN GGSOR)
C      READ(TMPCRD,LFRMT,ERR=5000) LVAL
C      TYPE(2)=.TRUE.
C 5000 CONTINUE
C*****READ STRING WITH INTEGER FORMAT
C      READ(TMPCRD,IFRMT,ERR=6000) IVAL
C      TYPE(3)=.TRUE.
C 6000 CONTINUE
C*****READ STRING WITH REAL FORMAT
      READ(TMPCRD,RFRMT,ERR=7000) RVAL
      TYPE(4)=.TRUE.
C*****CHECK FOR DECIMAL POINT IN VALUE AND MAGNITUDE OF
VALUE
      IF ((INDEX(TMPCRD, '.') .EQ. 0) .AND.
1      (ABS(RVAL) .LE. 1.0E10)) THEN
          IVAL=NINT (RVAL)
          TYPE(3)=.TRUE.
      ENDIF
      GO TO 8000
      7000 CONTINUE

```

Appendix D.1

```

C*****STRING IS NOT LOGICAL, INTEGER, OR REAL SO ASSUMED
TO BE CHAR
C*****COMPARE STRING LENGTH TO CHARACTER VARIABLE LENGTH
      IF (IE-IS+1 .GT. LENCVAL) GO TO 9300
C*****TRANSFER CHARACTER STRING
      CVAL=CARD(IS:IE)
C*****SET LENGTH OF CHARACTER STRING
      LENGTH=IE - IS + 1
C*****SET VARIABLE FLAG TYPE FOR CHARACTER VARIABLE FOUND
      TYPE(1)=.TRUE.
      8000  CONTINUE
      ENDIF
C*****CHECK FOR BEGINNING OF COMMENT
      IF (CARD(IC:IC) .NE. '$') IC=IC + 1
      RETURN
      9100 CONTINUE
C*****END OF RECORD ENCOUNTERED SEARCHING FOR VALUE POSITION
C*****SET END-OF-RECORD TYPE
      EOR=.TRUE.
      RETURN
      9200 CONTINUE
C*****LENGTH OF STRING TOO LONG FOR EITHER CHARACTER STORAGE
OR INTERNAL
C*****FORMATTED READ
      WRITE(6,9201) CARD, IL
      RETURN
      9300 CONTINUE
C*****LENGTH OF STRING TOO LONG FOR CHARACTER VARIABLE
      WRITE(6,9301) CARD(IS:IE), LENCVAL
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT(' (I',I3,',')')
      1002 FORMAT(' (E',I3,',.0')')
      1003 FORMAT(' (L',I3,',')')
      9201 FORMAT(1X,'>>>>LENGTH OF STRING TOO LONG FOR EITHER
CHARACTER ',
      1      'STORAGE OR INTERNAL FORMATTED READ',
      2      /1X,'>>>>',A,
      3      /1X,'>>>>RESET PARAMETER IL IN RDSTRG TO A
VALUE ',
      4      'GREATER THAN ',I3,' TO ACCOUNT FOR ',
      5      /1X,'>>>>LARGER STRING SIZE FOR VALUES ON INPUT
FILE',/)
      9301 FORMAT(1X,'>>>>LENGTH OF STRING TOO LONG FOR
CHARACTER ',
      1      'VARIABLE STORAGE ',
      2      /1X,'>>>>',A,
      3      /1X,'>>>>RESET CORRESPONDING CHARACTER VARIABLE
LENGTH ',
      4      ' IN RDSTRG TO A VALUE ',
      4      /1X,'>>>>GREATER THAN ',I3,' TO ACCOUNT FOR ',
      5      'LARGER STRING SIZE FOR VALUES ON INPUT
FILE',/)
      END
      SUBROUTINE SEARCH (NVAR, CVAL, NAME, IPNT, IPOINT)
C*****LOCATE VARIABLE NAME CVAL USING BINARY SEARCH
RETURNING IPOINT
C*****AS POSITION IN IPNT OF NAME (IPOINT=0 IF NOT LOCATED)
      CHARACTER*(*) CVAL, NAME(NVAR)
      DIMENSION IPNT(NVAR)
C

```

Appendix D.1

```

C
C*****SET LOWER LIMIT POINTER FOR SEARCH RANGE
      IL=1
C*****SET UPPER LIMIT POINTER FOR SEARCH RANGE
      IH=NVAR
C*****SET MIDPOINT POINTER FOR SEARCH RANGE
      IM=IH / 2
C*****BEGINNING OF BINARY SEARCH LOOP
      1000 CONTINUE
C*****COMPARE SEARCH ID TO CURRENT MIDPOINT ID
      IF (CVAL .EQ. NAME(IPNT(IM))) GO TO 2000
C*****CHECK TO SEE IF MIDPOINT ID IS GREATER THAN SEARCH ID
      IF (CVAL .GT. NAME(IPNT(IM))) THEN
C*****SEARCH ID IS IN UPPER HALF OF SEARCH RANGE
C*****RESET LOWER LIMIT POINTER TO FORMER MIDPOINT
      IL=IM
C*****RESET MIDPOINT TO CURRENT INTERVAL
      IM=(IL+IH+1) / 2
      ELSE
C*****SEARCH ID IS IN LOWER HALF OF SEARCH RANGE
C*****RESET UPPER LIMIT POINTER TO FORMER MIDPOINT
      IH=IM
C*****RESET MIDPOINT TO CURRENT INTERVAL
      IM=(IL+IH) / 2
      ENDIF
      IF (IL+1 .EQ. IH) THEN
      IF ((CVAL .NE. NAME(IPNT(IL))) .AND.
1      (CVAL .NE. NAME(IPNT(IH)))) THEN
C*****VALUE NOT FOUND SO RETURN 0 FOR POINTER
      IPOINT=0
      RETURN
      ENDIF
      ENDIF
      GO TO 1000
      2000 CONTINUE
C*****VALUE FOUND SO RETURN MIDPOINT FOR POINTER
      IPOINT=IM
      RETURN
      END
      SUBROUTINE CSORT (NVAR, NAME, IPNT)
C*****SORT NVAR VALUES OF CHARACTER ARRAY NAME IN INCREASING
ORDER
C*****USING POINTER ARRAY IPNT
      CHARACTER*(*) NAME(NVAR)
      DIMENSION IPNT(NVAR)
C
C
      N=NVAR
      L=N/2+1
      IR=N
      100 CONTINUE
      IF (L.LE.1) GO TO 700
      L=L-1
      LHOLD=IPNT(L)
      200 CONTINUE
      J=L
      300 CONTINUE
      I=J
      J=2*J
      IF (J-IR) 400, 500, 600
      400 CONTINUE
      IF (NAME(IPNT(J)) .LT. NAME(IPNT(J+1))) J=J+1

```


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```

500 CONTINUE
    IF (NAME(LHOLD) .GE. NAME(IPNT(J))) GO TO 600
    IPNT(I)=IPNT(J)
    GO TO 300
600 CONTINUE
    IPNT(I)=LHOLD
    GO TO 100
700 CONTINUE
    LHOLD=IPNT(IR)
    IPNT(IR)=IPNT(1)
    IR=IR - 1
    IF (IR .GT. 1) GO TO 200
    IPNT(1)=LHOLD
    RETURN
END
SUBROUTINE SUBVEC
C*****SUBSTITUTE SAMPLE VECTOR VALUES INTO DEFAULT VALUE
ARRAY
    PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
    MAXCAS=8,
    1          MAXISS=20, MAXLEV=10, MAXVAR=100,
    MAXVAL=12000,
    2          MAXSPC=10, MAXTIM=10)
    COMMON /LHSBLK/ XLHS(MAXSMP)
    CHARACTER*7 NAME
    LOGICAL LDEFLT, LREAL
    COMMON /DEFLT1/ NAME(MAXVAR)
    COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
    NVCB4,
    1          NVCB5, IDIMEN(3,MAXVAR),
    ISPOS(MAXVAR),
    2          ISMPPS(MAXVAL), IPNT(MAXVAR),
    LDEFLT(MAXVAL),
    3          LREAL(MAXVAL)
    COMMON /VALUES/ RVL(MAXVAL)
    DIMENSION IVL(MAXVAL)
    EQUIVALENCE (IVL, RVL)
C
C
C*****MAKE SAMPLE VECTOR SUBSTITUTIONS
    DO 1000 IVAL=1,NVAL
C*****CHECK FOR POSITIVE SAMPLE VECTOR SUBSTITUTION
POSITION
    IF (ISMPPS(IVAL) .GT. 0) THEN
C*****CHECK FOR REAL VALUE
    IF (LREAL(IVAL)) THEN
C*****TRANSFER REAL VALUE
    RVL(IVAL)=XLHS(ISMPPS(IVAL))
    ELSE
C*****TRANSFER INTEGER VALUE
    IVL(IVAL)=NINT(XLHS(ISMPPS(IVAL)))
    ENDIF
    ENDIF
1000 CONTINUE
    RETURN
END
SUBROUTINE WRTPAR
C*****PRINT DEFAULT AND SAMPLE VECTOR SUBSTITUTION
INFORMATION FOR
C*****BINNED AND DIRECT EXECUTIONS

```

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```

        PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
        1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
        2          MAXSPC=10, MAXTIM=10)
        PARAMETER (MAXPR=132)
        CHARACTER*(MAXPR) RECOUT
        CHARACTER*7 NAME
        LOGICAL LDEFLT, LREAL
        COMMON /DEFLT1/ NAME(MAXVAR)
        COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
        1          NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),
        2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
        3          LREAL(MAXVAL)
        COMMON /VALUES/ RVL(MAXVAL)
        DIMENSION IVL(MAXVAL)
        EQUIVALENCE (IVL, RVL)

C
C
C*****PRINT HEADER RECORD
        WRITE(6,1001)
C*****LOAD OUTPUT RECORD BEFORE PRINTING (10 OR FEWER VALUES
PER RECORD)
        IVAL=0
C*****LOOP OVER VARIABLES, PRINTING IN SORTED ORDER
        DO 4000 IVR=1,NVAR
            IVAR=IPNT(IVR)
C*****START NEW RECORD FOR EACH VARIABLE
            WRITE(RECOUT,2001) NAME(IVAR)
C*****INITIALIZE VALUE POSITION FOR CURRENT VARIABLE
            IVAL=ISPOS(IVAR) - 1
C*****SET COLUMN POINTER
            IC=1
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (3RD
DIMENSION)
            DO 3000 IDM3=1,IDIMEN(3,IVAR)
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (2ND
DIMENSION)
                DO 2000 IDM2=1,IDIMEN(2,IVAR)
C*****LOOP OVER VALUES FOR CURRENT VARIABLE (1ST
DIMENSION)
                    DO 1000 IDM1=1,IDIMEN(1,IVAR)
C*****INCREMENT VALUE POINTER
                        IVAL=IVAL + 1
C*****INCREMENT COLUMN
                        IC=IC + 11
C*****CHECK FOR DEFAULT AND SAMPLE VECTOR
SUBSTITUTION
                            IF (ISMPPS(IVAL) .GT. 0) THEN
C*****TRANSFER SAMPLE VECTOR POSITION TO
OUTPUT RECORD
                                WRITE(RECOUT(IC:IC+10),2002)
ISMPPS(IVAL)
                                ELSE IF (LDEFLT(IVAL)) THEN
C*****CHECK FOR REAL DEFAULT VALUE
                                    IF (LREAL(IVAL)) THEN
C*****TRANSFER REAL VALUE TO OUTPUT RECORD
                                        WRITE(RECOUT(IC:IC+10),2003)
RVL(IVAL)

```

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                                ELSE
C*****TRANSFER INTEGER VALUE TO OUTPUT
RECORD
                                WRITE(RECOUT(IC:IC+10),2004)
IVL(IVAL)
                                ENDIF
                                ELSE
C*****NO DEFAULT OR SAMPLE VECTOR
SUBSTITUTION
                                WRITE(RECOUT(IC:IC+10),2005)
                                ENDIF
C*****CHECK FOR OUTPUT RECORD WITH MORE THAN 104
COLUMNS
                                IF (IC .GT. 104) THEN
C*****PRINT OUTPUT RECORD
                                WRITE(6,2010) RECOUT
C*****INITIALIZE OUTPUT RECORD
                                RECOUT=' '
C*****RESET COLUMN POINTER
                                IC=1
                                ENDIF
1000                                CONTINUE
2000                                CONTINUE
3000                                CONTINUE
C*****IF INFORMATION IS STORED ON OUTPUT RECORD, PRINT
OUTPUT RECORD
                                IF (IC .GT. 1) WRITE(6,2010) RECOUT
4000 CONTINUE
C*****START NEW PAGE
                                WRITE(6,3001)
                                RETURN
C*****FORMAT STATEMENTS
1001 FORMAT('1',/1X,130('*'),
1                                /1X,30('*'),5X,'DEFAULT INPUT AND SAMPLE VECTOR

2                                'SUBSTITUTION INFORMATION',5X,34('*'),
3                                /1X,130('*'),/)
2001 FORMAT(1X,A9)
2002 FORMAT(' V-POS-',I3.3)
2003 FORMAT(1PE11.3)
2004 FORMAT(I11)
2005 FORMAT(' NO VALUE')
2010 FORMAT(A)
3001 FORMAT('1')
END
SUBROUTINE TRANS (CB1, CB2, CB3)
C*****TRANSFER VALUES FROM ARRAY RVAL TO COMMON BLOCKS CB1
AND CB2
C*****IN THIS ORDER
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
1                                MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2                                MAXSPC=10, MAXTIM=10)
CHARACTER*7 NAME
LOGICAL LDEFLT, LREAL
COMMON /DEFLT1/ NAME(MAXVAR)
COMMON /DEFLT2/ NVAR, NVAL, NVCB1, NVCB2, NVCB3,
NVCB4,
1                                NVCB5, IDIMEN(3,MAXVAR),
ISPOS(MAXVAR),

```

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      2          ISMPPS(MAXVAL), IPNT(MAXVAR),
LDEFLT(MAXVAL),
      3          LREAL(MAXVAL)
      COMMON /VALUES/ RVL(MAXVAL)
      DIMENSION IVL(MAXVAL)
      EQUIVALENCE (IVL, RVL)
      DIMENSION CB1(NVCB1), CB2(NVCB2), CB3(NVCB3)
C
C
C*****INITIALIZE VALUE COUNTER
      IVAL=0
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 1
      IF (NVCB1 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 1
      DO 1000 I=1,NVCB1
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB1(I)=RVL(IVAL)
      1000    CONTINUE
      ENDIF
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 2
      IF (NVCB2 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 2
      DO 2000 I=1,NVCB2
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB2(I)=RVL(IVAL)
      2000    CONTINUE
      ENDIF
C*****CHECK NUMBER OF VALUES ASSIGNED TO COMMON BLOCK 3
      IF (NVCB3 .GT. 0) THEN
C*****TRANSFER VALUES FOR COMMON BLOCK 3
      DO 3000 I=1,NVCB3
C*****INCREMENT VALUE COUNTER
      IVAL=IVAL + 1
      CB3(I)=RVL(IVAL)
      3000    CONTINUE
      ENDIF
      RETURN
      END
      SUBROUTINE WRREL
C*****PRINT CONTENTS OF COMMON BLOCKS
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
      MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
      MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
      DFVPA(MAXSPC),
      1          DFCPA(MAXSPC), FEVSE(MAXSPC),
      FDCH(MAXSPC),
      2          FCCI(MAXSPC), DFCAV(MAXSPC),
      VBPUF(MAXSPC),
      3          FCONV(MAXSPC), FCONC(MAXSPC),
      DFSPRV(MAXSPC),
      4          DFSPRC(MAXSPC), FREVO(MAXSPC),
      VALISS(MAXISS),
      5          FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
      WFAC, PFAC,
      6          FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
      FTLPL,

```

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      7          FTLP, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
      8          TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
      9          ELEV, PUFF
C
C
      WRITE(6,1001)
C*****PRINT COMMON BLOCK BASVAL ARRAY VARIABLES
      WRITE(6,1002) 'BASVAL', 'BASE VALUES FOR GGSOR'
      WRITE(6,1003) 'FCOR', 'FVES', 'DFVPA', 'DFCPA',
,
      1          'FEVSE', 'FDCH', 'FCCI', 'DFCAV',
,
      2          'VBPUF', 'FCONV'
      DO 1000 K=1, NSPEC
        WRITE(6,1004) FCOR(K), FVES(K), DFVPA(K), DFCPA(K),
      1          FEVSE(K), FDCH(K), FCCI(K), DFCAV(K),
      2          VBPUF(K), FCONV(K)
1000 CONTINUE
      WRITE(6,1003) 'FCONC', 'DFSPRV', 'DFSPRC', 'FREVO',
,
      DO 2000 K=1, NSPEC
        WRITE(6,1004) FCONC(K), DFSPRV(K), DFSPRC(K),
FREVO(K)
2000 CONTINUE
      WRITE(6,1003) 'VALISS'
      DO 3000 IISS=1, MAXISS
        WRITE(6,1004) VALISS(IISS)
3000 CONTINUE
C*****PRINT COMMON BLOCK BASVAL SINGLE VARIABLES
      WRITE(6,1003) 'FLT11', 'FLT12', 'NSPEC', 'FLV',
,
      1          'FHPE', 'EVSE', 'WFAC', 'PFAC',
,
      2          'FPLBYE', 'FPLBYP'
      WRITE(6,1004) FLT11, FLT12, FLOAT(NSPEC), FLV,
      1          FHPE, EVSE, WFAC, PFAC,
      2          FPLBYE, FPLBYP
      WRITE(6,1003) 'FPLBYD', 'FPLBYC', 'FTLPH', 'FTLPL',
,
      1          'FTLP', 'TC11', 'TC12', 'TB11',
,
      2          'TB12', 'TB21'
      WRITE(6,1004) FPLBYD, FPLBYC, FTLPH, FTLPL,
      1          FTLP, TC11, TC12, TB11,
      2          TB12, TB21
      WRITE(6,1003) 'TB22', 'TBS1', 'TBS2', 'TBR1',
,
      1          'TBR2', 'TW', 'T1', 'T2',
,
      2          'DT1', 'DT2'
      WRITE(6,1004) TB22, TBS1, TBS2, TBR1,
      1          TBR2, TW, T1, T2,
      2          DT1, DT2
      WRITE(6,1003) 'DTCDB', 'ELEV', 'PUFF'
      WRITE(6,1004) DTCDB, ELEV, PUFF
      RETURN
C*****FORMAT STATEMENTS
1001 FORMAT('1')
```

