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Seismic Safety Margins Research Program

Equipment Fragility Data Base

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EQUIPMENT FRAGILITY DATA BASE

ABSTRACT

Part of the effort of the Seismic Safety Margins Research Program (SSMRP) has been directed at generating a fragility data base for equipment used in control and safety systems in commercial nuclear power plants. Component fragility data have been compiled in various forms, depending on their content, intended use, and level of reduction. The data are stored in a relational data base on the LLNL CDC 7600 computers; this provides easy accessibility for LLNL computer users. This report describes the present structure of the data base and presents its contents through the use of tables. This report is a revision of an earlier one of the same name and numbers (NUREG/CR-2680) and (UCRL-53038). Additional data have been included and the presentation has been revised to enhance its usability.

CONTENTS

EXECUTIVE SUMMARY

This report describes a relational data base, which consists of seismic fragility descriptions for nuclear power plant equipment and data from which many of the fragilities were developed. The fragilities stem primarily from three sources:

1. Design analysis reports from manufacturers of components for the Zion Nuclear Power Plant.

2. Experimental data obtained from the results of component manufacturer's qualification tests, failure data testing by independent laboratories, and data obtained from the U.S. Army Corps of Engineers SAFEGUARD Subsystem Hardness Assurance Program.

3. The results of an extensive expert opinion survey conducted by the Seismic Safety Margins Research Program (SSMRP).

The basic data resulting from the expert opinion survey, including 10th, 50th, and 90th percentile estimates of probability of failure for many categories of equipment and a variety of failure modes are included. Also included are the results of combining both individual opinions within a failure mode and various failure modes within categories. The statistical methods used in making these combinations are discussed.

Since the process of adding to the data base and statistically combining these data is continuing, the listings of data included represent the status of the contents of the data base at this report date and may be upgraded by new data at any time.

1.0 INTRODUCTION

One of the primary objectives of the SSMRP is to develop both a methodology and mathematical models that realistically predict the probability of radioactive releases from seismically induced events in nuclear power plants. The Fragilities Development Project[1] was established to help meet this objective. Research in the project centers on the development of power plant structure and component fragility in probabilistic terms. A complete presentation of the sources of data and methodology used by the SSMKP for fragilities development is included in Ref. 1.

Approximately 50 generic categories of mechanical and electrical components were originally identified for this purpose. Of this number, 37 were chosen for subsequent fragility development. The fragilities developed for these categories are based on site-specific data and design reports from the Zion Nuclear Power Plant, the U.S. Army Corps of Engineers Safeguard Program, and the results of an extensive expert opinion survey conducted by the SSMRP. This data base consists of a variety of information, all related in some way to the development of the fragilities for these categories of components.

The data base was structured on LLNL's CDC 7600 computers through the use of the FRAMIS data base management system, and while access to the data is most conveniently accomplished by using FAMIS, it can also be accomplished with the tables in this report. FRAMIS is documented in Refs. 2 and 3.

Some of the data have been grouped into tables that were structured for convenience in the fragility data reduction process. Other tables were structured simply to allow convenient storage of information. FRAMIS allows easy regrouping of data into virtually any format that the user may find useful. This data base is continuing to expand as new data are collected.

2.0 DATA SOURCES

For various reasons, actual fragility data for mechanical and electrical components are very scarce. Consequently, the SSMRP conducted an extensive expert opinion survey that yielded probabilistic information for several of the component categories. In addition, data and design reports from the Zion Nuclear Power Plant and data from the U.S. Army Corps of Engineers Safeguard Program were used.

2.1 EXPERT OPINION SOURCES

Approximately 50 generic component categories were identified for fragility determination. Experts were asked to identify modes of failure and estimate 10th, 50th, and 90th percentile values for component strength at failure by these modes as a function of an appropriate fragility parameter (usually spectral acceleration). Each set of opinion data was evaluated using several criteria, including source (i.e., manufacturer, test laboratory, professor, etc.), basis (i.e., test, analysis, etc.), and the expert's own evaluation of level of his expertise. Weighting factors reflecting the degree of confidence in the experts' opinions were then applied to each set of estimates.

Thus, for a particular generic category of component and a particular failure mode, one set of data consists of one expert opinion of the 10th, 50th, and 90th percentile values of strength at failure and a subjective weighting factor.

The information obtained in the survey and the results of various levels of reduction of the data are included in this data base.

2.2 ANALYSIS AND TEST DATA SOURCES

Data and design reports from the Zion Nuclear Power Plant and data from the U.S. Army Corps of Engineers Safeguard Program were compiled and reduced for the SSMRP by Structural Mechanics Associates (SMA).[4] Selected data from Ref. 4 are included in this data base. Modifications of these data (as described in Section 3.2 of this report) are also included.

3.0 DATA ANALYSIS

3.1 EXPERT OPINION ANALYSIS

It was assumed that a single fragility curve of normal or lognormal distribution can approximately represent each generic component for a particular failure mode. Since the various sets of expert opinion data could be based on quite different components (because of size, manufacturing techniques, design, etc.) within a single generic category, it was necessary to provide for subgrouping of similar components within a category for each mode.* For each failure mode, the model for the qth percentile estimate provided by the jth expert in the ith group is:

$$x_{ijq} = \mu + Z_q\sigma + T_i + E_{ijq} \quad ,$$

$$i = 1, \ldots, I \quad ,$$

$$j = 1, \ldots, N_i \; ; \quad \sum_{i=1}^{I} N_i = N \quad ,$$

q = 10, 50, 90 indicating 10th, 50th, and 90th percentile estimates

where

μ, σ are the mean and standard deviations to be estimated.

T_i is the deviation of qth percentile for ith group from overall qth percentile ($\mu + Z_q\sigma$). The T_i's are assumed to be independent, identically distributed (IID) random variables with zero mean and standard deviation, σ_T.

E_{ijq} is the variation in estimate of qth percentile given by jth expert in ith group. E_{ijq}'s are assumed to be IID random variables with zero mean and standard deviation, σ_E.

Z_q is the value of the standardized normal cumulative distribution function at the qth percentile.

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*The statistical analysis methods used were selected and developed for this application by R. W. Mensing and L. L. George. A more complete presentation of the methods can be found in Ref. 5.

The parameters to be estimated are μ, σ, σ_E and σ_T as just defined. We assume the weights assigned to each expert opinion to be w_{ij} for the jth expert in the ith group.