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```

1002 FORMAT(/1X,130('='),
1          /1X,5('*'),' CONTENTS OF COMMON BLOCK ',A,'
',5('*'),
2          /7X,A,
3          /1X,130('='))
1003 FORMAT(/3X,10(A7,4X))
1004 FORMAT(1X,1P,10E11.3)
END
SUBROUTINE BINTRN (IBIN)
C*****PERFORM BIN TRANSLATION
C
C=====BIN DIMENSIONS
C
C-----
C-----
C===== INDX(1): ACCIDENT SEQUENCES
C      1: FAST STATION BLACKOUT
C      2: SLOW STATION BLACKOUT
C      3: FAST TRANSIENT
C      4: SLOW TRANSIENT
C      5: FAST TC
C      6: SLOW TC
C===== INDX(2): ZR OXIDATION
C      1: HIGH
C      2: LOW
C===== INDX(3): VESSEL CONDITION AT VESSEL BREACH
C      1: HIGH PRESSURE, NO LOW PRESSURE INJECTION AFTER
VB
C      2: LOW PRESSURE, NO LOW PRESSURE INJECTION AFTER
VB
C      3: HIGH PRESSURE, LPI RECOVERY AFTER VB
C      4: LOW PRESSURE, LPI RECOVERY AFTER VB
C      5: NO VESSEL BREACH
C===== INDX(4): FRACTION OF CORE PARTICIPATING IN DCH OR
STEAM EXPLOSION
C      1: HIGH DCH, NO STEAM EXPLOSION
C      2: LOW DCH, NO STEAM EXPLOSION
C      3: NO DCH, HIGH STEAM EXPLOSION
C      4: NO DCH, LOW STEAM EXPLOSION
C      5: NO DCH, NO STEAM EXPLOSION
C===== INDX(5): POOL BYPASS
C      1: NOMINAL (860 CFM)
C      2: EARLY NOMINAL, INTERMEDIATE LARGE (COMLPETE
BYPASS)
C      3: EARLY NOMINAL, LATE SMALL (8600 CFM)
C      4: EARLY NOMINAL, LATE LARGE
C      5: EARLY SMALL, LATE SMALL
C      6: EARLY SMALL, INTERMEDIATE LARGE
C      7: EARLY SMALL, LATE LARGE
C      8: EARLY LARGE, LATE LARGE
C===== INDX(6): CONTAINMENT FAILURE
C      1: EARLY LEAK BEFORE VB
C      2: EARLY RUPTURE BEFORE VB
C      3: EARLY VENT
C      4: LEAK AT VB
C      5: RUPTURE AT VB
C      6: LATE LEAK
C      7: LATE RUPTURE
C      8: LATE VENT
C      9: NO CF
C===== INDX(7): CONTAINMENT SPRAY
C      1: NO SPRAY

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C          2: EARLY SPRAY ONLY
C          3: LATE SPRAY ONLY
C          4: EARLY AND LATE SPRAY
C===== INDX(8): MOLTEN CORE CONCRETE INTERACTION
C          1: DRY CAVITY
C          2: WET CAVITY (WATER ALMOST DRYOUT AFTER 10 HOURS)
C          3: FLOODED CAVITY
C          4: DELAY CCI RELEASE
C          5: NO CCI RELEASE (I.E., COOLABLE DEBRIS BED)
C===== INDX(9): TAIL PIPE VACUUM BREAKER STUCK OPEN
C          1: YES (SOME POOL BYPASS DURING IN-VESSEL RELEASE)
C          2: NO
C
C
C-----
C
C SPECIES INDEX = ISP, 1 TO NSPEC; ORDER IS
NG,I,CS,TE,SR,RU,LA,CE,BA
C
C
=====
PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
2          MAXSPC=10, MAXTIM=10)
CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
LOGICAL NOCALC, SAMPLE, REPRTB, BINNED, BYRUN, CONSFL,
DIAG,
1 EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
COMMON /KEYS/ NOCALC, SAMPLE, REPRTB, BINNED, BYRUN,
CONSFL, DIAG,
1 EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
1          STL(MAXSPC), STIL, STRVOL(MAXSPC),
2          ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
1          DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
2          FCCI(MAXSPC), DFCAV(MAXSPC),
VBPWF(MAXSPC),
3          FCONV(MAXSPC), FCONC(MAXSPC),
DFSFRV(MAXSPC),
4          DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
5          FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
6          FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
7          FTLF, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
8          TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
9          ELEV, PUFF

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COMMON /BINNED/ FCOR0(MAXSPC,MAXCAS),
FVESO(MAXSPC,MAXCAS),
1 DFVPA0(MAXSPC,MAXCAS),
DFCPA0(MAXSPC,MAXCAS),
2 FDCH0(MAXSPC,MAXCAS),
FEVSE0(MAXSPC,MAXCAS),
3 FCCI0(MAXSPC,MAXCAS),
DFCAVO(MAXSPC,MAXCAS),
4 VBPUF0(MAXSPC,MAXCAS),
FCONVO(MAXSPC,MAXCAS),
5 FCONCO(MAXSPC,MAXCAS),
DFSPRVO(MAXSPC,MAXCAS),
6 DFSPRCO(MAXSPC,MAXCAS),
FREVOO(MAXSPC,MAXCAS),
7 FLTI10(MAXCAS), FLTI20(MAXCAS),
FHPEO(MAXCAS),
8 EVSE0(MAXCAS), FPLBY0(3), TWO(MAXTIM),
9 T10(MAXTIM), DT10(MAXTIM),
DT20(MAXTIM),
A PUFF0(MAXTIM)
COMMON /BININD/ INDX(MAXBD)
C
C
ICAM1=ICHAR('A') - 1
C*****ACCIDENT SEQUENCE
INDX(1) = ICHAR(BINARR(IBIN)(1:1)) - ICAM1
C*****ZR OXIDATION
INDX(2) = ICHAR(BINARR(IBIN)(2:2)) - ICAM1
C*****REACTOR PRESSURE AT VESSEL BREACH
INDX(3) = ICHAR(BINARR(IBIN)(3:3)) - ICAM1
C*****FRACTION OF CORE PARTICIPATING IN DCH OR STEAM
EXPLOSION
INDX(4) = ICHAR(BINARR(IBIN)(4:4)) - ICAM1
C*****POOL BYPASS
INDX(5) = ICHAR(BINARR(IBIN)(5:5)) - ICAM1
C*****CONTAINMENT FAILURE TIME AND MODE
INDX(6) = ICHAR(BINARR(IBIN)(6:6)) - ICAM1
C*****CONTAINMENT SPRAYS
INDX(7) = ICHAR(BINARR(IBIN)(7:7)) - ICAM1
C*****MOLTEN CORE CONCRETE INTERACTION
INDX(8) = ICHAR(BINARR(IBIN)(8:8)) - ICAM1
C*****TAIL PIPE VACUUM BREAKER STUCK OPEN
INDX(9) = ICHAR(BINARR(IBIN)(9:9)) - ICAM1
C*****SET LOGICAL FLAGS TO BE PASSED INTO GGSORC
C*****TEMPORARY COOLABLE DEBRIS BED OR COOLABLE DEBRIS BED
TMPCDB=(INDX(8) .EQ. 4)
CDB=(INDX(8) .EQ. 5)
C*****VESSEL BREACH
VB=(INDX(3) .NE. 5)
C*****SUPPRESSION POOL TEMPERATURE
SUBCL=(INDX(1) .EQ. 1) .OR. (INDX(1) .EQ. 3) .OR.
1 (INDX(1) .EQ. 4) .OR. (INDX(1) .EQ. 5)
C*****NO CONTAINMENT FAILURE FLAG
NOCF=(INDX(6) .EQ. 9)
C*****EARLY CF BEFORE VB
ECF=(INDX(6) .LE. 3)
C*****INTERMEDIATE CF AT VB
ICF=(INDX(6) .EQ. 4) .OR. (INDX(6) .EQ. 5)
C*****TAIL PIPE VACUUM BREAKER STUCK OPEN FLAG
BRKOPN=(INDX(9) .EQ. 1)
C*****LOOP OVER SPECIES

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DO 500 ISP=1, NSPEC
C*****FCOR *****
      IF (INDX(2) .EQ. 1) THEN
        FCOR(ISP)=FCOR0(ISP,1)
      ELSE
        FCOR(ISP)=FCOR0(ISP,2)
      ENDIF
C*****FVES *****
      IF (INDX(1) .LE. 2) THEN
C*****STATION BLACKOUT
        IF ((INDX(3) .EQ. 1) .OR. (INDX(3) .EQ. 3)) THEN
C*****HIGH PRESSURE AT VB
          FVES(ISP)=FVES0(ISP,1)
        ELSE
C*****LOW PRESSURE AT VB
          FVES(ISP)=FVES0(ISP,2)
        ENDIF
      ELSE
C*****TRANSIENTS, TC: CRD FLOW
        IF ((INDX(3) .EQ. 1) .OR. (INDX(3) .EQ. 3)) THEN
C*****HIGH PRESSURE AT VB
          FVES(ISP)=FVES0(ISP,3)
        ELSE
C*****LOW PRESSURE AT VB
          FVES(ISP)=FVES0(ISP,2)
        ENDIF
      ENDIF
C*****REVOLATILIZATION AFTER VESSEL BREACH
      IF (INDX(3) .EQ. 5) THEN
C*****NO VESSEL BREACH, NO REVOLATILIZATION
        FREVO(ISP)=0.0
      ELSE IF ((INDX(3) .EQ. 3) .OR. (INDX(3) .EQ. 4))
THEN
C*****LPI RECOVERY, AFTER VB
        FREVO(ISP)=FREVO0(ISP,3)
      ELSE
C*****NO LPI RECOVERY AFTER VB
        FREVO(ISP)=FREVO0(ISP,1)
      ENDIF
C*****FCCI *****
      IF (CDB) THEN
C*****COOLABLE DEBRIS BED: NO CCI RELEASE
        FCCI(ISP)=0.0
      ELSE IF ((INDX(8) .EQ. 1) .OR. TPCDB) THEN
C*****DRY CAVITY OR CCI RELEASE AFTER WATER DRYOUT
        IF (INDX(2) .EQ. 1) THEN
C*****HIGH ZR OXIDATION .IE., LOW ZR CONTENT IN
MCCI
          FCCI(ISP)=FCCI0(ISP,1)
        ELSE
C*****LOW ZR OXIDATION IE., HIGH ZR CONTENT IN MCCI
          FCCI(ISP)=FCCI0(ISP,3)
        ENDIF
      ELSE
C*****WATER OVER DEBRIS DURING CCI RELEASE
        IF (INDX(2) .EQ. 1) THEN
C*****HIGH ZR OXIDATION .IE., LOW ZR CONTENT IN
MCCI
          FCCI(ISP)=FCCI0(ISP,4)
        ELSE

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*****LOW ZR OXIDATION IE., HIGH ZR CONTENT IN MCCI
      FCCI(ISP)=FCCIO(ISP,2)
      ENDIF
    ENDIF
*****FCONV: CONTAINMENT RETENTION FOR IN-VESSEL RELEASE,
OUTER
*****      CONTAINMENT ONLY
*****FCONC: CONTAINMENT RETENTION FOR EX-VESSEL RELEASE,
INCLUDING
*****      DRYWELL AND OUTER CONTAINMENT
*****THIS IS RETENTION WITHOUT CONSIDERING OTHER EFFECTS
SUCH AS:
*****POOL BYPASS, CONTAINMENT SPRAYS, ETC.
      IF (INDX(6) .EQ. 9) THEN
*****NO CONTAINMENT FAILURE
          FCONV(ISP)=FCONVO(ISP,7)
          FCONC(ISP)=FCONCO(ISP,7)
      ELSE IF ((INDX(6) .EQ. 1) .OR. (INDX(6) .EQ. 4))
THEN
*****EARLY LEAK
          IF (SUBCL) THEN
*****SUPPRESSION POOL IS SUBCOOLED
              FCONV(ISP)=FCONVO(ISP,1)
              FCONC(ISP)=FCONVO(ISP,1)
          ELSE
              FCONV(ISP)=FCONVO(ISP,2)
              FCONC(ISP)=FCONCO(ISP,2)
          ENDIF
      ELSE IF ((INDX(6) .EQ. 2) .OR. (INDX(6) .EQ. 3)
.OR.
      1      (INDX(6) .EQ. 5)) THEN
*****EARLY RUPTURE
          IF (SUBCL) THEN
*****SUPPRESSION POOL SUBCOOLED
              FCONV(ISP)=FCONVO(ISP,3)
              FCONC(ISP)=FCONCO(ISP,3)
          ELSE
*****SUPPRESSION POOL SATURATED
              FCONV(ISP)=FCONVO(ISP,4)
              FCONC(ISP)=FCONCO(ISP,4)
          ENDIF
      ELSE IF (INDX(6) .EQ. 6) THEN
*****LATE LEAK
          FCONV(ISP)=FCONVO(ISP,5)
          FCONC(ISP)=FCONCO(ISP,5)
      ELSE
*****LATE RUPTURE OR LATE VENTING
          FCONV(ISP)=FCONVO(ISP,6)
          FCONC(ISP)=FCONCO(ISP,6)
      ENDIF
*****FDCH OR EX-VESSEL STEAM EXPLOSION *****
      IF (INDX(4) .EQ. 5) THEN
*****NO DCH, NO STEAM EXPLOSION
          FHPE=0.0
          EVSE=0.0
          FDCH(ISP)=0.0
          FEVSE(ISP)=0.0
      ELSE IF (INDX(4) .LE. 2) THEN
*****DCH, NO STEAM EXPLOSION
          EVSE=0.
          FEVSE(ISP)=0.
          FDCH(ISP)=FDCHO(ISP,1)

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      IF (INDX(4) .EQ. 1) THEN
        FHPE=FHPEO(1)
      ELSE
        FHPE=FHPEO(2)
      ENDIF
    ELSE
      C*****NO DCH, BUT EX-VESSEL STEAM EXPLOSION
      FHPE=0.0
      FDCH(ISP)=0.0
      FEVSE(ISP)=FEVSEO(ISP,1)
      IF (INDX(4) .EQ. 3) THEN
        EVSE=EVSEO(1)
      ELSE
        EVSE=EVSEO(2)
      ENDIF
    ENDIF
  C*****POOL BYPASS
  C*****FPLBYE, FPLBYI, AND FPLBYL:
  C*****FOR EARLY PHASE, ASSUME VACUUM BREAKER STICKS OPEN
  C*****FOR ASSIGNING
  C*****FPLBYE. IF BRKOPEN IS FALSE, SET FPLBYE TO 0.0
  C*****LATER
      IF (INDX(5) .LE. 4) THEN
        C*****ALL EARLY NOMINAL CASES: TAIL PIPE VACUUM
        C*****BREAKER STAYS CLOSED
        FPLBYE=FPLBYO(1)
        IF (INDX(5) .EQ. 1) THEN
          C*****NOMINAL BYPASS FOR ALL STAGES
          FPLBYI=FPLBYO(1)
          FPLBYL=FPLBYO(1)
        ELSE IF (INDX(5) .EQ. 2) THEN
          C*****EARLY NOMINAL, INTERMEDIATE LARGE
          FPLBYI=FPLBYO(3)
          FPLBYL=FPLBYO(3)
        ELSE IF (INDX(5) .EQ. 3) THEN
          C*****EARLY NOMINAL, LATE SMALL
          FPLBYI=FPLBYO(1)
          FPLBYL=FPLBYO(2)
        ELSE
          C*****EARLY NOMINAL, LATE LARGE
          FPLBYI=FPLBYO(1)
          FPLBYL=FPLBYO(3)
        ENDIF
      ELSE IF (INDX(5) .EQ. 5) THEN
        C*****EARLY SMALL OR LATE SMALL
        FPLBYE=FPLBYO(2)
        FPLBYI=FPLBYO(2)
        FPLBYL=FPLBYO(2)
      ELSE IF (INDX(5) .EQ. 6) THEN
        C*****EARLY SMALL, INTERMEDIATE LARGE
        FPLBYE=FPLBYO(2)
        FPLBYI=FPLBYO(3)
        FPLBYL=FPLBYO(3)
      ELSE IF (INDX(5) .EQ. 7) THEN
        C*****EARLY SMALL, LATE LARGE
        FPLBYE=FPLBYO(2)
        FPLBYI=FPLBYO(2)
        FPLBYL=FPLBYO(3)
      ELSE IF (INDX(5) .EQ. 8) THEN
        C*****EARLY LARGE AND LATE LARGE
        FPLBYE=FPLBYO(3)