1. To estimate (μ, σ), minimize

$$SS(\mu, \sigma) = \sum_i \sum_j w_{ij} \sum_q (x_{ijq} - \mu - Z_q\sigma)^2$$

with respect to (μ, σ) resulting in:

$$\hat{\mu} = \frac{1}{3} \sum_q \sum_i \sum_j w_{ij} x_{ijq} ,$$

$$\hat{\sigma} = \frac{1}{2Z_{90}} \left[\sum_i \sum_j w_{ij}(x_{ij90} - x_{ij10}) \right] .$$

2. Estimation of σ_T and σ_E is based on finding unbiased estimators.

Define the estimators as follows:

$$SSE = \sum_q \sum_i \sum_j w_{ij}(x_{ijq} - \hat{\mu} - Z_q\hat{\sigma})^2 ,$$

$$SST = \sum_q \sum_i \sum_j w_{ij}(x_{ijq} - \bar{x}_{i.q})^2 ,$$

where

$$\bar{x}_{i.q} = \frac{1}{w_{i.}} \sum_j w_{ij} x_{ijq} ,$$

$$w_{i.} = \sum_j w_{ij} ,$$

$$SSM = \sum_q \sum_i \sum_j w_{ij} (\bar{x}_{..q} - \hat{\mu} - Z_q\hat{\sigma})^2 ,$$

where

$$\bar{x}_{..q} = \sum_i \sum_j w_{ij} x_{iq} \quad .$$

The expectations for SSE, SST and SSM are then

$$E[SSM] = \sigma_E^2 \sum_i \sum_j w_{ij}^2 \tag{1}$$

$$E[SST] = 3\sigma_E^2 \left(1 - \sum_i \frac{\sum_j w_{ij}^2}{w_{i.}} \right). \tag{2}$$

$$E[SSE] = 3(\sigma_{T_2}^2 + \sigma_E^2) - 2\sigma_E^2 \sum_i \sum_j w_{ij}^2 - 3\sigma_T^2 \sum_i w_i^2 \quad . \tag{3}$$

Solving Eq. (2) for σ_E^2 and replacing E[SST] with SST,

$$\hat{\sigma}_E^2 = \frac{SST/3}{1 - \sum_i \frac{\sum_j w_{ij}^2}{w_i}} \quad . \tag{4}$$

Similarly from Eq. (1):

$$\hat{\hat{\sigma}}_E^2 = \frac{SSM}{\sum_i \sum_j w_{ij}^2} \quad . \tag{5}$$

Solving Eq. (3) for σ_T^2 yields

$$\sigma_T^2 = \frac{E[SSE] - 3\sigma_E^2 + 2\sigma_E^2 \sum_i \sum_j w_{ij}^2}{3(1 - \sum_i w_i^2)} \quad . \tag{6}$$

Thus, we have two estimates for σ_T^2

$$\hat{\sigma}_T^2 = \frac{SSE - 3\hat{\sigma}_E^2 + 2\sigma_E^2 \sum_i \sum_j w_{ij}^2}{3(1 - \sum_i w_i^2)} \quad . \tag{7}$$

$$\hat{\hat{\sigma}}_T^2 = \frac{SSE - 3\sigma_E^2 + 2\hat{\hat{\sigma}}_E^2 \sum_i \sum_j w_{ij}^2}{3(1 - \sum_i w_i^2)} \quad . \tag{8}$$

If data for more than one failure mode is available for analysis, the fragilities of the individual modes are combined to yield the union of these modes, i.e.,

$$F_{TOTAL} = [1 - (1 - F_1)\ (1 - F_2)...(1 - F_N)] \quad .$$

The application of these statistical methods to the expert opinion data was accomplished through the use of the Fortran program, FRAGSTAT, which is documented in Ref. 6.

3.2 OTHER ANALYSIS

Reference 4 contains fragilities with lognormal distribution only. For consistency and comparison purposes, it was desirable to have both normal and lognormal data; therefore, a procedure for fitting the lognormal data to result in a suitable normal distribution was needed. The following criteria were used:

a. The statistical mean of the normal distribution was assumed to be the same as the median of the lognormal distributions, i.e. $\mu = m$.

b. The standard deviation of the normal distribution was assumed to be

$$\sigma_N = \frac{X_{50} - X_{10}}{Z_{50} - Z_{10}} = \frac{X_{50} - X_{10}}{1.28} \quad ,$$

where

X_{50} = the fragility parameter at 50% probability of failure,

X_{10} = the fragility parameter at 10% probability of failure,

Z_{50} = the value of the standardized normal cumulative distribution function at 50th percentile,

Z_{10} = the value of the standardized normal cumulative distribution function at 10th percentile.

c. The value of the fragility parameter at 90% probability of failure is then given by

$$X_{90} = X_{50} + (Z_{50} - Z_{10})\ \sigma_N$$

$$= X_{50} + 1.28\ \sigma_N \ .$$

3.3 EXAMPLE OF COMBINING DATA

To illustrate the procedure used in combining data from several sources to develop a single fragility, consider, for example, the category of small miscellaneous valves (Category 18). There are 15 sets of expert opinion data for Category 18. (OPNO 132 through OPNO 146 in the data base table OPINION)* The first 10 sets will suffice to illustrate the procedure. A portion of the data for these opinions follows:

OPNO	Weight	Percentile Estimates			Failure Mode
		10%	50%	90%	
132	3.0	10.00	12.00	15.00	Leakage
133	3.0	6.60	7.80	10.80	Internal seat leakage
134	3.0	12.00	15.00	20.00	Gauling of stem
135	1.5	6.00	7.50	8.50	Stem binding
136	3.0	15.00	30.00	50.00	Internal damage
137	1.5	10.50	12.00	14.25	Mechanical binding of the valve
138	3.0	10.00	18.00	30.00	Structural failure
139	3.0	12.00	15.00	20.00	Structural fatigue at neck
140	3.0	12.00	18.00	24.00	Top structure of valve
141	3.0	20.00	50.00	100.00	Fracture of valve body

*The data base tables are all listed in Section 6.2.

The fragility parameter for each is spectral acceleration (g).

The failure mode description of the first two sets clearly calls for them to be grouped together as one mode.

The next four (134-137) are similar in failure mode, each indicating a functional problem, and in addition 134 and 135 are probably the same failure mode. Therefore, 134 through 137 will contribute to the same failure but a further subgrouping of 134 and 135 is indicated.

The last four sets all indicate structural failure, and in addition 139 and 140 are for the same location on the valve. Therefore, 138 through 141 will contribute to the same failure mode and further subgrouping of 139 and 140 is indicated. The following summarizes the grouping to be used:

OPNO	Group	Subgroup	Failure Mode
132	1	1	Leakage
133	1	1	Leakage
134	2	1	Functional Failure
135	2	1	Functional Failure
136	2	2	Functional Failure
137	2	3	Functional Failure
138	3	1	Structural Failure
139	3	2	Structural Failure
140	3	2	Structural Failure
141	3	3	Structural Failure

Applying the analysis described in Section 3.1 leads to the following log-normal results.

	Individual		Mode		Total	
OPNO	$\bar{y}_m$	β	$\bar{y}_m$	β	$\bar{y}_m$	β
132	12.1	0.159	10.0	0.329	8.5	0.339
133	8.2	0.203				
134	15.3	0.201	15.9	0.620		
135	7.3	0.142				
136	28.2	0.476				
137	12.2	0.120				
138	17.5	0.430	21.6	0.714		
139	15.3	0.201				
140	17.3	0.275				
141	46.4	0.635				

Thus, for this particular grouping of data, a resulting single distribution for fragility of $\bar{y}_m$ = 8.5 g, β = 0.339 is obtained.

Figure 1 shows the results of combining the groupings of expert opinion data to result in one fragility curve for the functional failure mode. The influence of the high weight factor assigned to OPNO 136 can be seen in the tendency of the result toward higher fragility levels.

Figure 2 shows the results of combining the three failure modes to result in one fragility curve for the category. Here the mode of lowest fragility dominates the result. This will be true in every case of combining modes since the result is computed by the union of the individual modes.

Other groupings might be considered than the preceding ones. For example, leakage might not be considered a failure mode of concern, and in that case OPNO's 132 and 133 would not be used. Data from sources other than expert opinion can be included in the groupings by first determining from the cumulative distribution function the 10th, 50th and 90th percentile values of spectral acceleration (or appropriate parameter), assigning a weight factor, and then treating the data in the same manner as expert opinion.

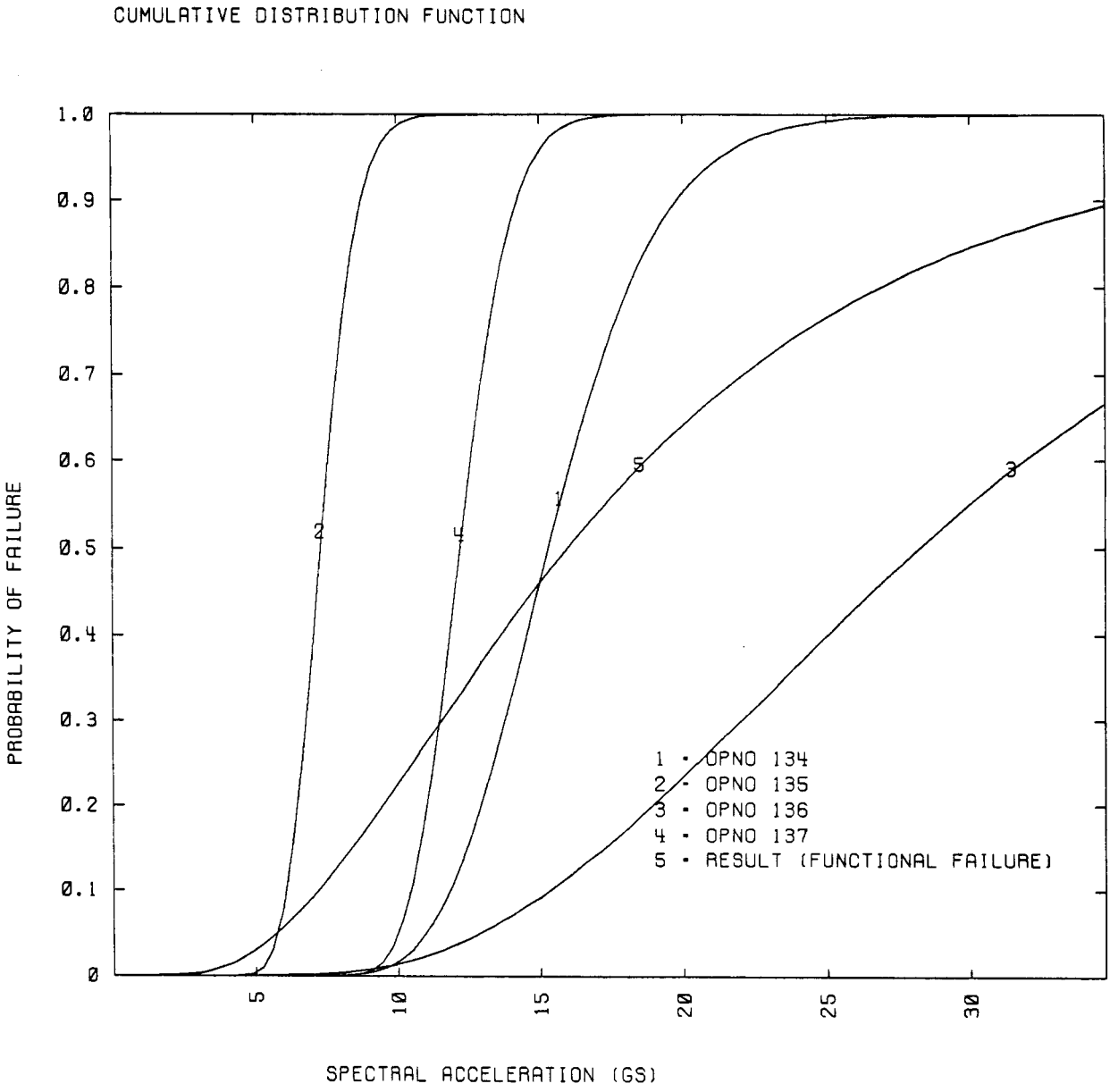

Figure 1. Results of combining groups.