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      FPLBYI=FPLBYO(3)
      FPLBYL=FPLBYO(3)
    ENDIF
C*****IF BRKOPN IS FALSE, THEN FPLBYE=0.0 IRREGARDLESS OF
DRYWELL
C*****LEAKAGE SINCE EVERYTHING GOES THROUGH POOL
      IF (.NOT. BRKOPN) FPLBYE=0.0
      IF (BRKOPN) THEN
C*****FOR VACUUM BREAKER STUCK OPEN CASES, ASSIGN TAIL
PIPE FLOW
C*****FRACTION FOR HIGH PRESSURE VERSUS LOW PRESSURE
SEQUENCES
      IF ((INDX(3) .EQ. 1) .OR. (INDX(3) .EQ. 3)) THEN
C*****VESSEL AT HIGH PRESSURE
      FTLPH=FTLPH
      ELSE
C*****VESSEL AT LOW PRESSURE
      FTLPL=FTLPL
    ENDIF
    ELSE
C*****VACUUM BREAKER STAYS CLOSED, NO POOL BYPASS
      FTLP=0.0
    ENDIF
C*****THE THREE POOL BYPASS FRACTIONS ARE FOR A "DRY
CAVITY" AND
C*****"FAILED CONTAINMENT". IT IS MULTIPLIED BY 'PFAC' IF
CONTAINMENT
C*****HAS NOT FAILED AND DIVIDED BY 'WFAC' IF THE CAVITY
IS FLOODED.
C*****
C*****ESTIMATE BYPASS FRACTION FOR THE VESSEL BREACH PUFF
(FPLBYP),
C*****DCH (FPLBYD) AND CCI RELEASES (FPLBYC)
C*****
C*****FOR IN-VESSEL RELEASE PHASE, ASSUMES NO PRESSURE
FACTOR (PFAC)
C*****APPLIES BUT STEAMING FACTOR (WFAC) ALWAYS APPLIES
      FPLBYE=FPLBYE / WFAC
C*****FOR THE PUFF CASE, IT IS ASSUMED VALUES WITH STEAM
ALWAYS APPLY
C*****ROUGHLY CONSISTENT WITH TB2
C*****FOR DCH, POOL BYPASS IS TREATED LIKE PUFF RELEASE
      FPLBYP=FPLBYI / WFAC
      FPLBYD=FPLBYI / WFAC
C*****LATE CONTAINMENT FAILURE CASES, APPLY PRESSURE
CORRECTION
      IF (INDX(6) .GE. 6) THEN
      FPLBYP=FPLBYP * PFAC
      FPLBYD=FPLBYD * PFAC
    ENDIF
C*****CCI RELEASE
      FPLBYC=FPLBYL
C*****FOR WET OR FLOODED CAVITY CASES, STEAMING FACTOR
APPLIES
      IF ((INDX(8) .EQ. 2) .OR. (INDX(8) .EQ. 3))
1      FPLBYC=FPLBYC / WFAC
      IF (INDX(6) .GE. 6) FPLBYC=FPLBYC * PFAC
C*****ALL FRACTIONS OF POOL BYPASS SHOULD BE <= 1.0
      FPLBYE=MIN (FPLBYE, 1.0)
      FPLBYP=MIN (FPLBYP, 1.0)
      FPLBYD=MIN (FPLBYD, 1.0)
      FPLBYC=MIN (FPLBYC, 1.0)

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C*****LATE IODINE RELEASE FROM POOL
      IF (SUBCL) THEN
        FLT11=FLT110(1)
      ELSE
        FLT11=FLT110(2)
      ENDIF
C*****LATE IODINE RELEASE FROM CAVITY WATER
      IF ((INDX(8) .EQ. 1) .OR. TMPCDB) THEN
C*****DRY CAVITY CASES
        FLT12=1.0
      ELSE IF (INDX(8) .EQ. 2) THEN
C*****WET CAVITY CASE LIKE TBS
        FLT12=FLT120(1)
      ELSE IF (INDX(8) .EQ. 3) THEN
C*****FLOODED CAVITY CASE LIKE TC
        FLT12=FLT120(2)
      ELSE
C*****NO CCI RELEASE CASE
        FLT12=0.0
      ENDIF
C*****IN-VESSEL RELEASE POOL SCRUBBING
      DFVPA(ISP)=DFVPA0(ISP,1)
C*****EX-VESSEL RELEASE POOL SCRUBBING
      DFCPA(ISP) = DFCPA0(ISP,1)
C*****CONTAINMENT (WETWELL) SPRAY DF
      IF (INDX(7) .EQ. 1) THEN
C*****NO SPRAYS
        DFSPRV(ISP)=1.0
        DFSPRC(ISP)=1.0
      ELSE IF (INDX(7) .EQ. 2) THEN
C*****EARLY SPRAYS ONLY
        DFSPRV(ISP)=DFSPRV0(ISP,1)
        DFSPRC(ISP)=1.0
      ELSE IF (INDX(7) .EQ. 3) THEN
C*****LATE SPRAYS ONLY
        DFSPRV(ISP)=1.0
        DFSPRC(ISP)=DFSPRC0(ISP,1)
      ELSE
C*****EARLY SPRAYS AND LATE SPRAYS
        DFSPRV(ISP)=DFSPRV0(ISP,1)
        DFSPRC(ISP)=DFSPRC0(ISP,1)
      ENDIF
C*****REACTOR CAVITY WATER SCRUBBING OF FISSION PRODUCTS
      IF ((INDX(8) .EQ. 1) .OR. TMPCDB) THEN
C*****DRY CAVITY OR DELAYED CCI RELEASE CASE
        DFCAV(ISP)=1.0
      ELSE IF (INDX(8) .EQ. 2) THEN
C*****WET CAVITY LIKE BMI-2139 TBS/TBR
        DFCAV(ISP)=DFCAV0(ISP,1)
      ELSE
C*****FLOODED CAVITY CDB: LIKE BMI-2139 TC
        DFCAV(ISP)=DFCAV0(ISP,2)
      ENDIF
C*****OTHER VARIABLES NOT SAMPLED IN LHS
C*****ASSUMES ALL CORE ULTIMATELY LEAVE VESSEL AFTER
VESSEL BREACH
      FLV=1.0
      IF (.NOT. VB) FLV=0.0
C*****VESSEL BREACH PUFF RELEASE
      VBPUF(ISP)=VBPUF0(ISP,1)
      500 CONTINUE

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C*****WARNING TIME
      IF ((INDX(1) .EQ. 1) .OR. (INDX(1) .EQ. 3) .OR.
1      (INDX(1) .EQ. 5)) THEN
C*****FAST STATION BLACKOUT, FAST TRANSIENT, FAST TC
      TW=TWO(1)
      ELSE IF ((INDX(1) .EQ. 2) .OR. (INDX(1) .EQ. 4)) THEN
C*****SLOW STATION BLACKOUT, SLOW TRANSIENT
      TW=TWO(2)
      ELSE
C*****SLOW TC
      TW=TWO(3)
      ENDIF
C*****CONTAINMENT FAILURE TIME OR START OF FIRST RELEASE
C*****WARNING TIME, CONTAINMENT FAILURE TIME, OR FIRST
RELEASE TIME
      IF ((INDX(1) .EQ. 1) .OR. (INDX(1) .EQ. 3) .OR.
1      (INDX(1) .EQ. 5)) THEN
C*****FAST SBO, FAST TRANSIENTS, FAST TC
      TW=TWO(1)
      IF (INDX(6) .LE. 3) THEN
C*****CF BEFORE VB
      T1=T10(1)
      ELSE IF (INDX(6) .GE. 6) THEN
C*****LATE CF OR NO CF
      T1=T10(3)
      ELSE
C*****CF AT VB
      T1=T10(2)
      ENDIF
      ELSE IF ((INDX(1) .EQ. 2) .OR. (INDX(1) .EQ. 4)) THEN
C*****SLOW SBO, SLOW TRANSIENTS
      TW=TWO(2)
      IF (INDX(6) .LE. 3) THEN
C*****CF BEFORE VB
      T1=T10(4)
      ELSE IF (INDX(6) .GE. 6) THEN
C*****LATE CF OR NO CF
      T1=T10(6)
      ELSE
C*****CF AT VB
      T1=T10(5)
      ENDIF
      ELSE
C*****SLOW TC
      TW=TWO(3)
      IF (INDX(6) .LE. 3) THEN
C*****CF BEFORE VB
      T1=T10(7)
      ELSE IF (INDX(6) .GE. 6) THEN
C*****LATE CF OR NO CF
      T1=T10(9)
      ELSE
C*****CF AT VB
      T1=T10(8)
      ENDIF
      ENDIF
C*****RELEASE DURATIONS DT1 AND DT2
C
      IF (INDX(6) .EQ. 9) THEN
C*****NO C.F.
      DT1 = DT10(4)
      DT2 = DT20(3)

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      ELSE IF (INDX(6).LE.3) THEN
C*****C.F. LEAK, RUPTURE, OR VENT BEFORE V.B.
      DT1 = DT10(1)
      IF (INDX(4).LE.4) THEN
C*****DCH, OR EVSE OCCURS
      DT2 = DT20(1)
      ELSE
C*****NO DCH, NO EVSE
      DT2 = DT20(2)
      ENDIF
C*****IF THE EARLY C.F. IS LEAK THEN USE LEAKAGE DT2
      IF (INDX(6).EQ.1) DT2 = DT20(3)
      ELSE IF ((INDX(6).EQ.4).OR.(INDX(6).EQ.6)) THEN
C*****LEAK AT V.B. OR LEAK LATE
      DT1 = DT10(4)
      DT2 = DT20(3)
      ELSE
C*****C.F. RUPTURE AT V.B. OR LATE OR VENT LATE
      IF (SUBCL) THEN
      DT1 = DT10(2)
      ELSE
      DT1 = DT10(3)
      ENDIF
      DT2 = DT20(2)
      ENDIF
C*****START OF SECOND RELEASE
C*****NO TEMPORARY COOLABLE DEBRIS BED
      T2=DT1 + DT1
C*****TEMPORARY COOLABLE DEBRIS BED
      IF (TMPCDB) T2=T2 + DTCDB
C*****FOR LATE CONTAINMENT FAILURE CASES, ASSIGN FRACTION
C*****OF TOTAL RELEASE TO THE FIRST RELEASE SEGMENT
C*****SET DEFAULT OF PUFF TO 1.0
      PUFF = 1.0
      IF ((INDX(6) .EQ. 7) .OR. (INDX(6) .EQ. 8)) THEN
C*****LATE RUPTURE OR LATE VENT
      PUFF=PUFF0(1)
      ELSE IF ((INDX(6).EQ.6).OR.(INDX(6).EQ.9)) THEN
C*****LATE LEAK OR NO CONTAINMENT FAILURE
      PUFF=PUFF0(2)
      ENDIF
      RETURN
      END
      SUBROUTINE EXPTAB
C*****SET VARIABLES IN COMMON BLOCK BINNED BY INTERPOLATION
      OF
C*****EXPERT OPINION TABLES
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
      MAXCAS=8,
      1 MAXISS=20, MAXLEV=10, MAXVAR=100,
      MAXVAL=12000,
      2 MAXSPC=10, MAXTIM=10)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
      DFPVA(MAXSPC),
      1 DFCPA(MAXSPC), FEVSE(MAXSPC),
      FDCH(MAXSPC),
      2 FCCI(MAXSPC), DFCAV(MAXSPC),
      VBPUF(MAXSPC),
      3 FCONV(MAXSPC), FCONC(MAXSPC),
      DFSPRV(MAXSPC),

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      4      DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
      5      FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
      6      FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
      7      FTLP, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
      8      TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
      9      ELEV, PUFF
      COMMON /BINNED/ FCORO(MAXSPC,MAXCAS),
FVESO(MAXSPC,MAXCAS),
      1      DFVPAO(MAXSPC,MAXCAS),
DFCPAO(MAXSPC,MAXCAS),
      2      FDCHO(MAXSPC,MAXCAS),
FEVSEO(MAXSPC,MAXCAS),
      3      FCCIO(MAXSPC,MAXCAS),
DFCAVO(MAXSPC,MAXCAS),
      4      VBPUFO(MAXSPC,MAXCAS),
FCONVO(MAXSPC,MAXCAS),
      5      FCONCO(MAXSPC,MAXCAS),
DFSPRVO(MAXSPC,MAXCAS),
      6      DFSPRCO(MAXSPC,MAXCAS),
FREVOO(MAXSPC,MAXCAS),
      7      FLTI1O(MAXCAS), FLTI2O(MAXCAS),
FHPEO(MAXCAS),
      8      EVSEO(MAXCAS), FPLBYO(3), TWO(MAXTIM),
      9      T1O(MAXTIM), DT1O(MAXTIM),
DT2O(MAXTIM),
      A      PUFFO(MAXTIM)
      COMMON /EXPERT/ FCORL(MAXSPC,MAXLEV,MAXCAS),
      1      FVESL(MAXSPC,MAXLEV,MAXCAS),
      2      FREVOL(MAXSPC,MAXLEV,MAXCAS),
      3      FCCIL(MAXSPC,MAXLEV,MAXCAS),
      4      FCONVL(MAXSPC,MAXLEV,MAXCAS),
      5      FCONCL(MAXSPC,MAXLEV,MAXCAS),
      6      FLTI1L(MAXLEV,MAXCAS),
FLTI2L(MAXLEV,MAXCAS),
      7      FDCHL(MAXSPC,MAXLEV,MAXCAS),
      8      FEVSEL(MAXSPC,MAXLEV,MAXCAS),
      9      DFVPAL(MAXSPC,MAXLEV,MAXCAS),
      A      DFCPAL(MAXSPC,MAXLEV,MAXCAS),
      B      DFCAVL(MAXSPC,MAXLEV,MAXCAS),
      C      DFSPRVL(MAXSPC,MAXLEV,MAXCAS),
      D      DFSPRCL(MAXSPC,MAXLEV,MAXCAS),
      E      PRBLEV(MAXLEV)
      DATA I1 / 1 /
C
C
C*****SET VALUES FOR RELEASE FRACTIONS DURING IN-VESSEL
RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(1), FCORL,
FCORO,
      1      PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM VESSEL
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(2), FVESL,
FVESO,
      1      PRBLEV)
C*****SET VALUES FOR REVOLATILIZATION RELEASE AFTER VESSEL
BREACH

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      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(3),
FREVOL, FREVOO,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS DURING CCI RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(4), FCCIL,
FCCIO,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM CONTAINMENT TO
ENVIRONMENT
C*****FOR IN-VESSEL RELEASE SOURCE TERMS
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(5),
FCONVL, FCONVO,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FROM CONTAINMENT TO
ENVIRONMENT
C*****FOR EX-VESSEL RELEASE SOURCE TERMS
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(6),
FCONCL, FCONCO,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FOR LATE IODINE
RELEASE FROM
C*****SUPPRESSION POOL
      CALL INTERP (I1, MAXLEV, MAXCAS, VALISS(7), FLT11L,
FLT110,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS FOR LATE IODINE
RELEASE FROM
C*****CAVITY WATER
      CALL INTERP (I1, MAXLEV, MAXCAS, VALISS(8), FLT12L,
FLT120,
      1          PRBLEV)
C*****SET VALUES FOR RELEASE FRACTIONS DUE TO DIRECT
CONTAINMENT HEATING
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(9), FDCHL,
FDCHO,
      1          PRBLEV)
C*****SET VALUES FOR SUPPRESSION POOL DF FOR IN-VESSEL
RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(10),
DFVPAL, DFVPAO,
      1          PRBLEV)
C*****SET VALUES FOR SUPPRESSION POOL DF AFTER VESSEL BREACH
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(11),
DFCPAL, DFCPAO,
      1          PRBLEV)
C*****SET VALUES FOR CAVITY WATER DF FOR CCI RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(12),
DFCAVL, DFCAVO,
      1          PRBLEV)
C*****SET VALUES FOR CONTAINMENT SPRAYS DF FOR IN-VESSEL
RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(13),
DFSPRVL, DFSPRVO,
      1          PRBLEV)
C*****SET VALUES FOR CONTAINMENT SPRAYS DF FOR EX-VESSEL
RELEASE
      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(14),
DFSPRCL, DFSPRCO,
      1          PRBLEV)
C*****SET VALUES FOR EX-VESSEL STEAM EXPLOSION RELEASE

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      CALL INTERP (MAXSPC, MAXLEV, MAXCAS, VALISS(15),
FEVSEL, FEVSEO,
      1          PRBLEV)
      RETURN
      END
      SUBROUTINE INTERP (MAXSPC, MAXLEV, MAXCAS, PROB, RL,
RO, PRBLEV)
C*****PERFORM INTERPOLATION IN SPECIFIED EXPERT OPINION
TABLE
      DIMENSION RL(MAXSPC,MAXLEV,MAXCAS), RO(MAXSPC,MAXCAS),