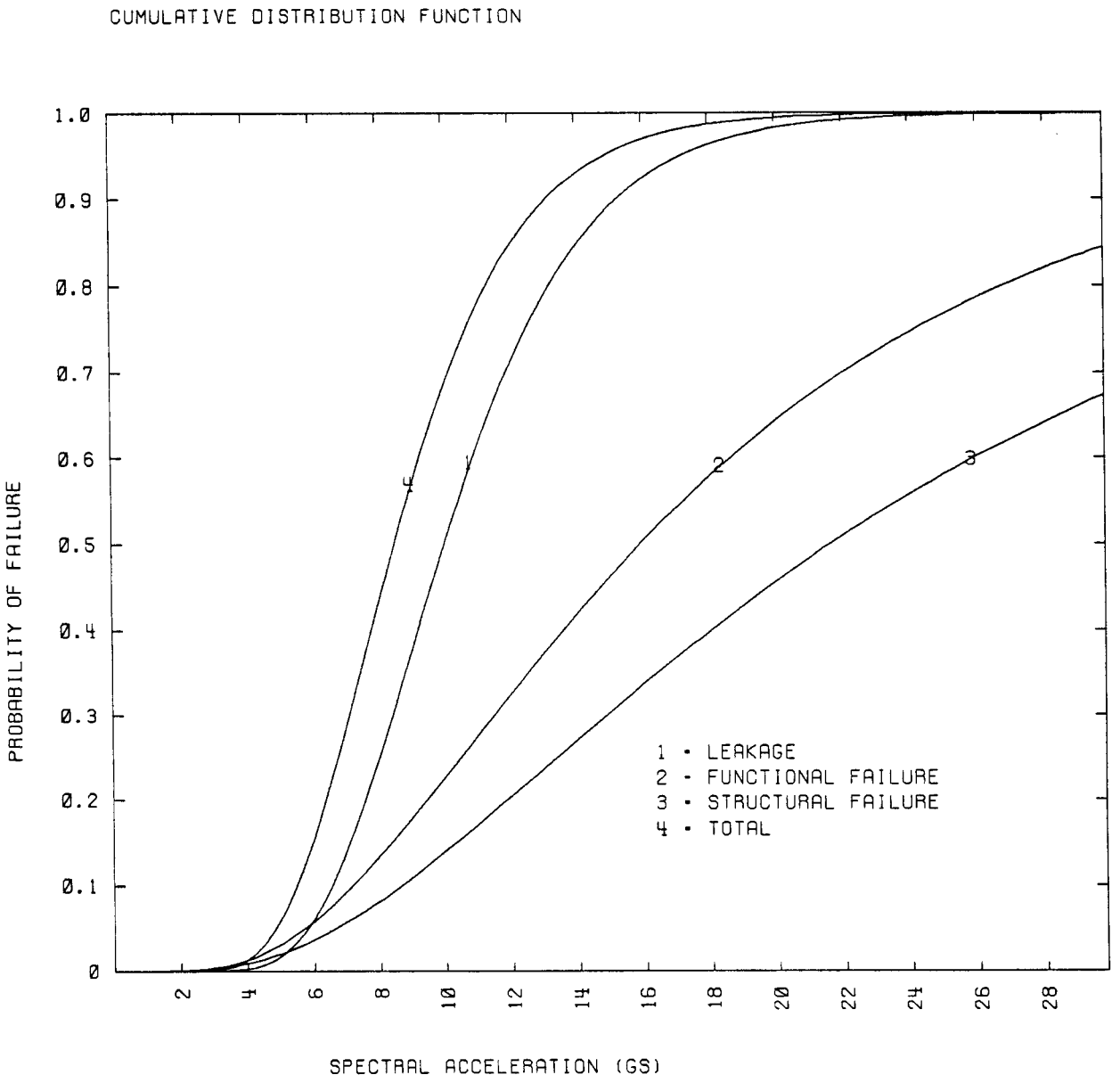

Figure 2. Results of combining modes.

4.0 LOAD SCALE FACTORS FOR PIPING ELEMENTS

The development of fragilities for the piping systems at Zion presented a different kind of problem than other categories of equipment, since fragility descriptions were needed for virtually every conceivable combination of piping elements. The approach taken was to avoid developing separate fragilities for each combination by relating individual pipe element fragilities to a master pipe element fragility by means of a load scale factor, F_p, defined as

$$F_p = \frac{\text{Capacity of reference pipe element}}{\text{Capacity of pipe element under consideration}} .$$

These factors were computed for several sizes and schedules of pipe elements, including straight pipe, butt welds, elbows, miter joints, and branch connections. The development of the load scale factors is discussed in detail in Ref. 4. The data base contains the resulting load scale factors together with the related piping element parameters. They can be found in this report in tables in Section 6.2.

5.0 SUMMARY OF FRAGILITIES

Section 6.0 of this report deals with the details of the data base structure and content. The results of the various groups of data tend to be obscurred by the number and details of the individual data sets, and since the results of the groupings may be the only material of interest to some readers, they have been extracted and are presented in this section. The following tables are computer listings produced from the contents of the data base through the use of the relational capabilities of the FRAMIS data base manager. Each table represents one category of equipment and each set of results consists of the lognormal distribution parameters (median and beta), the failure mode description, associated notes, and group identifier that can be used to obtain further information from the data base tables presented in Section 6.2.

6.0 DATA BASE DESCRIPTION

In its current structure, the data base consists of 12 tables. Some of the data have been grouped into tables that were structured for convenience in the fragility data reduction process. Others were structured to allow convenient storage of information. The data base was structured on LLNL's CDC 7600 conmputers through the use of the FRAMIS data base management system, and while access to the data is most conveniently accomplished through FRAMIS, it can be accomplished with the tables in this report as illustrated below.

6.1 RELATIONAL STRUCTURE

Each of the 12 tables contains not only lists of data, but also entities that allow relationships to be constructed between tables. For example, many of the tables contain an appropriate category number along with each set of data. This allows relationships to be constructed between all of the tables that contain category numbers. These relationships can be used to build new tables representing compilations or subsets of the other tables. It is also possible to relate data from tables that do not contain common entities if an intermediate table containing an entity common to both is available. For example, the fragilities in table RESULTS* can be related to the expert opinions in table OPINION by first relating RESULTS to GRPMODE using entity RESNO, then relating GRPMODE to GRPDEF using the entity GRPNO, and finally relating GRPDEF to OPINION using the entity OPNO. Applying this procedure to RES01A (the first entry in table RESULTS) shows that three expert opinions (and two calculated fragilities) were used in the development of RES01A. The 10th, 50th, and 90th percentile opinions (along with other information) for each can be found in table OPINION using the pertinent value of OPNO. Relational operations such as these are quickly and easily accomplished using FRAMIS.

*See Section 6.2 for descriptions and contents of individual tables.

1

CATEGORY: 1.0 REACTOR CORE ASSEMBLY

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP01A	3.916	.708	SP ACCEL G	BINDING OF CONTROL RODS DUE TO SEISMICALLY INDUCED DEFORMATIONS	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
GRP01B	5.646	.757	SP ACCEL G	DEFORMATION OF GUIDE TUBES DUE TO SEISMIC IMPACT OF FUEL BUNDLE	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
GRP01C	6.693	.823	SP ACCEL G	FAILURE OF CORE SUPPORT STRUCTURE DUE TO INERTIA LOAD OF FUEL	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
SMA01	2.746	.369	SP ACCEL G	DEFOR. OF GUIDE TUBES / GUIDE PLATE WELD	FREQUENCY 5-15 HZ , 5% DAMPING
SMA02	5.989	.339	SP ACCEL G	CONTROL ROD HOUSING DEFORMATION	FREQUENCY 6 HZ , 5% DAMPING
RES01A	2.056	.396			GRPMODE LISTS GROUPS INCLUDED IN RES01A

1

CATEGORY: 2.1 REACTOR PRESSURE VESSEL

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP02A	4.162	.275	SP ACCEL G	BUCKLING OF SKIRT	ALL MODES: PREDOMINANT FREQUENCIES, MARK II 9-15 HZ,MARK III 3-5 HZ. MARK II & III REFER TO GE BWR CONTAINMENTS PRESS BOUND FAIL. ALL MODES.
GRP02B	5.430	.289	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS	ALL MODES: PREDOMINANT FREQUENCIES, MARK II 9-15 HZ,MARK III 3-5 HZ. MARK II & III REFER TO GE BWR CONTAINMENTS PRESS BOUND FAIL. ALL MODES.
GRP02C	6.462	.325	SP ACCEL G	STRESS INTENSITY AT VESSEL SUPPORT	POOL TYPE REACTOR VESSEL (LIQ. SODIUM) PREDOMINANT FREQUENCIES, MODE # 1-7 HZ MODE #2-7.5 HZ MODES #3--- PRESS. BOUND FAIL; ALL MODES.
RES02A	3.833	.230			GRPMODE LISTS GROUPS INCLUDED IN RES02A

1

CATEGORY: 2.2 PRESSURIZER

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP02D	3.108	.361	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS	PRESSURIZER. BOTH MODES PREDOMINANT FREQUENCY, 7.0 HZ. PERCENTILES INCLUDE LOCA. PRESS, BOUND. FAIL; ALL MODES.
GRP02E	5.430	.289	SP ACCEL G	BUCKLING OF SKIRT	PRESSURIZER. BOTH MODES PREDOMINANT FREQUENCY, 7.0 HZ. PERCENTILES INCLUDE LOCA. PRESS, BOUND. FAIL; ALL MODES.
SMA05	2.000	.398	SP ACCEL G	SUPPORT SKIRT BOLTING	FREQUENCY 18-22 HZ , 5% DAMPING
RES02B	3.022	.333			GRPMODE LISTS GROUPS INCLUDED IN RES02B

1

CATEGORY: 2.3 STEAM GENERATOR

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP02F	1.891	.208	SP MOMENTS	RUPTURE AT PRIMARY INLET OR OUTLET NOZZLE, RUPTURE AT FEEDWATER NOZZLE	STEAM GENERATOR. BOTH MODES: PREDOMINANT FREQUENCY, 10-15 HZ. MODE #1 FACTORS TIME SY (SY FROM PRESS. BOUND. FAIL; ALL MODES.
GRP02G	4.716	.339	FORCES	NOZZLE FAILURE	STEAM GENERATOR ALL MODES: PREDOMINANT FREQUENCIES:MODES # 1 10-30 MODES # 2 RIGID MODES # 3 20-100 HZ. PRESS. BOUND. FAIL; ALL MODES.
GRP02H	3.896	.201	SP ACCEL G	FAILURE OF STEAM GENERATOR LEG IMBEDMENT IN CONTAINMENT FLOOR	STEAM GENERATOR . ALL MODES: PREDOMINANT FREQUENCY 7.5 HZ ALL MODES: VERTICAL DIRECTION ACCELERATION PRESS. BOUND. FAIL; ALL MODES.
GRP02I	2.886	.275	SP ACCEL G	FAILURE OF CONNECTION BETWEEN SUPPORT LEG AND STEAM GENERATOR BODY	STEAM GENERATOR . ALL MODES: PREDOMINANT FREQUENCY 7.5 HZ ALL MODES: VERTICAL DIRECTION ACCELERATION PRESS. BOUND. FAIL; ALL MODES.
GRP02J	8.166	.422	SP ACCEL G	TUBING FAILURE	STEAM GENERATOR ALL MODES: PREDOMINANT FREQUENCIES:MODES # 1 10-30 MODES # 2 RIGID MODES # 3 20-100 HZ. PRESS. BOUND. FAIL; ALL MODES.
SMA04	3.287	.440	SP ACCEL G	SUPPORT COLUMN FAILURE	FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP
RES02C	1.890	.208			FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP GRPMODE LISTS GROUPS INCLUDED IN RES02C
RES02D	4.718	.339			GRPMODE LISTS GROUPS INCLUDED IN RES02D
RES02E	2.445	.263			GRPMODE LISTS GROUPS INCLUDED IN RES02E

1

CATEGORY: 3.0 PRIMARY COOLANT PIPING

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP03A	202.350	.406	MOM FT-KIP	RUPTURE AT CONNECTIONS TO COMPONENTS DUE TO COMPONENT SUPPORT FAILURE	MASTER PIPING CURVE
RES03A	201.000	.406			GRPMODE LISTS GROUPS INCLUDED IN RES03A

1

CATEGORY: 7.0 LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP07A	1.650	.445	SP ACCEL G	RUPTURE OF ANCHOR BOLTS	ALL MODES: PREDOMINANT FREQUENCY 4-10 HZ
GRP07B	2.467	.536	SP ACCEL G	BUCKLING OF SUPPORT SKIRT OR LEGS	PREDOM. FREQ. 4-10 HZ
SMA06	21.977	.407	SP ACCEL G	SUPPORT SKIRT COLLAPSE	FREQUENCY 20.7 HZ , 5% DAMPING
SMA07	7.925	.519	SP ACCEL G	PLASTIC BUCKLING OF SHELL	FREQUENCY 6.3 HZ , 5% DAMPING
RES07A	1.459	.399			GRPMODE LISTS GROUPS INCLUDED IN RES07A

CATEGORY: 8.0 LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP08A	2.079	.275	SP ACCEL G	RUPTURE OF ANCHOR BOLTS	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
GRP08B	3.254	.319	SP ACCEL G	BUCKLING OF TANK WALL	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
GRP08C	5.312	.305	SP ACCEL G	TENSILE RUPTURE OF TANK WALL	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
SMA08	.828	.389	PK GD AC G	BUCKLING OF TANK WALLS AT BASE	RIGID TANK + SLOSH
SMA09	3.597	.436	PK GD AC G	BENDING OF VERTICAL STIFFNER	RIGID TANK + SLOSH
RES08A	2.013	.254			GRPMODE LISTS GROUPS INCLUDED IN RES08A

CATEGORY: 9.0 LARGE HORIZONTAL VESSELS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP09A	3.912	.609	FLOOR AC G	SUPPORT SYSTEM FAILURE (BOLTS)	PREDOMINANT FREQUENCY: 12 TO 20 HZ. DIESEL FUEL TANK.
RES09A	3.910	.609			GRPMODE LISTS GROUPS INCLUDED IN RES09A

1

CATEGORY: 10.0 SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP10A	2.079	.275	ACCEL G	RUPTURE OF ANCHOR BOLTS	BOTH MODES: PREDOMINANT FREQUENCY 15-30 HORIZONTAL TANK AND HEAT EXCHANGERS.
GRP10B	12.769	.359	ACCEL G	STRUCTURAL FAILURE	PREDOMINANT FREQUENCY: GREATER THEN 20 H SMALL VESSELS.
GRP10C	2.599	.452	ACCEL G	SUPPORT FAILURE	BOTH MODES: PREDOMINANT FREQUENCY 15-30 HORIZONTAL TANK AND HEAT EXCHANGERS.
SMA10	7.925	.599	SP ACCEL G	SUPPORT FAILURE	FREQUENCY 6.9 HZ , 5% DAMPING
SMA11	7.171	.516	PK ACCEL G	SUPPORT LEG FAILURE	FREQUENCY 12.8 HZ , 5% DAMPING
RES10A	1.841	.275			GRPMODE LISTS GROUPS INCLUDED IN RES10A

1

CATEGORY: 11.0 BURIED PIPE

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
SMA12	1.399	.601	PK GD AC G	BUCKLING AND FRACTURE	ZION BURIED PIPE
SMA13	1.399	.601	PK GD AC G	BUCKLING AND FRACTURE	ZION BURIED PIPE
RES11A	201.000	.406			GRPMODE LISTS GROUPS INCLUDED IN RES11A

1

CATEGORY: 12.0 REACTOR COOLANT PUMP

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP12A	3.557	.401	SP ACCEL G	FAILURE OF CONNECTION TO SUPPORT LEGS	BOTH MODES, PREDOMINANT FREQUENCIES: 4.5 PERCENTILES INCLUDE LOCA.
GRP12B	5.847	.406	SP ACCEL G	BUCKLING OF SUPPORT LEG	BOTH MODES, PREDOMINANT FREQUENCIES: 4.5 PERCENTILES INCLUDE LOCA.
SMA14	3.287	.440	SP ACCEL G	SUPPORT COLUMN BOLTING	FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP
RES12A	2.640	.336			FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP GRPMODE LISTS GROUPS INCLUDED IN RES12A