      1          PRBLEV(MAXLEV)
      LOGICAL FIRST
      DATA FIRST / .TRUE. /

C
C
      IF (FIRST) THEN
C*****DETERMINE NUMBER OF LEVELS
      DO 100 ILEV=2,MAXLEV
        IF (PRBLEV(ILEV) .LE. 0.0) THEN
          NLEV=ILEV - 1
          GO TO 200
        ENDIF
      100  CONTINUE
          NLEV=MAXLEV
      200  CONTINUE
          IF (NLEV .LE. 1) THEN
            WRITE(6,1002)
            STOP
          ENDIF
          FIRST=.FALSE.
        ENDIF
C*****VALIDATE PROBABILITY
      IF (PROB .LT. PRBLEV(1)) THEN
        WRITE(6,1001) PROB, (PRBLEV(I),I=1,NLEV)
        STOP
      ENDIF
C*****LOCATE PROBABILITY LEVELS TO INTERPOLATE BETWEEN
      DO 1000 ILEV=2,NLEV
        IF (PROB .LE. PRBLEV(ILEV)) THEN
          JLEV=ILEV
          GO TO 2000
        ENDIF
      1000 CONTINUE
C*****PROBABILITY VALUE OUTSIDE OF TABLE RANGE
      WRITE(6,1001) PROB, (PRBLEV(I),I=1,NLEV)
      STOP
      2000 CONTINUE
C*****LOOP OVER CASES
      DO 4000 ICAS=1,MAXCAS
C*****LOOP OVER SPECIES
        DO 3000 ISPEC=1,MAXSPC
C*****PERFORM INTERPOLATION FOR CURRENT SPECIES AND
CASE
          IF ((RL(ISPEC,1,ICAS) .GT. 0.0) .AND.
      1          (RL(ISPEC,NLEV,ICAS)/RL(ISPEC,1,ICAS) .GT.
      10.)) THEN
C*****PERFORM LOGARITHMIC INTERPOLATION
      RO(ISPEC,ICAS)=10.**(LOG10(RL(ISPEC,JLEV-1,ICAS)) +
      1          (PROB-PRBLEV(JLEV-1)) *

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      2
      (LOG10(RL(ISPEC,JLEV,ICAS))-LOG10(RL(ISPEC,JLEV-1,ICAS))) /
      3      (PRBLEV(JLEV)-PRBLEV(JLEV-1)))
      ELSE
C*****PERFORM LINEAR INTERPOLATION
      RO(ISPEC,ICAS)=RL(ISPEC,JLEV-1,ICAS) +
      1      (PROB-PRBLEV(JLEV-1)) *
      2
      (RL(ISPEC,JLEV,ICAS)-RL(ISPEC,JLEV-1,ICAS)) /
      3      (PRBLEV(JLEV)-PRBLEV(JLEV-1))
      ENDIF
      3000 CONTINUE
      4000 CONTINUE
      RETURN
C*****FORMAT STATEMENTS
      1001 FORMAT(/1X,'>>>>PROBABILITY VALUE ('F5.2,') OUT OF
RANGE FOR ',
      1      'INTERPOLATION OF LEVELS',
      2      /1X,'>>>>PRBLEV(I)='20F6.3)
      1002 FORMAT(/1X,'>>>>FEWER THAN 2 PROBABILITY LEVELS
(PRBLEV) ',
      1      'SPECIFIED')
      END
      SUBROUTINE GGSORC (IOBS, IBIN)
C*****CALCULATE XXSOR TYPE OF SOURCE TERMS FOR THE GRAND
GULF
C-----
-----
C
C      - - - - OUTPUT - - -
C
C ST(ISP) == TOTAL ENVIRONMENTAL RELEASE FRACTIONS FOR
SPECIES 'ISP'
C      (EARLY + LATE)
C STE(ISP) == RELEASES UP THROUGH VESSEL BREACH. THE
DEFINING TIME
C      IS RELEASE TO THE CONTAINMENT; ACTUAL
RELEASE TO THE
C      ENVIRONMENT WILL BE LATER IF CONTAINMENT
FAILURE IS LATER
C STCCI(ISP) == CCI RELEASE SOURCE TERMS
C STL(ISP) == LATE RELEASE SOURCE TERMS (CCI+STIL+STRVOL)
C STIL == "LATE" IODINE COMPONENT, TREATED AS GASEOUS
(E.G., ORGANIC)
C      IODINE RELEASED FROM POOL AND FLOODED
CAVITY;
C      NO DF'S OR CONTAINMENT RETENTION FACTORS
APPLY
C STRVOL(ISP)== I, CS AND TE COMPONENT REVOLATILIZED FROM
PRIMARY SYSTEM:
C      TREATED AS AEROSOL; DF'S FOR SPRAYS,
SUPPRESSION POOL
C      SCRUBBING, AND CONTAINMENT RETENTION APPLY
C=====
=====
C
C SPECIES INDEX=ISP, 1 TO NSPEC; ORDER IS
NG,I,CS,TE,SR,RU,LA,CE,BA
C
C FCOR == RELEASE FRACTION OF EACH ELEMENT GROUP FROM THE
FUEL DURING

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C          DURING IN-VESSEL RELEASE
C FVES == RELEASE FRACTION FROM THE VESSEL (FRACTION OF
FCOR)
C DFVPA == POOL DF'S DURING IN-VESSEL RELEASE
C DFCPA == POOL DF'S DURING CCI RELEASE
C VBPUF == PUFF RELEASE FRACTION OF THE TOTAL CORE AT
VESSEL BREACH
C          - - - POOL BYPASS PARAMETERS - - -
C FPLBYE, FPLBYP, FPLBYD, FPLBYC ==
C          FRACTION OF POOL BYPASS AT IFFERENT TIME STEPS:
C          EARLY (BEFORE VB), PUFF SOURCE TERMS,
C          DCH SOURCE TERMS, AND CCI SOURCE TERMS.
C          THIS FRACTION DO NOT GO THROUGH SUPPRESSION POOL
C FCONV == FRACTIONS OF AEROSOL SPECIES RELEASED FROM THE
RCS TO THE
C          CONTAINMENT AND THEN TO THE ENVIRONMENT
C FCONC == FRACTIONS OF AEROSOL SPECIES RELEASED TO FROM
CCI TO THE
C          CONTAINMENT AND THEN TO THE ENVIRONMENT
(INCLUDES DRYWELL
C          RETENTION AND OUTER CONTAINMENT RETENTION)
C DFSPRV== DF'S FOR SPRAYS (ESTIMATED FROM CALCULATED CS
AND I RELEASES)
C DFSPRC== DF'S FOR SPRAYS (ESTIMATED FROM CALCULATED SR
AND CE RELEASES)
C FLTI1 == LATE IODINE RELEASE FROM SUPPRESSION POOL
C FLTI2 == LATE IODINE RELEASE FROM CAVITY WATER
C
      PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
      1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
      2          MAXSPC=10, MAXTIM=10)
      CHARACTER BINARR*(MAXBD), BTITLE*80, TITLE*80
      COMMON /BINS/ BINARR(MAXBIN), BTITLE, TITLE
      LOGICAL NOCALC, SAMPLE, REPTB, BINNED, BYRUN, CONSFL,
DIAG,
      1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /KEYS/ NOCALC, SAMPLE, REPTB, BINNED, BYRUN,
CONSFL, DIAG,
      1          EXPERT, PRTINP, NOCF, SUBCL, CDB, TMPADB, BRKOPN,
VB, ECF, ICF
      COMMON /SRCTRM/ ST(MAXSPC), STE(MAXSPC),
STCCI(MAXSPC),
      1          STL(MAXSPC), STIL, STRVOL(MAXSPC),
      2          ST1(MAXSPC), ST2(MAXSPC), RV(MAXSPC)
      COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
      1          DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
      2          FCCI(MAXSPC), DFCV(MAXSPC),
VBPUF(MAXSPC),
      3          FCONV(MAXSPC), FCONC(MAXSPC),
DFSPRV(MAXSPC),
      4          DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
      5          FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
      6          FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,

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      7          FTLP, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
      8          TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
      9          ELEV, PUFF
COMMON /BININD/ INDX(MAXBD)
COMMON /CONTRL/ NLHS, NOBS, NSTART, NBIN, NDM, NTOT
DIMENSION RFDCH(MAXSPC), RFCCI(MAXSPC), RFBVB(MAXSPC),

1          RFEVSE(MAXSPC)
C
C
C*****ZERO OUT THE SOURCE TERM ARRAYS
DO 1000 ISP=1,NSPEC
  RFBVB(ISP)=0.0
  RFEVSE(ISP)=0.0
  RFDCH(ISP)=0.0
  RFCCI(ISP)=0.0
  ST(ISP)=0.0
  STE(ISP)=0.0
  STCCI(ISP)=0.0
  STL(ISP)=0.0
  STRVOL(ISP)=0.0
1000 CONTINUE
  POOLI=0.0
  CAVWI=0.0
  STIL=0.0
C*****SAVE I, CS, AND TE IN VESSEL FOR REVOLATILIZATION IN
LATE RELEASES
DO 1200 ISP=2,4
  RV(ISP)=FCOR(ISP) * (1.0-FVES(ISP))
1200 CONTINUE
C*****RELEASE FROM VESSEL PRIOR TO VESSEL BREACH
DO 2000 ISP=1,NSPEC
C*****RELEASE FRACTION THRU TAIL PIPE THAT BYPASSES POOL
  RELF1=FTLP * FPLBYE / DFSPRV(ISP)
C*****RELEASE FRACTION THRU TAIL PIPE THAT GOES THRU POOL
  RELF2=FTLP * (1.0-FPLBYE) / MAX (DFCPA(ISP),
DFSPRV(ISP))
C*****RELEASE FRACTION THRU T-QUENCHER
  RELF3=(1.0-FTLP) / MAX (DFVPA(ISP), DFSPRV(ISP))
C*****EARLY RELEASE FRACTION
  STE(ISP)=FCOR(ISP) * FVES(ISP) *
(RELF1+RELF2+RELF3) *
1          FCONV(ISP)
  RFBVB(ISP)=STE(ISP)
C*****SAVE IODINE IN POOL
  IF (ISP.EQ. 2) THEN
    POOLI=FCOR(ISP) * FVES(ISP) *
1          MAX (0.0, (1.0-RELF1-RELF2-RELF3))
  ENDIF
2000 CONTINUE
  IF (DIAG) THEN
C*****DIAGNOSTIC PRINT
    WRITE(6,2001)
    WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
    WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
    WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
    WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
    WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
    WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)

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        WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
        WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4),
POOLI,
    1          CAVWI, STIL
        ENDIF
C*****IF NO VB, THEN NO PUFF, NO CCI, NO DCH SOURCE TERMS
        IF (.NOT. VB) GO TO 7500
C*****ADD VESSEL BREACH PUFF RELEASE TO EARLY SOURCE TERM
        DO 3000 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO VESSEL BREACH PUFF THAT
        BYPASSES POOL
            RELF1=FPLBYP / DFSPRC(ISP)
C*****RELEASE FRACTION DUE TO VESSEL BREACH PUFF THAT
        GOES THRU POOL
            RELF2=(1.0-FPLBYP) / MAX (DFCPA(ISP), DFSPRC(ISP))
C*****EARLY RELEASE FRACTION
            STE(ISP)=STE(ISP) +
VBPUF(ISP)*(RELF1+RELF2)*FCONC(ISP)
            STE(ISP)=MIN (STE(ISP), 1.0)
C*****SAVE IODINE IN POOL
            IF (ISP.EQ. 2) THEN
                POOLI=POOLI + VBPUF(ISP)*MAX (0.0,
(1.0-RELF1-RELF2))
            ENDIF
        3000 CONTINUE
        IF (DIAG) THEN
C*****DIAGNOSTIC PRINT
            WRITE(6,3001)
            WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
            WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
            WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
            WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
            WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
            WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
            WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
            WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
            WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4),
POOLI,
    1          CAVWI, STIL
        ENDIF
C*****ADD DIRECT CONTAINMENT HEATING RELEASE TO EARLY SOURCE
        TERM
        DO 4000 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO DIRECT CONTAINMENT HEATING
            RFDCH(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPUF(ISP))) *
FLV *
    1          FHPE * FDCH(ISP)
            IF (RFDCH(ISP) .GT. 0.0) THEN
C*****RELEASE FRACTION DUE TO DIRECT CONTAINMENT
            HEATING THAT
C*****BYPASSES POOL
                RELF1=FPLBYD / DFSPRC(ISP)
C*****RELEASE FRACTION DUE TO DIRECT CONTAINMENT
            HEATING THAT
                GOES THRU POOL
                RELF2=(1.0-FPLBYD) / MAX (DFCPA(ISP),
DFSPRC(ISP))
C*****EARLY RELEASE FRACTION
                STE(ISP)=STE(ISP) + RFDCH(ISP) * (RELF1+RELF2) *
FCONC(ISP)
                STE(ISP)=MIN (STE(ISP), 1.0)

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Appendix D.1

```

C*****SAVE IODINE IN POOL
      IF (ISP.EQ. 2) THEN
        POOLI=POOLI + RFDCH(ISP)*MAX (0.0,
(1.0-RELF1-RELF2))
      ENDIF
    ENDIF
  4000 CONTINUE
    IF (DIAG) THEN
C*****DIAGNOSTIC PRINT
      WRITE(6,4201)
      WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
      WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
      WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
      WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
      WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
      WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
      WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
      WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
      WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4),
POOLI,
      1 CAVWI, STIL
    ENDIF
C*****ADD EX-VESSEL STEAM EXPLOSION (DCH TAKES PRECEDENT
OVER EVSE)
      DO 4500 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO EX-VESSEL STEAM EXPLOSION
      RFEVSE(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPUF(ISP))) *
FLV *
      1 EVSE * FEVSE(ISP)
      IF (RFEVSE(ISP) .GT. 0.0) THEN
C*****RELEASE FRACTION DUE TO EX-VESSEL STEAM
EXPLOSION, THAT
C*****BYPASSES POOL
      RELF1=FPLBYD / DFSPRC(ISP)
C*****RELEASE FRACTION DUE TO EX-VESSEL STEAM
EXPLOSION THAT
C*****GOES THRU POOL
      RELF2=(1.0-FPLBYD) / MAX (DFCPA(ISP),
DFSPRC(ISP))
C*****EARLY RELEASE FRACTION
      STE(ISP)=STE(ISP) +
RFEVSE(1SP)*(RELF1+RELF2)*FCONC(ISP)
      STE(ISP)=MIN (STE(ISP), 1.0)
C*****SAVE IODINE IN POOL
      IF (ISP.EQ. 2) THEN
        POOLI=POOLI + RFEVSE(ISP)*MAX (0.0,
(1.0-RELF1-RELF2))
      ENDIF
    ENDIF
  4500 CONTINUE
    IF (DIAG) THEN
C*****DIAGNOSTIC PRINT
      WRITE(6,4501)
      WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
      WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
      WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
      WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
      WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
      WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
      WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
      WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)

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Appendix D.1

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WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4),
POOLI,
1          CAVWI, STIL
ENDIF
IF (EVSE .GT. 0.0) THEN
  XCCI=1.0 - EVSE
ELSE IF (FHPE .GT. 0.0) THEN
  XCCI=1.0 - FHPE
ELSE
  XCCI=1.0
ENDIF
IF (.NOT. CDB) THEN
C*****CORE-CONCRETE INTERACTION RELEASES AND CAVITY
SCRUBBING
  DO 5000 ISP=1,NSPEC
C*****RELEASE FRACTION DUE TO CORE-CONCRETE
INTERACTIONS
    RFCCI(ISP)=MAX (0.0, (1.0-FCOR(ISP)-VBPUF(ISP)))
  * FLV *
    1          XCCI * FCCI(ISP)
C*****RELEASE FRACTION DUE TO CORE-CONCRETE
INTERACTIONS THAT
C*****BYPASSES POOL
    RELF1=FPLBYC / MAX (DFCAV(ISP), DFSPRC(ISP))
C*****RELEASE FRACTION DUE TO CORE-CONCRETE
INTERACTIONS THAT
C*****GOES THRU POOL
    RELF2=(1.0-FPLBYC) /
    1          MAX (DFCAV(ISP), DF CPA(ISP), DFSPRC(ISP))
C*****CORE-CONCRETE RELEASE FRACTION
    STCCI(ISP)=RFCCI(ISP) * (RELF1+RELF2) *
FCONC(ISP)
C*****SAVE IODINE IN CAVITY WATER AND IN POOL
    IF (ISP .EQ. 2) THEN
      CAVWI=1.0 - 1.0/DFCAV(ISP)
      POOLI=POOLI + RFCCI(ISP) *
    1          MAX (0.0, (1.0-RELF1-RELF2-CAVWI))
      CAVWI=RFCCI(ISP) * CAVWI
    ENDIF
  5000 CONTINUE
ENDIF
C*****REVOLATIZATION RELEASE OF I, CS, AND TE
C***** (SIMILAR TO VESSEL BREACH PUFF RELEASE)
  DO 6000 ISP=2,4
C*****RELEASE FRACTION DUE TO REVOLATILIZATION THAT
BYPASSES POOL
    RELF1=FPLBYC / DFSPRC(ISP)
C*****RELEASE FRACTION DUE TO REVOLATILIZATION THAT GOES
THRU POOL
    RELF2=(1.0-FPLBYC) / MAX (DF CPA(ISP), DFSPRC(ISP))
C*****REVOLATILIZATION RELEASE FRACTION
    STRVOL(ISP)=FREVO(ISP) * RV(ISP) * (RELF1+RELF2) *
FCONC(ISP)
C*****SAVE IODINE IN POOL
    IF (ISP .EQ. 2) THEN
      POOLI=POOLI + FREVO(ISP)*RV(ISP)*
    1          MAX (0.0, (1.0-RELF1-RELF2))
    ENDIF
  6000 CONTINUE
C*****CCI, RCS REVOLATILIZATION WERE SKIPPED IF VESSEL
BREACH WAS PREVENTED,
C*****BUT LATE IODINE RELEASE FROM THE POOL CAN STILL OCCUR.

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Appendix D.1

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7500 CONTINUE
C*****NOW WE CALCULATE THE IODINE REVOLATILIZED FROM THE
POOL,
C*****WHICH IS NOT SUBJECT TO ANY DF'S OR CONTAINMENT
RETENTION IF
C*****CONTAINMENT FAILS. HOWEVER, IF NO CONTAINMENT FAILURE,
ASSUME
C*****ONLY SMALL FRACTION RELEASED TO ENVIRONMENT.
C*****FOR LATE IODINE RELEASE FROM CAVITY WATER, POOL BYPASS
FRACTION
C*****APPLIES. POOL DF OF IODINE APPLIES TO FRACTION GO
THROUGH POOL
      STIL1=FLTI1 * POOLI
      STIL2=FLTI2 * CAVWI * (FPLBYC+(1.0-FPLBYC)/DFCPA(2))
      STIL=STIL1 + STIL2
C*****IF NO CONTAINMENT FAILURE, LATE IODINE RELEASE IS
TREATED SIMILAR
C*****TO NOBLE GASES SINCE IODINE IS VOLATILE
      IF (NOCF) STIL=STIL * FCONC(1)
C*****ADD ALL SOURCE TERMS UP TO GET TOTAL SOURCE TERMS
      DO 8000 ISP=1, NSPEC
          STL(ISP)=STCCI(ISP) + STRVOL(ISP)
          ST(ISP)=STE(ISP) + STL(ISP)
8000 CONTINUE
      ST(2)=ST(2) + STIL
      STL(2)=STL(2) + STIL
C*****REALLOCATE RELEASE FRACTIONS
      DO 9000 ISP=1, NSPEC
          IF (ECF) THEN
C*****CF BEFORE VB
              ST1(ISP)=RFBVB(ISP)
              ST2(ISP)=ST(ISP) - ST1(ISP)
          ELSE IF (ICF) THEN
C*****CF AT VB
              ST1(ISP)=STE(ISP)
              ST2(ISP)=STL(ISP)
          ELSE
C*****LATE LEAK OR RUPTURE OR NO CONTAINMENT FAILURE
              STE(ISP)=0.0
              STL(IP)=ST(ISP)
              ST1(ISP)=PUFF * ST(ISP)
              ST2(ISP)=(1.0-PUFF) * ST(ISP)
          ENDIF
      ENDIF
9000 CONTINUE
C*****CALCULATE ENERGY RELEASES
      CALL ENERGY (E1, E2)
C*****CALCULATE ENERGY RELEASE RATES
      ER1=E1 / DT1
      ER2=E2 / DT2
      IF (DIAG) THEN
          WRITE(6,8001)
          WRITE(6,4202) (STE(ISP),ISP=1,NSPEC)
          WRITE(6,4203) (STL(ISP),ISP=1,NSPEC)
          WRITE(6,4204) (ST(ISP),ISP=1,NSPEC)
          WRITE(6,4205) (RFBVB(ISP),ISP=1,NSPEC)
          WRITE(6,4206) (RFEVSE(ISP),ISP=1,NSPEC)
          WRITE(6,4207) (RFDCH(ISP),ISP=1,NSPEC)
          WRITE(6,4208) (RFCCI(ISP),ISP=1,NSPEC)
          WRITE(6,4209) (STCCI(ISP),ISP=1,NSPEC)
          WRITE(6,4210) (RV(I),I=2,4), (STRVOL(I),I=2,4),
POOLI,

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1          CAVWI, STIL
      WRITE(6,4211) TW, T1, DT1, T2, DT2, ELEV, ER1, ER2
      WRITE(6,4212) (ST1(ISP),ISP=1,NSPEC)
      WRITE(6,4213) (ST2(ISP),ISP=1,NSPEC)
      ENDIF
      IF (CONSFL) THEN
C*****WRITE SOURCE TERM TO FILE
      WRITE(9,1003) IOBS, BINARR(IBIN)(1:NDM)
      WRITE(9,1004) TW, T1, DT1, T2, DT2, ELEV
      WRITE(9,1004) ER1, (ST1(ISP),ISP=1,NSPEC)
      WRITE(9,1004) ER2, (ST2(ISP),ISP=1,NSPEC)
      ENDIF
      RETURN
C*****FORMAT STATEMENTS
1003 FORMAT(I4,2X,A)
1004 FORMAT(1P10E12.4)
2001 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****',
1      /10X,'===== PARAMETER VALUES UP TO VESSEL
BREACH =====')
3001 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****',
1      /10X,'===== PARAMETER VALUES AFTER VESSEL
BREACH =====')
4201 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****',
1      /10X,'===== PARAMETER VALUES AFTER DCH =====')
4202 FORMAT(/5X,'STE:',1P,/(5X,10E10.2))
4203 FORMAT(5X,'STL:',1P,/(5X,10E10.2))
4204 FORMAT(5X,'ST:',1P,/(5X,10E10.2))
4205 FORMAT(5X,'RFBVB:',1P,/(5X,10E10.2))
4206 FORMAT(5X,'RFEVSE:',1P,/(5X,10E10.2))
4207 FORMAT(5X,'RFDCH:',1P,/(5X,10E10.2))
4208 FORMAT(5X,'RFCCI:',1P,/(5X,10E10.2))
4209 FORMAT(5X,'STCCI:',1P,/(5X,10E10.2))
4210 FORMAT(5X,1P,'RVI = ',E10.2,5X,'RVCS =
',E10.2,5X,'RVTE = ',E10.2,
1      /5X,'STRVOL(2) = ',E10.2,5X,'STRVOL(3) =
',E10.2,
2      5X,'STRVOL(4) = ',E10.2,
3      /5X,'POOLI = ',E10.2,5X,'CAVWI = ',E10.2,
4      5X,'STIL = ',E10.2)
4211 FORMAT(/5X,'SOURCE TERM INFORMATION:',
1      /5X,1P,'TW = ',E10.2,5X,'T1 = ',E10.2,5X,'DT1
= ',E10.2,5X,
2      'T2 = ',E10.2,5X,'DT2 = ',E10.2,
3      /5X,'ELEV = ',E10.2,5X,'ER1 = ',E10.2,5X,'ER2
= ',E10.2)
4212 FORMAT(5X,'ST1:',1P,/(5X,10E10.2))
4213 FORMAT(5X,'ST2:',1P,/(5X,10E10.2))
4501 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****',
1      /10X,'===== PARAMETER VALUES AFTER EVSE =====')
8001 FORMAT(/5X,'***** DIAGNOSTIC PRINT *****',
1      /10X,'===== PARAMETER VALUES AT END OF GGSORC
=====')
      END
      SUBROUTINE ENERGY (EARLY, TAIL)
C*****ESTIMATE ENERGY RELEASES FOR BOTH EARLY PUFF AND LATE
C*****TAIL. DATA BASE ARE TAKEN FROM RESULTS OF STCP
CALCULATIONS
C*****FOR GRAND GULF: TC, TB1, TB2, AND TBS.
C*****TC11: 15 MINUTE PUFF ENERGY RELEASE (BTU) FOR TC
C*****TC12: TOTAL ENERGY RELEASE (BTU) FOR TC
C*****EARLY: CALCULATED 15 MINUTE PUFF ENERGY RELEASE
(JOULES)

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C*****TAIL: CALCULATED ENERGY RELEASE AFTER 15 MINUTES
(JOULES)
C*****RLATCF: COORECTION FACTOR FOR LATE CONTAINMENT
FAILURE,
C*****          AND IS EQUAL TO RATIO OF TB22/TB12.
C*****SPRFAC: CONTAINMENT SPRAY FACTOR FOR BOTH EARLY AND
TAIL
C*****ENERGY RELEASE, AND IS EQUAL TO RATIO OF TBS2/TBR2.
          PARAMETER (MAXBD=20, MAXBIN=10000, MAXSMP=300,
MAXCAS=8,
          1          MAXISS=20, MAXLEV=10, MAXVAR=100,
MAXVAL=12000,
          2          MAXSPC=10, MAXTIM=10)
          COMMON /BASVAL/ FCOR(MAXSPC), FVES(MAXSPC),
DFVPA(MAXSPC),
          1          DFCPA(MAXSPC), FEVSE(MAXSPC),
FDCH(MAXSPC),
          2          FCCI(MAXSPC), DFCAV(MAXSPC),
VBPUF(MAXSPC),
          3          FCONV(MAXSPC), FCONC(MAXSPC),
DFSPRV(MAXSPC),
          4          DFSPRC(MAXSPC), FREVO(MAXSPC),
VALISS(MAXISS),
          5          FLTI1, FLTI2, NSPEC, FLV, FHPE, EVSE,
WFAC, PFAC,
          6          FPLBYE, FPLBYP, FPLBYD, FPLBYC, FTLPH,
FTLPL,
          7          FTLPL, TC11, TC12, TB11, TB12, TB21,
TB22, TBS1,
          8          TBS2, TBR1, TBR2, TW, T1, T2, DT1,
DT2, DTCDB,
          9          ELEV, PUFF
          COMMON /BININD/ INDX(MAXBD)
C
C
          RLATCF=TB22 / TB12
          SPRFAC=TBS2 / TBR2
C*****IF CONTAINMENT DOES NOT FAIL, BYPASS CALCULATION
          IF (INDX(6) .NE. 5) THEN
C*****CONTAINMENT FAILS EARLY OR LATE
C*****ASSIGN SPRAY FACTORS
          IF (INDX(7) .EQ. 1) THEN
              SPRAYV=1.0
              SPRAYC=1.0
          ELSE IF (INDX(7) .EQ. 2) THEN
              SPRAYV=SPRFAC
              SPRAYC=1.0
          ELSE IF (INDX(7) .EQ. 3) THEN
              SPRAYV=1.0
              SPRAYC=SPRFAC
          ELSE IF (INDX(7) .EQ. 4) THEN
              SPRAYV=SPRFAC
              SPRAYC=SPRFAC
          END IF
          IF (INDX(3) .EQ. 5) THEN
C*****NO VESSEL BREACH
              EARLY=TC11 / SPRAYV
              TAIL=0.0
          ELSE
C*****VESSEL BREACH
              IF (INDX(1) .GE. 5) THEN

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```
C*****LIKE TC SEQUENCE
      EARLY=TC11 / SPRAYV
      TAIL=(TC12-TC11) / SPRAYC
      ELSE IF ((INDX(1) .EQ. 1) .OR. (INDX(1) .EQ. 3))
THEN
C*****LIKE TBS/TBR SEQUENCES
      EARLY=TBS1 / SPRAYV
      TAIL=(TBS2-TBS1) / SPRAYC
      ELSE
C*****SLOW TRANSIENT AND SLOW SBO: LIKE TB1/TB2
SEQUENCES
      EARLY=TB21 / SPRAYV
      TAIL=(TB22-TB21) / SPRAYC
      ENDIF
      IF (INDX(6) .GE. 6) THEN
C*****CORRECT FOR LATE CF
      TAIL=TAIL / RLATCF
      ENDIF
      ENDIF
      ELSE
C*****NO CONTAINMENT FAILURE
      EARLY=0.0
      TAIL=0.0
      ENDIF
C*****CONVERT BTU TO JOULES
      EARLY=1055. * EARLY
      TAIL=1055. * TAIL
      RETURN
      END
```

APPENDIX D.2 GGSOR Data Base

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$ GGSOR DATA BASE : FEBRUARY 17, 1989
$*****
$ ENERGY RELEASE PARAMETERS BASED ON STCP VALUES (BTU) (BMI-2139)
TC11 5.45E+7 $ 15 MIN. ENERGY RELEASE (TC)
TC12 1.44E+8 $ TOTAL ENERGY RELEASE (TC)
TB11 1.91E+7 $ 15 MIN. ENERGY RELEASE (TB1)
TB12 1.95E+7 $ TOTAL ENERGY RELEASE (TB1)
TB21 1.96E+7 $ 15 MIN. ENERGY RELEASE (TB2)
TB22 4.67E+7 $ TOTAL ENERGY RELEASE (TB2)
TBS1 5.10E+6 $ 15 MIN. ENERGY RELEASE (TBS)
TBS2 2.80E+7 $ TOTAL ENERGY RELEASE (TBS)
TBR1 3.57E+6 $ 15 MIN. ENERGY RELEASE (TBR)
TBR2 5.45E+6 $ TOTAL ENERGY RELEASE (TBR)
$ WARNING TIME (S) CORE DAMAGE (2 FT ABOVE BOTTOM OF ACTIVE FUEL)
TWO(1) 3600. $ FAST STATION BLACKOUT
TWO(2) 43200. $ SLOW STATION BLACKOUT
TWO(3) 28800. $ SLOW TC
$ CONTAINMENT FAILURE TIME OR FIRST RELEASE TIME (S)
T10(1) 8280. $ FAST SEQUENCES, CF BEFORE VB
T10(2) 12960. $ FAST SEQUENCES, CF AT VB
T10(3) 50400. $ FAST SEQUENCES, CF LATE OR NO CF
T10(4) 48600. $ SLOW SBO, CF BEFORE VB
T10(5) 54000. $ SLOW SBO, CF AT VB
T10(6) 72000. $ SLOW SBO, CF LATE OR NO CF
T10(7) 32400. $ SLOW TC, CF BEFORE VB
T10(8) 36000. $ SLOW TC, CF AT VB
T10(9) 72000. $ SLOW TC, CF LATE OR NO CF
$ RELEASE DURATION FOR FIRST RELEASE (S)
DT10(1) 4680. $ CF RUPTURE, VENTING OR LEAK BEFORE VB
DT10(2) 180. $ CF RUPTURE AT VB OR LATE, SUBCOOLED
DT10(3) 900. $ CF RUPTURE AT VB OR LATE, SATURATED
DT10(4) 7200. $ LEAK
$ RELEASE DURATION FOR SECOND RELEASE (S)
DT20(1) 3600. $ CF RUPTURE BEFORE VB AND DCH OR EVSE AT VB
DT20(2) 14400. $ CF RUPTURE AT VB OR LATE
DT20(3) 21600. $ CF LEAK
$ DELAY TIME FOR SECOND RELEASE (S) FOR TEMPORARY COOLABLE DEBRIS BED
DTCDB 10800.
$ FIRST RELEASE (PUFF) FRACTION FOR LATE CONTAINMENT FAILURE
PUFF0(1) 0.90 $ LATE CONTAINMENT FAILURE
PUFF0(2) 0.50 $ LATE LEAK OR NO CONTAINMENT FAILURE
$ RELEASE ELEVATION (M)
ELEV 32.
$*****
$ FPLBYO: FRACTION OF POOL BYPASS HAS THREE CASES
FPLBYO(1) 0.0564 1.32 1.E+06
$ DRY CAVITY AND CONTAINMENT FAILURE CASES DERIVED FROM BMI-2139 GG STCP CALC
$ IF CAVITY IS WET, DIVIDED BY WFAC
$ IF LATE CF, MULTIPLIED BY PFAC
$ STEAMING CORRECTION FACTOR FOR FPLBYO IF CAVITY IS NOT DRY
WFAC 3.1
$ PRESSURE CORRECTION FACTOR FOR FPLBYO IF LATE CONTAINMENT FAILURE
PFAC 3.9
$ SPLIT FRACTION BETWEEN TAIL PIPE VACUUM BREAKER OPENING AND T-QUENCHER
$ HIGH PRESSURE SEQUENCES
FTLPH 0.39
$ LOW PRESSURE SEQUENCES
FTLPL 1.0
$*****
$ FHPE: FRACTION OF CORE PARTICIPATING IN DCH OR STEAM EXPLOSION
$ TWO CASES: (1) HIGH, (2) LOW