CATEGORY: 13.0 LARGE VERTICAL CENTRIFUGAL PUMPS WITH MOTOR DRIVE

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP13A	2.883	.275	SP ACCEL G	RUPTURE OF CONNECTIONS TO SUPPORT STRUTS	PREDOMINANT FREQUENCY 4.5 HZ. ALL MODES.
GRP13B	4.933	.159	SP ACCEL G	TENSILE FAILURE OF SUPPORT STRUTS	PREDOMINANT FREQUENCY 4.5 HZ. ALL MODES.
SMA15	3.490	.342	SP ACCEL G	BENDING OF PUMP CASING	FREQUENCY 7 HZ , 5% DAMPING
RES13A	2.868	.269			GRPMODE LISTS GROUPS INCLUDED IN RES13A

1

CATEGORY: 14.0 LARGE VERTICAL PUMPS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP14A	2.289	.417	SP ACCEL G	RUPTURE OF ANCHOR BOLTS DUE TO LARGE MOMENTS FROM VERTICAL INTAKE COLUMN	BOTH MODES: PREDOMINANT FREQUENCY, 3HZ. PERCENTILE 90 IS TENTATIVE
GRP14B	4.577	.417	SP ACCEL G	RUPTURE OF VERTICAL INTAKE COLUMN	BOTH MODES: PREDOMINANT FREQUENCY, 3HZ. PERCENTILE 90 IS TENTATIVE
RES14A	2.207	.387			GRPMODE LISTS GROUPS INCLUDED IN RES14A

CATEGORY: 15.0 MOTOR DRIVEN COMPRESSORS AND PUMPS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
SMA16	3.190	.338	ACCEL G	IMPELLER DEFLECTION	FREQUENCY 7 HZ , 5% DAMPING
					FREQUENCY 7 HZ , 5% DAMPING
SMA17	11.705	.419	ACCEL G	MOUNTING BOLT FAILURE	FREQUENCY 7 HZ , 5% DAMPING
					FREQUENCY 7 HZ , 5% DAMPING
SMA18	4.665	.413	Z PRD AC G	FLANGE BENDING	ZION SAFETY INJECTION PUMP , RIGID
SMA19	7.171	.278	Z PRD AC G	SHAFT BENDING	ZION SAFETY INJECTION PUMP, RIGID
SMA20	8.248	.318	Z PRD AC G	THRUST BEARING FAILURE	ZION CENTR. CHARGING PUMP, RIGID
SMA21	39.646	.304	Z PRD AC G	SHAFT DEFLECTION	ZION CENTR. CHARGING PUMP, RIGID
SMA22	32.460	.408	Z PRD AC G	GENERIC FUNCTION	GENERIC PUMPS & COMPR., RIGID
RES15A	4.315	.340			GRPMODE LISTS GROUPS INCLUDED IN RES15A
RES15B	3.185	.337			GRPMODE LISTS GROUPS INCLUDED IN RES15B

1

CATEGORY: 16.0 LARGE MOTOR OPERATED VALVES (> 4IN.)

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP16A	17.305	.275	SP ACCEL G	BREAKS AT WELD ENDS	PREDOMINANT FREQUENCY: MODE #1, 10-20 HZ. MODE #2, 30-50 HZ. MODE #3, 30-50HZ.
GRP16B	10.623	.257	SP ACCEL G	RUPTURE OF PIPE SUPPORT AT NOZZLE	ALL MODES: PREDOMINANT FREQUENCIES 2-10 HZ.
GRP16C	7.606	.314	SP ACCEL G	LOSS OF CONTROL AIR	BUTTERFLY VALVE PREDOMINANT FREQUENCY: RIGID.
GRP16D	11.190	.358	SP ACCEL G	ELECTRICAL FAILURE IN ACTUATOR	ALL MODES. PREDOMINANT FREQUENCY RIGID. BALL VALVE WITH ACTUATOR AND LOGIC CABINET
GRP16G	10.591	.476	PK ACCEL G	FRACTURE OF VALVE ACTUATOR TOP COVER AT CONNECTION TO VALVE BODY	PREDOMINANT FREQUENCY: MODE #1 VALVE ACTUATOR 27.7 HZ. MODE " SPRING MECHANISM 10-12 HZ. RUGGLES KLINGEMAN TRIP VALVE.
GRP16H	7.029	.271	PK ACCEL G	FAILURE OF SPRING MECHANISM DUE TO EXCESSIVE PLASTIC DEFORMATION	PREDOMINANT FREQUENCY: MODE #1 VALVE ACTUATOR 27.7 HZ. MODE " SPRING MECHANISM 10-12 HZ. RUGGLES KLINGEMAN TRIP VALVE.
SMA23	7.538	.646	PK ACCEL G	DISTORTION OF EXTENDED OPERATOR STRUCTURE	RIGID RIGID
SMA24	7.316	.350	SP ACCEL G	OIL RESERVOIR HOLD DOWN BOLTS	RIGID
SMA25	43.816	.468	Z PD PK AC	GENERIC FUNCTION	RIGID
RES16A	4.829	.317			GRPMODE LISTS GROUPS INCLUDED IN RES16A
RES16B	7.606	.315			GRPMODE LISTS GROUPS INCLUDED IN RES16B

1

CATEGORY: 17.0 LARGE RELIEF AND CHECK VALVES (> 4IN.)

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP17C	8.917	.132	SP ACCEL G	DISC BECOMES DISENGAGED	PREDOMINANT FREQUENCIES BOTH MODES: RIGID
GRP17D	12.654	.130	SP ACCEL G	DISC BECOMES BOUND	PREDOMINANT FREQUENCIES BOTH MODES: RIGID
SMA26	47.465	.474	SP ACCEL G	GENERIC FUNCTION	RIGID
RES17A	8.900	.130			RIGID GRPMODE LISTS GROUPS INCLUDED IN RES17A

1

CATEGORY: 18.0 SMALL MISCELLANEOUS VALVES (< 4IN.)

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP18B	15.959	.620	SP ACCEL G	INTERNAL DAMAGE	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
GRP18C	21.563	.714	SP ACELL G	STRUCTURAL FATIGUE	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
RES18A	12.466	.544			GRPMODE LISTS GROUPS INCLUDED IN RES18A

1

CATEGORY: 19.0 HORIZONTAL MOTORS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP19A	12.429	.360	ACCEL G	BINDING OF ROTATING PARTS	PREDOMINANT FREQUENCIES ARE > 33 HZ.
GRP19B	20.801	.275	ACCEL G	RUPTURE OF ANCHOR BOLTS	PREDOMINANT FREQUENCIES ARE > 33 HZ.
RES19A	12.078	.325			GRPMODE LISTS GROUPS INCLUDED IN RES19A