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Appendix D.2

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FHPEO(1) 0.4 0.1
$ *****
$ EVSE: FRACTION OF CORE PARTICIPATING IN EX-VESSEL STEAM EXPLOSION
EVSEO(1) 0.2 0.05
$ *****
$ PUFF RELEASE AT VESSEL BREACH: ONE SET FOR ALL => USE GG TB1/TB2
VBP UFO(1,1) 7.55E-5 5.92E-5 6.83E-5 5.30E-5 1.87E-7 2.31E-10 7.64E-12
0.0 5.63E-6
$ *****
$ THE FOLLOWING DATA BLOCKS WHICH HAVE VARIABLES ENDING WITH "0"
$ ARE TAKEN FROM MEDIAN VALUES FROM EXPERT OPINION VALUES FOR GRAND GULF
$ UNLESS OTHERWISE NOTED.
$ (1) FIRST DIMENSION IS CHEMICAL SPECIES
$ (2) SECOND DIMENSION IS CASE
$ *****
$ NUMBER OF CHEMICAL SPECIES (NG, I, CS, TE, SR, RU, LA, CE, BA)
NSPEC 9
$ *****
$ FCORO : IN-VESSEL RELEASE FRACTION FROM CORE TO RPV ATMOS.
$ BWR CASE 1: HIGH ZR OXIDATION
FCORO(1,1) .9 .74 .59 .15 6.4E-3 4.6E-3 1.0E-4 1.5E-4 8.6E-3
$ BWR CASE 2: LOW ZR OXIDATION
FCORO(1,2) .90 .69 .59 .14 4.0E-3 2.0E-3 1.0E-4 1.5E-4 6.5E-3
$ BWR CASE 2: LOW ZR OXIDATION
$ *****
$ FVESO: FRACTION OF RADIONUCLIDE LEAVING VESSEL DURING IN-VESSEL
$ RELEASE PHASE
$ FVES BWR CASE 1: TBUX (FAST, HIGH PRESSURE)
FVESO(1,1) 1. .086 .033 .033 .033 .033 .033 .033 .033
$ FVES BWR CASE 2: TBU (FAST, LOW PRESSURE)
FVESO(1,2) 1. .41 .30 .27 .26 .26 .26 .26 .26
$ FVES BWR CASE 3: TCUX (SLOW, HIGH PRESSURE, CRD)
FVESO(1,3) 1. .28 .25 .10 .078 .078 .078 .078 .078
$ *****
$ FCCIO: RELEASE FRACTIONS FROM MOLTEN CORE CONCRETE INTERACTION
$ FCCI BWR CASE 1: LOW ZR CONTENTS AND DRY CAVITY
FCCIO(1,1) 1. 1. 1. .66 .052 5.6E-9 2.2E-3 2.9E-3 .061
$ FCCI BWR CASE 2: LOW ZR CONTENTS AND WATER OVER DEBRIS
FCCIO(1,2) 1. 1. 1. .64 .036 1.7E-9 2.1E-3 2.5E-3 .032
$ FCCI BWR CASE 3: HIGH ZR CONTENTS AND DRY CAVITY
FCCIO(1,3) 1. 1. 1. .67 .052 5.6E-9 2.2E-3 2.9E-3 .061
$ FCCI BWR CASE 4: HIGH ZR CONTENTS AND WATER OVER DEBRIS
FCCIO(1,4) 1. 1. 1. .64 .036 1.7E-9 2.1E-3 2.5E-3 .032
$ *****
$ FDCH: DIRECT CONTAINMENT HEATING RELEASE
$ FDCH: BWR ONE CASE ONLY: FOR HIGH PRESSURE SEQUENCES
FDCHO(1,1) 1.0 1.0 1.0 .043 .012 .020 .011 .011 .012
$ *****
$ FEVSE: EX-VESSEL STEAM EXPLOSION RELEASE
FEVSEO(1,1) 1. 1. 1. .043 .012 .020 .011 .011 .012
$ *****
$ FLTI1: LATE IODINE RELEASE FROM SUPPRESSION POOL: IODINE ONLY
$ FLTI1 CASE 1: SUBCOOLED SUPPRESSION POOL
FLTI10(1) 1.55E-3
$ FLTI1 CASE 2: SATURATED SUPPRESSION POOL
FLTI10(2) 4.63E-3
$ *****
$ FLTI2: LATE IODINE RELEASE FROM CAVITY WATER: IODINE ONLY
$ FLTI2 CASE 1: WET CAVITY (LIKE TBS)
FLTI20(1) .847
$ FLTI2 CASE 2: FLOODED CAVITY LIKE TC (REPLENISHABLE WATER SUPPLY)
FLTI20(2) .435

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$*****
$ FREVOO: REVOLATILIZATION RELEASE AFTER VESSEL BREACH: I,CS AND TE
$ SET ALL OTHER NUCLIDE GROUPS TO ZERO
$   BWR CASE 1: STATION BLACKOUT AND HIGH DRYWELL TEMPERATURE
FREVOO(1,1) 1. .115 .051 0. 0. 0. 0. 0. 0.
$   BWR CASE 2: STATION BLACKOUT AND LOW DRYWELL TEMPERATURE
$   (NOT APPLICABLE TO GRAND GULF SINCE GRAND GULF CONTAINMENT SPRAY
$   IS IN OUTER CONTAINMENT, NOT DRYWELL)
FREVOO(1,2) 1. .114 .050 0. 0. 0. 0. 0. 0.
$   BWR CASE 3: ATWS HIGH PRESSURE (TCUX) AND LOW PRESS. SYSTEMS
$   AVAILABLE FOR INJECTION AFTER VESSEL BREACH
FREVOO(1,3) 1. .03 .001 0. 0. 0. 0. 0. 0.
$*****
$ FCONV: CONTAINMENT RELEASE FRACTION BEFORE VESSEL BREACH
$   FCONV GG CASE 1: EARLY LEAK SUBCOOLED POOL
FCONVO(1,1) 1. .233 .233 .233 .233 .233 .233 .233 .233
$   FCONV GG CASE 2: EARLY LEAK SATUARATED POOL
FCONVO(1,2) 1. .245 .245 .245 .245 .245 .245 .245 .245
$   FCONV GG CASE 3: EARLY RUPTURE SUBCOOLED POOL
FCONVO(1,3) 1. .639 .639 .639 .639 .639 .639 .639 .639
$   FCONV GG CASE 4: EARLY RUPTURE SATURATED POOL
FCONVO(1,4) 1. .639 .639 .639 .639 .639 .639 .639 .639
$   FCONV GG CASE 5: LATE LEAK
FCONVO(1,5) 1. .052 .052 .052 .052 .052 .052 .052 .052
$   FCONV GG CASE 6: LATE RUPTURE
FCONVO(1,6) 1. .084 .084 .084 .084 .084 .084 .084 .084
$   NO CONTAINMENT FAILURE CASE
FCONVO(1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
$*****
$ FCONC: CONTAINMENT RELEASE FRACTION AFTER VESSEL BREACH
$   FCONC GG CASE 1: EARLY LEAK SUBCOOLED POOL
FCONCO(1,1) 1. .280 .280 .251 .251 .251 .251 .251 .251
$   FCONC GG CASE 2: EARLY LEAK SATURATED POOL
FCONCO(1,2) 1. .251 .251 .231 .231 .231 .231 .231 .231
$   FCONC GG CASE 3: EARLY RUPTURE SUBCOOLED POOL
FCONCO(1,3) 1. .743 .743 .720 .720 .720 .720 .720 .720
$   FCONC GG CASE 4: EARLY RUPTURE SATURATED POOL
FCONCO(1,4) 1. .719 .719 .675 .675 .675 .675 .675 .675
$   FCONC GG CASE 5: LATE LEAK
FCONCO(1,5) 1. .052 .052 .082 .063 .082 .063 .072 .072
$   FCONC GG CASE 6: LATE RUPTURE
FCONCO(1,6) 1. .084 .084 .107 .094 .107 .094 .094 .094
$   NO CONTAINMENT FAILURE CASE
FCONCO(1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
$*****
$ SUPPRESSION POOL DF VALUES BASED ON VALUES FROM DRAFT NUREG/CR-4551
$ EXPERT MEDIAN VALUES
$   SUPPRESSION POOL DF THROUGH SRV T-QUENCHERS
DFVPAO(1,1) 1.0 56. 56. 56. 56. 56. 56. 56. 56.
$   SUPPRESSION POOL DF THROUGH DOWNCOMERS
DFCPAO(1,1) 1.0 6.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8
$*****
$ CONTAINMENT SPRAYS DF BASED ON VALUES FROM DRAFT NUREG/CR-4551
DFSPRVO(1,1) 1.0 11. 11. 11. 11. 11. 11. 11. 11.
DFSPRCO(1,1) 1.0 17. 17. 17. 17. 17. 17. 17. 17.
$*****
$ CAVITY WATER DF VALUES BASED ON VALUES FROM DRAFT NUREG/CR-4551
$ EXPERT MEDIAN VALUES
$   CASE 1: WET CAVITY LIKE GRAND GULF TBS CASE
DFCAVO(1,1) 1.0 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4.4
$   CASE 2: FLOODED CAVITY LIKE GRAND GULF TC CASE
DFCAVO(1,2) 1.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0

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Appendix D.2

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$ *****
$ =====
$ *****
$ GRAND GULF LATIN HYPERCUBE SAMPLE INTERPOLATION DATA BASE
$ ALL VARIABLE ARRAYS END WITH "L" TO REPRESENT LHS VARIABLES
$ STANDARD ARRAYS HAVE THREE DIMENSIONS:
$ FIRST DIMENSION = RADIONUCLIDE GROUP 1 THROUGH 9
$ SECOND DIMENSION = CUMULATIVE PROBABILITY POINTS
$ THIRD DIMENSION = DIFFERENT CASES
$ NINE NUCLIDE GROUPS GOING ACROSS: NG,I,CS,TE,SR,RU,LA,CE,BA
$ NINE CUMULATIVE PROBABILITY POINTS GOING DOWN:
$ 0.,0.01,0.05,0.25,0.5,0.75,0.95,0.99,1.0
PRBLEV 0.0 0.01 0.05 0.25 0.50 0.75 0.95 0.99 1.00
$ EACH CASE CONSISTS OF A BLOCK OF DATA OF 9 BY 9
$ *****
$ FCORL : IN-VESSEL RELEASE FRACTION FROM CORE TO RPV ATMOS.
$ BWR CASE 1: HIGH ZR OXIDATION
FCORL(1,1,1) .05 .03 .02 0. 0. 0. 0. 0. 0.
FCORL(1,2,1) .073 .049 .033 3.0E-3 3.0E-5 0. 0. 0. 2.2E-4
FCORL(1,3,1) .17 .13 .07 .018 2.5E-4 0. 0. 0. 1.2E-3
FCORL(1,4,1) .56 .34 .26 .071 2.1E-3 5.0E-5 2.0E-5 2.0E-5 4.2E-3
FCORL(1,5,1) .9 .74 .59 .15 6.4E-3 4.6E-3 1.0E-4 1.5E-4 8.6E-3
FCORL(1,6,1) 1. .96 .89 .59 .018 .02 1.2E-3 3.0E-3 .03
FCORL(1,7,1) 1. 1. 1. .91 .52 .081 .021 .085 .52
FCORL(1,8,1) 1. 1. 1. .99 1. .14 .1 .51 1.
FCORL(1,9,1) 1. 1. 1. 1. 1. .27 .11 1. 1.
$ BWR CASE 2: LOW ZR OXIDATION
FCORL(1,1,2) .02 6.0E-3 5.0E-3 0. 0. 0. 0. 0. 0.
FCORL(1,2,2) .033 6.6E-3 5.8E-3 2.9E-3 3.0E-5 0. 0. 0. 1.1E-4
FCORL(1,3,2) .084 9.2E-3 9.0E-3 7.3E-3 1.5E-4 0. 0. 0. 2.2E-4
FCORL(1,4,2) .41 .16 .088 .049 7.6E-4 5.0E-5 2.0E-5 2.0E-5 1.7E-3
FCORL(1,5,2) .90 .69 .59 .14 4.0E-3 2.0E-3 1.0E-4 1.5E-4 6.5E-3
FCORL(1,6,2) 1. .91 .83 .46 .013 .012 9.5E-4 2.5E-3 .027
FCORL(1,7,2) 1. 1. 1. .89 .52 .058 .021 .085 .52
FCORL(1,8,2) 1. 1. 1. .98 1. .14 .10 .51 1.
FCORL(1,9,2) 1. 1. 1. 1. 1. .27 .11 1. 1.
$ *****
$ FVESL: FRACTION OF RADIONUCLIDE LEAVING VESSEL DURING IN-VESSEL
$ RELEASE PHASE
$ FVESL BWR CASE 1: TBUX (FAST, HIGH PRESSURE)
FVESL(1,1,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FVESL(1,2,1) 1. 2.0E-5 2.0E-5 1.0E-5 1.0E-5 1.0E-5 1.0E-5 1.0E-5 1.0E-5
FVESL(1,3,1) 1. 8.0E-5 8.0E-5 5.0E-5 5.0E-5 5.0E-5 5.0E-5 5.0E-5 5.0E-5
FVESL(1,4,1) 1. 9.6E-3 5.1E-3 1.9E-3 1.9E-3 1.9E-3 1.9E-3 1.9E-3 1.9E-3
FVESL(1,5,1) 1. .086 .033 .033 .033 .033 .033 .033 .033
FVESL(1,6,1) 1. .33 .32 .31 .25 .25 .25 .25 .25
FVESL(1,7,1) 1. .79 .79 .78 .77 .77 .77 .77 .77
FVESL(1,8,1) 1. .96 .96 .96 .95 .95 .95 .95 .95
FVESL(1,9,1) 1. 1. 1. 1. 1. 1. 1. 1. 1.
$ FVESL BWR CASE 2: TBU (FAST, LOW PRESSURE)
FVESL(1,1,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FVESL(1,2,2) 1. 5.9E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3 3.3E-3
FVESL(1,3,2) 1. .041 .023 .023 .023 .023 .023 .023 .023
FVESL(1,4,2) 1. .23 .14 .14 .13 .13 .13 .13 .13
FVESL(1,5,2) 1. .41 .30 .27 .26 .26 .26 .26 .26
FVESL(1,6,2) 1. .63 .60 .59 .58 .58 .58 .58 .58
FVESL(1,7,2) 1. .99 .99 .99 .99 .99 .99 .99 .99
FVESL(1,8,2) 1. 1. 1. 1. 1. 1. 1. 1. 1.
FVESL(1,9,2) 1. 1. 1. 1. 1. 1. 1. 1. 1.
$ FVESL BWR CASE 3: TCUX (SLOW, HIGH PRESSURE, CRD)
FVESL(1,1,3) 1. 0. 1.0E-5 0. 0. 0. 0. 0. 0.
FVESL(1,2,3) 1. 8.0E-5 8.0E-5 2.0E-5 2.0E-5 2.0E-5 2.0E-5 2.0E-5 2.0E-5

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FVESL(1,3,3)	1.	.018	7.6E-3	1.0E-4	1.0E-4	1.0E-4	1.0E-4	1.0E-4	1.0E-4
FVESL(1,4,3)	1.	.089	.052	4.9E-3	4.8E-3	4.8E-3	4.8E-3	4.8E-3	4.8E-3
FVESL(1,5,3)	1.	.28	.25	.10	.078	.078	.078	.078	.078
FVESL(1,6,3)	1.	.75	.63	.39	.29	.29	.29	.29	.29
FVESL(1,7,3)	1.	.95	.9	.7	.7	.7	.7	.7	.7
FVESL(1,8,3)	1.	.99	.99	.88	.88	.88	.88	.88	.88
FVESL(1,9,3)	1.	1.	1.	.98	.98	.98	.98	.98	.98

\$ FCCIL: RELEASE FRACTIONS FROM MOLTEN CORE CONCRETE INTERACTION

\$ FCCI GG CASE 1: LOW ZR CONTENTS AND DRY CAVITY

FCCIL(1,1,1)	1.	1.	1.	4.4E-3	0.	1.0E-9	0.	0.	3.0E-5
FCCIL(1,2,1)	1.	1.	1.	.012	5.0E-5	1.0E-9	0.	0.	1.2E-4
FCCIL(1,3,1)	1.	1.	1.	.069	3.1E-4	1.2E-9	1.0E-5	3.0E-5	4.9E-4
FCCIL(1,4,1)	1.	1.	1.	.32	2.6E-3	2.4E-9	2.1E-4	3.2E-4	3.2E-3
FCCIL(1,5,1)	1.	1.	1.	.66	.052	5.6E-9	2.2E-3	2.9E-3	.061
FCCIL(1,6,1)	1.	1.	1.	.76	.62	5.0E-6	.013	.026	.45
FCCIL(1,7,1)	1.	1.	1.	.94	.95	7.3E-3	.086	.018	.88
FCCIL(1,8,1)	1.	1.	1.	.99	.99	9.7E-2	.1	.2	.98
FCCIL(1,9,1)	1.	1.	1.	1.	1.	.25	.1	.2	1.

\$ FCCI GG CASE 2: LOW ZR CONTENTS AND WET CAVITY

FCCIL(1,1,2)	1.	1.	1.	1.2E-3	0.	1.0E-9	0.	0.	1.0E-5
FCCIL(1,2,2)	1.	1.	1.	4.8E-3	2.0E-5	1.0E-9	0.	0.	8.0E-5
FCCIL(1,3,2)	1.	1.	1.	.032	2.7E-4	1.1E-9	0.	1.0E-5	3.6E-4
FCCIL(1,4,2)	1.	1.	1.	.26	2.0E-3	1.3E-9	1.9E-4	2.6E-4	2.3E-3
FCCIL(1,5,2)	1.	1.	1.	.64	.036	1.7E-9	2.1E-3	2.5E-3	.032
FCCIL(1,6,2)	1.	1.	1.	.74	.59	1.0E-6	.012	.02	.41
FCCIL(1,7,2)	1.	1.	1.	.93	.94	2.5E-3	.084	.17	.87
FCCIL(1,8,2)	1.	1.	1.	.99	.99	5.8E-2	.099	.2	.98
FCCIL(1,9,2)	1.	1.	1.	1.	1.	.15	.1	.2	1.