1

CATEGORY: 20.0 GENERATORS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP20A	5.948	.441	SP ACCEL G	CONTROL FAILURE	PREDOMINANT RESPONSE FREQUENCIES: 1ST MODE 7.0 TO 20.6 HZ. 2ND MODE 8.3 TO 13.8 HZ. DIESEL GENERATORS.
GRP20B	5.948	.441	SP ACCEL G	OIL LEVEL REGULATOR	PREDOMINANT RESPONSE FREQUENCIES: 1ST MODE 7.0 TO 20.6 HZ. 2ND MODE 8.3 TO 13.8 HZ. DIESEL GENERATORS.
GRP20C	5.646	.476	SP ACCEL G	ANCHOR BOLT FAILURE	PREDOMINANT RESPONSE FREQUENCIES: 15 HZ. DIESEL GENERATORS.
GRP20D	10.350	.279	SP ACCEL G	CRANKSHAFT LOCK UP	PREDOMINANT RESPONSE FREQUENCIES: 15 HZ. DIESEL GENERATORS.
SMA28	.931	.354	SP ACCEL G	RELAY CHATTER	FREQUENCY 30 HZ , 5% DAMPING
SMA29	1.960	.361	SP ACCEL G	FAILED RELAY	FREQUENCY 11 HZ , 5% DAMPING
SMA30	.735	.397	SP ACCEL G	VALVE TRIP	FREQUENCY 22 HZ , 5% DAMPING
SMA31	8.935	.546	SP ACCEL G	STRUCTURAL	RIGID
RES20A	.651	.330			GRPMODE LISTS GROUPS INCLUDED IN RES20A

1

CATEGORY: 21.0 BATTERIES

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP21A	2.289	.417	ACCEL G	FAILURE OF BATTENS	PREDOMINANT FREQUENCY IS >25 HZ. BATTERY RACKS
GRP21B	20.801	.275	ACCEL G	CASE BREAKAGE DUE TO A BAD STAND	PREDOMINANT FREQUENCY >15 HZ. DC POWER BATTERIES.
SMA32	17.116	.484	SP ACCEL G	ANCHOR BOLTS	FREQUENCY 8 HZ , 5% DAMPING
SMA33	5.259	.385	SP ACCEL G	CASE CRACKING & PLATE FAILURE	FREQUENCY 8 HZ , 5% DAMPING
RES21A	2.287	.418			GRPMODE LISTS GROUPS INCLUDED IN RES21A

1

CATEGORY: 22.0 SWITCHGEAR

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP22A	2.330	.486	SP ACCEL G	SPURIOUS OPERATION OF A PROTECTIVE RELAY	FREQUENCIES: SIDE TO SIDE = 6-11 HZ. FRONT TO BACK = 16-20 HZ. VERTICAL = >30 HZ. 26" WIDE METALCLAD SWITCHGEAR.
SMA34	2.588	1.510	SP ACCEL G	RELAY CHATTER	FREQUENCY 5-10 HZ , 5% DAMPING
SMA35	9.583	.818	SP ACCEL G	BREAKER TRIP	FREQUENCY 5-10 HZ , 5% DAMPING
SMA36	18.174	.881	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
RES22A	2.330	.486			GRPMODE LISTS GROUPS INCLUDED IN RES22A

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CATEGORY: 23.0 DRY TRANSFORMERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP23A	4.660	.503	SP ACCEL G	INTERNAL STRUCTURAL FAILURE, SHORT OF ELECTRICAL CONNECTION	FRAGILITY PARAMETER AT FLOOR TO TRANSFORMER INTERFACE PREDOMINANT FREQUENCIES: COOLER UNIT: 7.5, 7.7 HZ. INTERNAL STRUCTURE: 7.2, 7.6 HZ. HV PORCELAIN: 8.1, 10.8 HZ.
GRP23B	9.526	.680	SP ACCEL G	FAILURE OF SUPPORT FRAME	PREDOMINANT FREQUENCY FOR ALL MODES: >10 HZ.
GRP23C	3.108	.351	SP ACCEL G	RUPTURE OF ANCHOR BOLTS	PREDOMINANT FREQUENCY FOR ALL MODES: >10 HZ.
SMA37	13.330	.408	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
RES23A	2.780	.327			GRPMODE LISTS GROUPS INCLUDED IN RES23A

CATEGORY: 24.0 AIR HANDLING UNITS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP24A	6.215	.360	FLOOR AC G	STRUCTURAL FAILURE	PREDOMINANT RESPONSE FREQUENCY IS 21 HZ. HVAC FANS.
SMA38	2.746	.410	SP ACCEL G	RUBBING OF FAN ON HOUSING	FREQUENCY 4.3 HZ , 5% DAMPING
SMA39	2.945	.416	SP ACCEL G	RUBBING OF MOTOR ROTOR ON HOUSING	FREQUENCY 4.3 HZ , 5% DAMPING
SMA40	11.822	.424	SP ACCEL G	GENERIC FUNCTION	FREQUENCY 10-30 HZ , 5% DAMPING
					FREQUENCY 10-30 HZ , 5% DAMPING
RES24A	2.238	.337			GRPMODE LISTS GROUPS INCLUDED IN RES24A

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CATEGORY: 26.0 INSTRUMENT PANELS AND RACKS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP26A	2.079	.275	ACCEL G	INSTRUMENT FAILURE	PREDOMINANT FREQUENCIES: MODE #1 RIGID MODE #2 11 HZ. PERCENTILES ARE FACTORS TIMES SSE. INSTRUMENT RACKS.
GRP26B	4.933	.383	ACCEL G	WELD FAILURE	PREDOMINANT FREQUENCIES: MODE #1 RIGID MODE #2 11 HZ. PERCENTILES ARE FACTORS TIMES SSE. INSTRUMENT RACKS.
SMA41	2.588	1.510	SP ACCEL G	RELAY CHATTER	FREQ 5-10 HZ , 5% DAMPING
SMA42	9.583	.818	SP ACCEL G	BREAKER TRIP	FREQ 5-10 HZ , 5% DAMPING FREQ 5-10 HZ , 5% DAMPING
SMA43	18.174	.881	SP ACCEL G	STRUCTURAL	FREQ 5-10 HZ , 5% DAMPING
RES26A	1.151	.759			GRPMODE LISTS GROUPS INCLUDED IN RES26A

1

CATEGORY: 27.0 CONTROL PANELS AND RACKS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP27B	16.827	.407	SP ACCEL G	COMPONENT MALFUNCTION	PREDOMINANT FREQUENCY IS >20 HZ. STRUCTURAL FAILURE UNLIKELY WITH MODERN DESIGN.
GRP27C	25.972	.223	SP ACCEL G	STRUCTURAL MOUNTING OF CABINETS	PREDOMINANT FREQUENCY FOR ALL MODES >12 HZ. THESE MODES OF FAILURE ALSO APPLY TO BREAKER PANELS, AUXILIARY RELAY PANELS, INSTRUMENT RACKS AND DIESEL GENERATORS.
GRP27D	24.655	.159	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENTS	PREDOMINANT FREQUENCY FOR ALL MODES >12 HZ. THESE MODES OF FAILURE ALSO APPLY TO BREAKER PANELS, AUXILIARY RELAY PANELS, INSTRUMENT RACKS AND DIESEL GENERATORS.
SMA44	15.643	.436	SP ACCEL G	ELECTRICAL MALFUNCTION	FREQUENCY 5-10 HZ , 5% DAMPING
SMA46	9.583	.818	SP ACCEL G	BREAKER TRIP	FREQUENCY 5-10 HZ , 5% DAMPING
SMA47	18.174	.881	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
RES27A	11.460	.499			GRPMODE LISTS GROUPS INCLUDED IN RES27A