\$ FCCI GG CASE 3: HIGH ZR CONTENTS AND DRY CAVITY

FCCIL(1,1,3)	1.	1.	1.	4.4E-3	0.	1.0E-9	0.	0.	3.0E-5
FCCIL(1,2,3)	1.	1.	1.	.012	5.0E-5	1.0E-9	0.	0.	1.2E-4
FCCIL(1,3,3)	1.	1.	1.	.069	3.1E-4	1.2E-9	1.0E-5	3.0E-5	4.9E-4
FCCIL(1,4,3)	1.	1.	1.	.40	2.6E-3	2.4E-9	2.1E-4	3.2E-4	3.2E-3
FCCIL(1,5,3)	1.	1.	1.	.67	.052	5.6E-9	2.2E-3	2.9E-3	.061
FCCIL(1,6,3)	1.	1.	1.	.79	.65	5.0E-6	.02	.031	.51
FCCIL(1,7,3)	1.	1.	1.	.96	.97	7.3E-3	.11	.18	.9
FCCIL(1,8,3)	1.	1.	1.	.99	1.	9.7E-2	.15	.2	.98
FCCIL(1,9,3)	1.	1.	1.	1.	1.	.25	.16	.2	1.

\$ FCCI GG CASE 4: HIGH ZR CONTENTS AND WATER OVER DEBRIS

FCCIL(1,1,4)	1.	1.	1.	1.2E-3	0.	1.0E-9	0.	0.	1.0E-5
FCCIL(1,2,4)	1.	1.	1.	4.8E-3	2.0E-5	1.0E-9	0.	0.	8.0E-5
FCCIL(1,3,4)	1.	1.	1.	.032	2.7E-4	1.1E-9	0.	1.0E-5	3.6E-4
FCCIL(1,4,4)	1.	1.	1.	.26	2.0E-3	1.3E-9	1.9E-4	2.6E-4	2.3E-3
FCCIL(1,5,4)	1.	1.	1.	.64	.036	1.7E-9	2.1E-3	2.5E-3	.032
FCCIL(1,6,4)	1.	1.	1.	.74	.59	1.0E-6	.012	.02	.41
FCCIL(1,7,4)	1.	1.	1.	.93	.94	2.5E-3	.084	.17	.87
FCCIL(1,8,4)	1.	1.	1.	.99	.99	5.8E-2	.099	.2	.98
FCCIL(1,9,4)	1.	1.	1.	1.	1.	.15	.1	.2	1.

\$ FDCH: BWR ONE CASE ONLY: FOR HIGH PRESSURE SEQUENCES

\$ FISRT DIMENSION = RADIONUCLIDE GROUP

\$ SECOND DIMENSION = PROBABILITY POINTS

FDCHL(1,1,1)	1.	.063	.063	0.	0.	0.	0.	0.	0.
FDCHL(1,2,1)	1.	.15	.15	0.	0.	0.	0.	0.	0.
FDCHL(1,3,1)	1.	.50	.50	.001	.001	.001	.001	.001	.001
FDCHL(1,4,1)	1.	1.	1.	.008	.002	.007	.002	.002	.004
FDCHL(1,5,1)	1.	1.	1.	.043	.012	.020	.011	.011	.012
FDCHL(1,6,1)	1.	1.	1.	.600	.030	.063	.040	.040	.067
FDCHL(1,7,1)	1.	1.	1.	.975	.751	.700	.087	.087	.863
FDCHL(1,8,1)	1.	1.	1.	1.	.980	.900	.200	.280	.980
FDCHL(1,9,1)	1.	1.	1.	1.	1.	.950	.230	.330	1.

Appendix D.2

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$*****
$ FEVSE: EX-VESSEL STEAM EXPLOSION RELEASE
FEVSEL(1,1,1) 1. .063 .063 0. 0. 0. 0. 0. 0.
FEVSEL(1,2,1) 1. .15 .15 0. 0. 0. 0. 0. 0.
FEVSEL(1,3,1) 1. .50 .50 .001 .001 .001 .001 .001 .001
FEVSEL(1,4,1) 1. 1. 1. .008 .002 .007 .002 .002 .004
FEVSEL(1,5,1) 1. 1. 1. .043 .012 .020 .011 .011 .012
FEVSEL(1,6,1) 1. 1. 1. .600 .030 .063 .040 .040 .067
FEVSEL(1,7,1) 1. 1. 1. .975 .751 .700 .087 .087 .863
FEVSEL(1,8,1) 1. 1. 1. 1. .980 .900 .200 .280 .980
FEVSEL(1,9,1) 1. 1. 1. 1. 1. .950 .230 .330 1.
$*****
$ FLTI1: LATE IODINE RELEASE FROM SUPPRESSION POOL: IODINE ONLY
$     THEREFORE, PROBABILITY GOING ACROSS
$     FIRST DIMENSION = PROBABILITY POINTS
$     SECOND DIMENSION = CASES
$     FLTI1 CASE 1: SUBCOOLED SUPPRESSION POOL
FLTI1L(1,1) 0. 0. 0. 5.00E-4 1.55E-3 .0278 .085 .097 .10
$     FLTI1 CASE 2: SATURATED SUPPRESSION POOL
FLTI1L(1,2) 0. 1.E-6 4.06E-5 9.36E-4 4.63E-3 .173 .759 .95 1.
$*****
$ FLTI2: LATE IODINE RELEASE FROM CAVITY WATER: IODINE ONLY
$     FLTI2 CASE 1: WET CAVITY (LIKE TBS)
FLTI2L(1,1) .080 .109 .153 .365 .847 .957 1. 1. 1.
$     FLTI2 CASE 2: FLOODED CAVITY LIKE TC (REPLENISHABLE WATER SUPPLY)
FLTI2L(1,2) .004 .04 .109 .247 .435 .670 .936 .985 1.
$*****
$ FREVOL: REVOLATILIZATION RELEASE AFTER VESSEL BREACH: I,CS AND TE
$ SET ALL OTHER NUCLIDE GROUPS TO ZERO
$     BWR CASE 1: STATION BLACKOUT AND HIGH DRYWELL TEMPERATURE
FREVOL(1,1,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,2,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,3,1) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,4,1) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVOL(1,5,1) 1. .115 .051 0. 0. 0. 0. 0. 0.
FREVOL(1,6,1) 1. .306 .132 .024 0. 0. 0. 0. 0.
FREVOL(1,7,1) 1. .557 .284 .224 0. 0. 0. 0. 0.
FREVOL(1,8,1) 1. .800 .535 .413 0. 0. 0. 0. 0.
FREVOL(1,9,1) 1. 1. .750 .800 0. 0. 0. 0. 0.
$     BWR CASE 2: STATION BLACKOUT AND LOW DRYWELL TEMPERATURE
$     (NOT APPLICABLE TO GRAND GULF SINCE GRAND GULF CONTAINMENT SPRAY
$     IS IN OUTER CONTAINMENT, NOT DRYWELL)
FREVOL(1,1,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,2,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,3,2) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,4,2) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVOL(1,5,2) 1. .114 .050 0. 0. 0. 0. 0. 0.
FREVOL(1,6,2) 1. .261 .122 .024 0. 0. 0. 0. 0.
FREVOL(1,7,2) 1. .486 .236 .209 0. 0. 0. 0. 0.
FREVOL(1,8,2) 1. .800 .438 .413 0. 0. 0. 0. 0.
FREVOL(1,9,2) 1. 1. .750 .800 0. 0. 0. 0. 0.
$     BWR CASE 3: ATWS HIGH PRESSURE (TCUX) AND LOW PRESS. SYSTEMS
$     AVAILABLE FOR INJECTION AFTER VESSEL BREACH
FREVOL(1,1,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,2,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,3,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,4,3) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FREVOL(1,5,3) 1. .03 .001 0. 0. 0. 0. 0. 0.
FREVOL(1,6,3) 1. .117 .061 .024 0. 0. 0. 0. 0.
FREVOL(1,7,3) 1. .439 .200 .209 0. 0. 0. 0. 0.
FREVOL(1,8,3) 1. .800 .287 .413 0. 0. 0. 0. 0.
FREVOL(1,9,3) 1. 1.00 .750 .800 0. 0. 0. 0. 0.

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Appendix D.2

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$*****
$ FCONVL: CONTAINMENT RELEASE FRACTION BEFORE VESSEL BREACH: ALL NINE GROUPS
$ FCONVL GG CASE 1: EARLY LEAK, SUBCOOLED POOL
FCONVL(1,1,1) 1. .001 .001 .001 .001 .001 .001 .001 .001
FCONVL(1,2,1) 1. .003 .003 .003 .003 .003 .003 .003 .003
FCONVL(1,3,1) 1. .012 .012 .012 .012 .012 .012 .012 .012
FCONVL(1,4,1) 1. .117 .117 .117 .117 .117 .117 .117 .117
FCONVL(1,5,1) 1. .233 .233 .233 .233 .233 .233 .233 .233
FCONVL(1,6,1) 1. .417 .417 .417 .417 .417 .417 .417 .417
FCONVL(1,7,1) 1. .676 .676 .676 .676 .676 .676 .676 .676
FCONVL(1,8,1) 1. .784 .784 .784 .784 .784 .784 .784 .784
FCONVL(1,9,1) 1. .949 .949 .949 .949 .949 .949 .949 .949
$ FCONVL GG CASE 2: EARLY LEAK, SATURATED POOL
FCONVL(1,1,2) 1. .002 .002 .002 .002 .002 .002 .002 .002
FCONVL(1,2,2) 1. .008 .008 .008 .008 .008 .008 .008 .008
FCONVL(1,3,2) 1. .030 .030 .030 .030 .030 .030 .030 .030
FCONVL(1,4,2) 1. .151 .151 .151 .151 .151 .151 .151 .151
FCONVL(1,5,2) 1. .245 .245 .245 .245 .245 .245 .245 .245
FCONVL(1,6,2) 1. .447 .447 .447 .447 .447 .447 .447 .447
FCONVL(1,7,2) 1. .695 .695 .695 .695 .695 .695 .695 .695
FCONVL(1,8,2) 1. .792 .792 .792 .792 .792 .792 .792 .792
FCONVL(1,9,2) 1. .953 .953 .953 .953 .953 .953 .953 .953
$ FCONVL GG CASE 3: EARLY RUPTURE, SUBCOOLED POOL
FCONVL(1,1,3) 1. .021 .021 .021 .021 .021 .021 .021 .021
FCONVL(1,2,3) 1. .090 .090 .090 .090 .090 .090 .090 .090
FCONVL(1,3,3) 1. .197 .197 .197 .197 .197 .197 .197 .197
FCONVL(1,4,3) 1. .437 .437 .437 .437 .437 .437 .437 .437
FCONVL(1,5,3) 1. .639 .639 .639 .639 .639 .639 .639 .639
FCONVL(1,6,3) 1. .790 .790 .770 .770 .770 .770 .770 .770
FCONVL(1,7,3) 1. .915 .915 .892 .892 .892 .892 .892 .892
FCONVL(1,8,3) 1. .966 .966 .966 .966 .966 .966 .966 .966
FCONVL(1,9,3) 1. .996 .996 .996 .996 .996 .996 .996 .996
$ FCONVL GG CASE 4: EARLY RUPTURE, SATURATED POOL
FCONVL(1,1,4) 1. .021 .021 .021 .021 .021 .021 .021 .021
FCONVL(1,2,4) 1. .090 .090 .090 .090 .090 .090 .090 .090
FCONVL(1,3,4) 1. .197 .197 .197 .197 .197 .197 .197 .197
FCONVL(1,4,4) 1. .437 .437 .437 .437 .437 .437 .437 .437
FCONVL(1,5,4) 1. .639 .639 .639 .639 .639 .639 .639 .639
FCONVL(1,6,4) 1. .790 .790 .770 .770 .770 .770 .770 .770
FCONVL(1,7,4) 1. .915 .915 .892 .892 .892 .892 .892 .892
FCONVL(1,8,4) 1. .966 .966 .966 .966 .966 .966 .966 .966
FCONVL(1,9,4) 1. .996 .996 .996 .996 .996 .996 .996 .996
$ FCONVL GG CASE 5: LATE LEAK
FCONVL(1,1,5) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,2,5) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,3,5) 1. .001 .001 .001 .001 .001 .001 .001 .001
FCONVL(1,4,5) 1. .008 .008 .008 .008 .008 .008 .008 .008
FCONVL(1,5,5) 1. .052 .052 .052 .052 .052 .052 .052 .052
FCONVL(1,6,5) 1. .128 .128 .128 .128 .128 .128 .128 .128
FCONVL(1,7,5) 1. .330 .330 .330 .330 .330 .330 .330 .330
FCONVL(1,8,5) 1. .510 .510 .510 .510 .510 .510 .510 .510
FCONVL(1,9,5) 1. .814 .814 .814 .814 .814 .814 .814 .814
$ FCONVL GG CASE 6: LATE RUPTURE
FCONVL(1,1,6) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,2,6) 1. 0. 0. 0. 0. 0. 0. 0. 0.
FCONVL(1,3,6) 1. .002 .002 .002 .002 .002 .002 .002 .002
FCONVL(1,4,6) 1. .017 .017 .017 .017 .017 .017 .017 .017
FCONVL(1,5,6) 1. .084 .084 .084 .084 .084 .084 .084 .084
FCONVL(1,6,6) 1. .186 .186 .186 .186 .186 .186 .186 .186
FCONVL(1,7,6) 1. .338 .338 .338 .338 .338 .338 .338 .338
FCONVL(1,8,6) 1. .540 .540 .540 .540 .540 .540 .540 .540
FCONVL(1,9,6) 1. .969 .969 .969 .969 .969 .969 .969 .969

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$      FCONVL: NO CONTAINMENT FAILURE CASE
FCONVL(1,1,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,2,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,3,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,4,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,5,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,6,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,7,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,8,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONVL(1,9,7)  0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
$*****
$ FCONC: CONTAINMENT RELEASE FRACTION AFTER VESSEL BREACH: ALL NINE GROUPS
$      FCONC GG CASE 1: EARLY LEAK, SUBCOOLED POOL
FCONCL(1,1,1)  1. .001 .001 .001 .001 .001 .001 .001 .001
FCONCL(1,2,1)  1. .003 .003 .003 .003 .003 .003 .003 .003
FCONCL(1,3,1)  1. .012 .012 .012 .012 .012 .012 .012 .012
FCONCL(1,4,1)  1. .115 .115 .088 .088 .088 .088 .088 .088
FCONCL(1,5,1)  1. .280 .280 .251 .251 .251 .251 .251 .251
FCONCL(1,6,1)  1. .461 .461 .428 .428 .428 .428 .428 .428
FCONCL(1,7,1)  1. .672 .672 .672 .672 .672 .672 .672 .672
FCONCL(1,8,1)  1. .779 .779 .779 .779 .779 .779 .779 .779
FCONCL(1,9,1)  1. .876 .876 .876 .876 .876 .876 .876 .876
$      FCONC GG CASE 2: EARLY LEAK, SATURATED POOL
FCONCL(1,1,2)  1. .002 .002 .002 .002 .002 .002 .002 .002
FCONCL(1,2,2)  1. .008 .008 .008 .008 .008 .008 .008 .008
FCONCL(1,3,2)  1. .030 .030 .024 .024 .024 .024 .024 .024
FCONCL(1,4,2)  1. .141 .141 .115 .115 .115 .115 .115 .115
FCONCL(1,5,2)  1. .251 .251 .231 .231 .231 .231 .231 .231
FCONCL(1,6,2)  1. .449 .449 .405 .405 .405 .405 .405 .405
FCONCL(1,7,2)  1. .689 .689 .689 .689 .689 .689 .689 .689
FCONCL(1,8,2)  1. .789 .789 .789 .789 .789 .789 .789 .789
FCONCL(1,9,2)  1. .892 .892 .892 .892 .892 .892 .892 .892
$      FCONC GG CASE 3: EARLY RUPTURE, SUBCOOLED POOL
FCONCL(1,1,3)  1. .038 .038 .015 .015 .015 .015 .015 .015
FCONCL(1,2,3)  1. .148 .148 .054 .054 .054 .054 .054 .054
FCONCL(1,3,3)  1. .218 .218 .169 .169 .169 .169 .169 .169
FCONCL(1,4,3)  1. .512 .512 .451 .451 .451 .451 .451 .451
FCONCL(1,5,3)  1. .743 .743 .720 .720 .720 .720 .720 .720
FCONCL(1,6,3)  1. .882 .882 .855 .855 .855 .855 .855 .855
FCONCL(1,7,3)  1. .985 .985 .985 .985 .985 .985 .985 .985
FCONCL(1,8,3)  1. .990 .990 .990 .990 .990 .990 .990 .990
FCONCL(1,9,3)  1. 1. 1. 1. 1. 1. 1. 1.
$      FCONC GG CASE 4: EARLY RUPTURE, SATURATED POOL
FCONCL(1,1,4)  1. .038 .038 .013 .013 .013 .013 .013 .013
FCONCL(1,2,4)  1. .148 .148 .042 .042 .042 .042 .042 .042
FCONCL(1,3,4)  1. .218 .218 .153 .153 .153 .153 .153 .153
FCONCL(1,4,4)  1. .491 .491 .435 .435 .435 .435 .435 .435
FCONCL(1,5,4)  1. .719 .719 .675 .675 .675 .675 .675 .675
FCONCL(1,6,4)  1. .859 .859 .828 .828 .828 .828 .828 .828
FCONCL(1,7,4)  1. .940 .940 .936 .936 .936 .936 .936 .936
FCONCL(1,8,4)  1. .974 .974 .974 .974 .974 .974 .974 .974
FCONCL(1,9,4)  1. .994 .994 .994 .994 .994 .994 .994 .994
$      FCONC GG CASE 5: LATE LEAK
FCONCL(1,1,5)  1. 0. 0. 0. 0. 0. 0. 0.
FCONCL(1,2,5)  1. 0. 0. .001 .001 .001 .001 .001
FCONCL(1,3,5)  1. .001 .001 .002 .002 .002 .002 .002
FCONCL(1,4,5)  1. .008 .008 .023 .014 .023 .014 .014
FCONCL(1,5,5)  1. .052 .052 .082 .063 .082 .063 .072
FCONCL(1,6,5)  1. .128 .128 .183 .149 .183 .149 .164
FCONCL(1,7,5)  1. .330 .330 .423 .392 .423 .392 .404
FCONCL(1,8,5)  1. .510 .510 .595 .510 .595 .510 .510
FCONCL(1,9,5)  1. .814 .814 .820 .814 .820 .814 .814

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$ FCONC GG CASE 6: LATE RUPTURE
FCONCL(1,1,6) 1. 0. 0. 0. 0. 0. 0. 0. 0. 0.
FCONCL(1,2,6) 1. 0. 0. .001 .001 .001 .001 .001 .001
FCONCL(1,3,6) 1. .002 .002 .003 .003 .003 .003 .003 .003
FCONCL(1,4,6) 1. .017 .017 .037 .020 .037 .020 .020 .020
FCONCL(1,5,6) 1. .084 .084 .107 .094 .107 .094 .094 .094
FCONCL(1,6,6) 1. .186 .186 .256 .226 .256 .226 .226 .226
FCONCL(1,7,6) 1. .338 .338 .775 .771 .775 .771 .771 .771
FCONCL(1,8,6) 1. .540 .540 .920 .920 .920 .920 .920 .920
FCONCL(1,9,6) 1. .969 .969 .973 .973 .973 .973 .973 .973
$ FCONCL: NO CONTAINMENT FAILURE CASE
FCONCL(1,1,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,2,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,3,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,4,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,5,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,6,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,7,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,8,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
FCONCL(1,9,7) 0.005 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6 1.0E-6
$*****
$ DFVPA: SUPPRESSION POOL DF DURING IN-VESSEL RELEASE PHASE
$ (THROUGH T-QUENCHER)
$ DFVPA GG CASE 1: DRAFT NUREG/CR-4551
DFVPAL(1,1,1) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFVPAL(1,2,1) 1.0 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1
DFVPAL(1,3,1) 1.0 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8
DFVPAL(1,4,1) 1.0 16. 16. 16. 16. 16. 16. 16. 16.
DFVPAL(1,5,1) 1.0 56. 56. 56. 56. 56. 56. 56. 56.
DFVPAL(1,6,1) 1.0 180. 180. 180. 180. 180. 180. 180. 180.
DFVPAL(1,7,1) 1.0 2500. 2500. 2500. 2500. 2500. 2500. 2500. 2500.
DFVPAL(1,8,1) 1.0 4300. 4300. 4300. 4300. 4300. 4300. 4300. 4300.
DFVPAL(1,9,1) 1.0 5000. 5000. 5000. 5000. 5000. 5000. 5000. 5000.
$*****
$ DFCPA: SUPPRESSION POOL DF THRU VENT PIPES
$ DFCPA GG CASE 1: DRAFT NUREG/CR-4551
DFCPAL(1,1,1) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCPAL(1,2,1) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCPAL(1,3,1) 1.0 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2
DFCPAL(1,4,1) 1.0 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6
DFCPAL(1,5,1) 1.0 6.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8
DFCPAL(1,6,1) 1.0 20. 20. 20. 20. 20. 20. 20. 20.
DFCPAL(1,7,1) 1.0 72. 72. 72. 72. 72. 72. 72. 72.
DFCPAL(1,8,1) 1.0 94. 94. 94. 94. 94. 94. 94. 94.
DFCPAL(1,9,1) 1.0 100. 100. 100. 100. 100. 100. 100. 100.
$*****
$ DFCAV: CAVITY WATER DF FOR CCI RELEASE
$ DFCAV GG CASE 1: WET CAVITY SIMILAR TO BMI-2139 GG TBS
$ (DRAFT NUREG/CR-4551)
DFCAVL(1,1,1) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCAVL(1,2,1) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCAVL(1,3,1) 1.0 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1
DFCAVL(1,4,1) 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0
DFCAVL(1,5,1) 1.0 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4.4
DFCAVL(1,6,1) 1.0 11. 11. 11. 11. 11. 11. 11. 11.
DFCAVL(1,7,1) 1.0 41. 41. 41. 41. 41. 41. 41. 41.
DFCAVL(1,8,1) 1.0 65. 65. 65. 65. 65. 65. 65. 65.
DFCAVL(1,9,1) 1.0 73. 73. 73. 73. 73. 73. 73. 73.
$ DFCAV GG CASE 2: FLOODED CAVITY SIMILAR TO BMI-2139 GG TC
DFCAVL(1,1,2) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCAVL(1,2,2) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
DFCAVL(1,3,2) 1.0 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2

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DFCAVL(1,4,2)	1.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
DFCAVL(1,5,2)	1.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
DFCAVL(1,6,2)	1.0	15.	15.	15.	15.	15.	15.	15.	15.
DFCAVL(1,7,2)	1.0	56.	56.	56.	56.	56.	56.	56.	56.
DFCAVL(1,8,2)	1.0	89.	89.	89.	89.	89.	89.	89.	89.
DFCAVL(1,9,2)	1.0	100.	100.	100.	100.	100.	100.	100.	100.
\$*****									
*									
\$ DFSPRV: SPRAY DF FOR IN-VESSEL RELEASES									
\$ DFSPRV GG CASE 1 DRAFT NUREG/CR-4551 (SURRY)									
DFSPRVL(1,1,1)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DFSPRVL(1,2,1)	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
DFSPRVL(1,3,1)	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
DFSPRVL(1,4,1)	1.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
DFSPRVL(1,5,1)	1.0	11.	11.	11.	11.	11.	11.	11.	11.
DFSPRVL(1,6,1)	1.0	29.	29.	29.	29.	29.	29.	29.	29.
DFSPRVL(1,7,1)	1.0	78.	78.	78.	78.	78.	78.	78.	78.
DFSPRVL(1,8,1)	1.0	95.	95.	95.	95.	95.	95.	95.	95.
DFSPRVL(1,9,1)	1.0	100.	100.	100.	100.	100.	100.	100.	100.
\$*****									
*									
\$ DFSPRC: SPRAY DF FOR CCI RELEASES									
\$ DFSPRC GG CASE 1 DRAFT NUREG/CR-4551 (SURRY)									
DFSPRCL(1,1,1)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DFSPRCL(1,2,1)	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
DFSPRCL(1,3,1)	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
DFSPRCL(1,4,1)	1.0	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
DFSPRCL(1,5,1)	1.0	17.	17.	17.	17.	17.	17.	17.	17.
DFSPRCL(1,6,1)	1.0	29.	29.	29.	29.	29.	29.	29.	29.
DFSPRCL(1,7,1)	1.0	480.	480.	480.	480.	480.	480.	480.	480.
DFSPRCL(1,8,1)	1.0	860.	860.	860.	860.	860.	860.	860.	860.
DFSPRCL(1,9,1)	1.0	1000.	1000.	1000.	1000.	1000.	1000.	1000.	1000.

APPENDIX D.3 Other Input Files for Sample Problem

GGSOR Execution Title, Options, and Input Files Identification

```

BINNED    $ EXECUTION MODE SWITCH (MUST BE FIRST KEYWORD; 2ND LINE MUST BE
TITLE)
ALL POSSIBLE BIN COMBINATIONS WITH EXPERT OPINION MEDIAN INPUT FOR GGSOR
$ EXECUTION OPTIONS
$PRTINP    $ ECHO INPUT
CONSFL     $ KEEP CONSEQUENCE INPUT DATA
$SUMWGT    $ PRODUCE REDUCED DIMENSION FILE
$KPBYRUN   $ USE OBSERVATION SPECIFIC BINS
REPORTB    $ PRINT BIN TRANSLATION RESULTS
DIAG       $ PRINT INTERMEDIATE DIAGNOSTIC VALUES
$ FILE ASSIGNMENTS
EXPERT     $ EXPERT OPINION TABLE
DEFAULT    MEDIAN.DAT      $ DEFAULT PARAMETER VALUES FILE
VECPOS     GG VECPOS.DAT   $ SAMPLE VECTOR POSITIONS
SAMPLE 1 2  LHS.DAT       $ SAMPLE VECTOR FILE, 1 SAMPLE STARTING WITH SAMPLE 2

```

Appendix D.3

GGSOR Accident Progression Bins Data for Sample Problem

GRAND GULF ACCIDENT SEQUENCES: LHS TEST 2/15/89

9 10

AAAAFAAAA

AAAAFBAAA

AAAEFBAAA

AAAAFEAAA

BAAAFBAAA

BAAEFBAAA

BAAFEAAA

FAAAFBAAB

FAAEFBAAA

FAAAFEAAA

GGSOR Vector Position Data for Sample Problem

```
$
$ GRAND GULF LATIN HYPERCUBE SAMPLE VECTOR POSTIIONS FILE,
$ USED TO DEFINE LOCATION OF SOURCE TERM ISSUE INFORMATION
$ IN LHS SAMPLE
$ (1) FCOR, (2) FVES, (3) FREVO, (4) FCCI, (5) FCONV, (6) FCONC,
$ (7) FLTI1, (8) FLTI2, (9) FDCH, (10) DFVPA, (11) DF CPA, (12) DFCAV,
$ (13) DFSPRV, (14) DFSPRC, (15) FEVSE
$
$ VALISS 1 2 3 4 5 6 7 7 8 9 9 10 11 11 12
```

Appendix D.3

GGSOR LHS Data for Sample Problem

1	15	0.823	0.091	0.810	0.637	0.995	0.785	0.662	0.830	0.672	0.150
0.042	0.766	0.743	0.984	0.397							
2	15	0.736	0.343	0.009	0.842	0.330	0.651	0.703	0.061	0.169	0.344
0.011	0.739	0.282	0.133	0.425							
3	15	0.805	0.006	0.554	0.666	0.558	0.006	0.926	0.944	0.452	0.780
0.167	0.546	0.096	0.754	0.872							
4	15	0.222	0.768	0.833	0.827	0.610	0.484	0.014	0.896	0.684	0.421
0.412	0.938	0.964	0.244	0.826							
5	15	0.170	0.953	0.629	0.692	0.178	0.068	0.029	0.028	0.457	0.015
0.490	0.749	0.188	0.370	0.046							
6	15	0.440	0.651	0.830	0.007	0.461	0.454	0.384	0.177	0.989	0.503
0.376	0.798	0.351	0.376	0.204							
7	15	0.778	0.768	0.532	0.133	0.487	0.364	0.522	0.456	0.172	0.038
0.123	0.998	0.794	0.586	0.073							
8	15	0.681	0.824	0.156	0.817	0.648	0.303	0.901	0.452	0.171	0.208
0.456	0.781	0.334	0.922	0.575							
9	15	0.147	0.224	0.358	0.055	0.478	0.109	0.029	0.794	0.710	0.848
0.112	0.603	0.508	0.503	0.307							
10	15	0.123	0.956	0.902	0.034	0.965	0.650	0.628	0.265	0.918	0.342
0.670	0.035	0.851	0.086	0.723							

APPENDIX D.4 GGSOR Procedure File

```
$ SET DEFAULT [JDJOHNS.GGSOR]
$ ASSIGN GGSOR.INP FOR005
$ ASSIGN GGSOR.OUT FOR006
$ ASSIGN GGSOR.CFL FOR009
$ RUN GGSOR
```

ALL POSSIBLE BIN COMBINATIONS WITH EXPERT OPINION MEDIAN INPUT FOR GGSOR

2	9	9	10	1						
2 AAAFAAAA										
3.6000E+03	8.2800E+03	4.6800E+03	1.2960E+04	2.1600E+04	3.2000E+01					
1.1497E+06	9.9412E-01	1.9739E-03	7.3875E-04	4.1787E-04	1.2824E-05	1.4145E-05	8.4141E-07	2.0994E-06	2.1288E-05	
1.1185E+06	5.8828E-03	6.8640E-03	1.5348E-02	3.1916E-02	6.6431E-02	8.8363E-05	4.1332E-03	2.0091E-03	5.2135E-02	
2 AAABFBAAA										
3.6000E+03	8.2800E+03	4.6800E+03	1.2960E+04	3.6000E+03	3.2000E+01					
1.1497E+06	9.9412E-01	6.6788E-03	2.4996E-03	1.4139E-03	4.3390E-05	4.7859E-05	2.8469E-06	7.1033E-06	7.2027E-05	
6.7110E+06	5.8828E-03	3.6397E-02	8.6719E-02	1.7478E-01	3.6380E-01	4.8391E-04	2.2635E-02	1.1003E-02	2.8551E-01	
2 AAABFBAAA										
3.6000E+03	8.2800E+03	4.6800E+03	1.2960E+04	1.4400E+04	3.2000E+01					
1.1497E+06	9.9412E-01	6.6788E-03	2.4996E-03	1.4139E-03	4.3390E-05	4.7859E-05	2.8469E-06	7.1033E-06	7.2027E-05	
1.6777E+06	5.8828E-03	4.4924E-02	1.0734E-01	2.9096E-01	6.0578E-01	1.1184E-04	3.7163E-02	1.7777E-02	4.7524E-01	
2 AAAAFEAAA										
3.6000E+03	1.2960E+04	1.8000E+02	1.3140E+04	1.4400E+04	3.2000E+01					
0.0000E+00	9.9652E-01	1.5945E-02	2.4847E-02	1.6485E-03	3.7476E-04	4.6466E-04	3.3954E-04	3.4322E-04	4.3802E-04	
0.0000E+00	3.4844E-03	2.7131E-02	6.4371E-02	1.7455E-01	3.6347E-01	6.7103E-05	2.2298E-02	1.0666E-02	2.8514E-01	
2 BAAAFBAAA										
4.3200E+04	4.8600E+04	4.6800E+03	5.3280E+04	3.6000E+03	3.2000E+01					
4.4184E+06	9.9412E-01	6.6788E-03	2.4996E-03	1.4139E-03	4.3390E-05	4.7859E-05	2.8469E-06	7.1033E-06	7.2027E-05	
7.9418E+06	5.8828E-03	3.8031E-02	8.4243E-02	1.6710E-01	3.4781E-01	4.6264E-04	2.1640E-02	1.0519E-02	2.7296E-01	
2 BAAEFBAAA										
4.3200E+04	4.8600E+04	4.6800E+03	5.3280E+04	1.4400E+04	3.2000E+01					
4.4184E+06	9.9412E-01	6.6788E-03	2.4996E-03	1.4139E-03	4.3390E-05	4.7859E-05	2.8469E-06	7.1033E-06	7.2027E-05	
1.9855E+06	5.8828E-03	4.6315E-02	1.0428E-01	2.7817E-01	5.7916E-01	1.0692E-04	3.5530E-02	1.6996E-02	4.5436E-01	
2 BAAAFEAAA										
4.3200E+04	5.4000E+04	9.0000E+02	5.4900E+04	1.4400E+04	3.2000E+01					
0.0000E+00	9.9652E-01	1.5680E-02	2.4209E-02	1.6382E-03	3.6020E-04	4.4635E-04	3.2474E-04	3.2845E-04	4.2194E-04	
0.0000E+00	3.4844E-03	2.9029E-02	6.2534E-02	1.6688E-01	3.4750E-01	6.4154E-05	2.1318E-02	1.0198E-02	2.7261E-01	
2 FAAAFBAAA										
2.8800E+04	3.2400E+04	4.6800E+03	3.7080E+04	3.6000E+03	3.2000E+01					
1.2286E+07	9.9412E-01	2.8115E-02	1.5060E-02	4.2279E-03	1.0318E-04	1.1381E-04	6.7701E-06	1.6892E-05	1.7128E-04	
2.6228E+07	5.8828E-03	4.8210E-02	8.4243E-02	1.6710E-01	3.4781E-01	4.6264E-04	2.1640E-02	1.0519E-02	2.7296E-01	
2 FAAEFBAAA										
2.8800E+04	3.2400E+04	4.6800E+03	3.7080E+04	1.4400E+04	3.2000E+01					
1.2286E+07	9.9412E-01	2.8115E-02	1.5060E-02	4.2279E-03	1.0318E-04	1.1381E-04	6.7701E-06	1.6892E-05	1.7128E-04	
6.5571E+06	5.8828E-03	5.6495E-02	1.0428E-01	2.7817E-01	5.7916E-01	1.0692E-04	3.5530E-02	1.6996E-02	4.5436E-01	
2 FAAAFEAAA										
2.8800E+04	3.6000E+04	9.0000E+02	3.6900E+04	1.4400E+04	3.2000E+01					
0.0000E+00	9.9652E-01	3.7117E-02	3.6769E-02	4.4522E-03	4.2000E-04	5.1230E-04	3.2866E-04	3.3824E-04	5.2119E-04	
0.0000E+00	3.4844E-03	3.9209E-02	6.2534E-02	1.6688E-01	3.4750E-01	6.4154E-05	2.1318E-02	1.0198E-02	2.7261E-01	

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