1

CATEGORY: 30.0 LOCAL INSTRUMENTS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP30A	8.962	.302	SP ACCEL G	RELAY CHATTER	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
GRP30B	10.623	.257	SP ACCEL G	LOOSENING OF FASTENERS	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
GRP30C	10.623	.257	SP ACCEL G	BASE STRUCTURAL FATIGUE	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
GRP30D	11.740	.201	SP ACCEL G	SIGNAL DRIFT	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
GRP30E	13.437	.223	SP ACCEL G	CONTACT CHATTER	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
GRP30F	16.710	.325	SP ACCEL G	SET POINT DRIFT	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
SMA48	47.465	.474	Z PRD AC G	ELECTRICAL FUNCTION	RIGID
RES30A	7.683	.203			GRPMODE LISTS GROUPS INCLUDED IN RES30A

1

CATEGORY: 31.0 MOTOR CONTROL CENTERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP31A	15.534	.361	SP ACCEL G	CHATTER OF CONTACTS	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
GRP31B	20.801	.275	SP ACCEL G	STRUCTURAL ANCHORING OF CABINET BASE	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
GRP31C	24.655	.159	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENT IN CABINET	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
SMA49	2.588	1.510	SP ACCEL G	RELAY CHATTER	FREQUENCY 5-10 HZ , 5% DAMPING
SMA50	9.583	.818	SP ACCEL G	BREAKER TRIP	FREQUENCY 5-10 HZ , 5% DAMPING
SMA51	18.174	.881	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
RES31A	14.331	.291			GRPMODE LISTS GROUPS INCLUDED IN RES31A

1

CATEGORY: 33.0 LIGHT FIXTURES

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP33A	9.193	.201	SP ACCEL G	DISLODGING OF AIR DUCT BLANKING CLIPS	FREQ. 4.5-6.5 HZ , DAMP 2%
RES33A	9.196	.201			GRPMODE LISTS GROUPS INCLUDED IN RES33A

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CATEGORY: 35.0 INVERTERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
SMA52	15.643	.436	SP ACCEL G	RELAY TRIP	FREQUENCY 5-10 HZ , 5% DAMPING

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CATEGORY: 36.0 CABLE TRAYS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP36A	3.108	.360	SP ACCEL G	FAILURE OF SUPPORTS	PREDOMINANT RESPONSE FREQUENCY IS 5-10 HZ. FOR ALL MODES.
GRP36B	5.847	.406	SP ACCEL G	RUPTURE OF PARTS BETWEEN SUPPORTS	PREDOMINANT RESPONSE FREQUENCY IS 5-10 HZ. FOR ALL MODES.
SMA53	2.829	.570	Z PD PK AC	CABLE SUPPORT SYSTEM	REFERENCED TO ZPA
RES36A	2.229	.392			GRPMODE LISTS GROUPS INCLUDED IN RES36A

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CATEGORY: 37.0 DUCTING

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP37A	7.050	.271	SP ACCEL G	CORNER TEARING	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
GRP37B	7.142	.677	SP ACCEL G	SUPPORT FAILURE	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
GRP37C	7.980	.806	SP ACCEL G	JOINT SEPARTION	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
GRP37D	6.693	.302	SP ACCEL G	RUPTURE OF DUCT BETWEEN SUPPORTS	PREDOMINANT FREQUENCY FOR RESPONSE 5 - 10 HZ. ALL MODES
GRP37E	9.088	.445	SP ACCEL G	GROSS BENDING FIRM	PREDOMINANT FREQUENCY FOR RESPONSE 10 HZ. ALL MODES.
RES37A	3.966	.407			GRPMODE LISTS GROUPS INCLUDED IN RES37A

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CATEGORY: 39.0 SWITCHYARD EQUIPMENT

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP39A	.766	.517	Z PRD ACCE	PORCELAIN FRACTURE	FREQUENCIES: 1ST MODE = 1.5-4.0 HZ. 2ND MODE = 4.5-8.0 HZ.
GRP39B	.317	.449	Z PRD ACCE	A B CIRCUIT BREAKER FAILURE	IN-SITU TESTING. FRAGILITY PARAMETER AT CIRCUIT BREAKER FOOTING. THESE ARE SWITCHYARD CIRCUIT BREAKERS. TORSIONAL FAILURE. MODES OF VIBRATION: 1ST 2.4 - 3.4 HZ. 2ND 7.8 - 12.2 HZ. AIR BLAST CIRCUIT BREAKERS.
GRP39C	.914	.610	Z PRD ACCE	H V TRANSFORMER STRUCTURAL FAILURE	FRAGILITY PARAMETER AT FLOOR TO TRANSFORMER INTERFACE PREDOMINANT FREQUENCIES: COOLER UNIT: 7.5, 7.7 HZ. INTERNAL STRUCTURE: 7.2, 7.6 HZ. HV PORCELAIN: 8.1, 10.8 HZ.
RES39A	.298	.416			GRPMODE LISTS GROUPS INCLUDED IN RES39A

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CATEGORY: 40.0 RELAYS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP40A	5.669	1.164	SP ACCEL G	RELAY CHATTER	PREDOMINANT RESPONSE FREQUENCY 20 TO 33 HZ.
SMA45	2.588	1.510	SP ACCEL G	RELAY CHATTER	5-10 HZ , 5% DAMPING
RES40A	3.990	.893			GRPMODE LISTS GROUPS INCLUDED IN RES40A

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CATEGORY: 41.0 CIRCUIT BREAKERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
SMA54	2.588	1.510	SP ACCEL G	RELAY CHATTER	5-10 HZ , 5% DAMPING
SMA55	9.583	.818	SP ACCEL G	RELAY TRIP	FREQUENCY 5-10 HZ , 5% DAMPING
SMA56	18.174	.881	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
SMA57	9.583	.818	SP ACCEL G	BREAKER TRIP	FREQUENCY 5-10 HZ , 5% DAMPING FREQUENCY 5-10 HZ , 5% DAMPING
SMA58	18.174	.881	SP ACCEL G	STRUCTURAL	FREQUENCY 5-10 HZ , 5% DAMPING
RES41A	7.630	.710			GRPMODE LISTS GROUPS INCLUDED IN RES41A

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CATEGORY: 48.0 RECOMBINERS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP48A	8.240	.144	FLOOR AC G	PIPE DEFORMATION	THE TEST WERE NOT TAKEN TO FAILURE. PREDOMINANT FREQUENCIES: MODE #1 9.5 HZ. MODE #2 21.5 HZ.
RES48A	8.243	.144			GRPMODE LISTS GROUPS INCLUDED IN RES48A

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CATEGORY: 49.0 CERAMIC INSULATORS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP49A	.332	.807	BASE ACCEL	FRACTURE OF PORCELAIN INSULATION	FREQ. 1-4 HZ
SMA59	4.998	.353	PK GD AC G	FRACT OF INSULATORS	REFERENCED TO ZPA
RES49A	.332	.807			GRPMODE LISTS GROUPS INCLUDED IN RES49A

CATEGORY: 50.0 SPENT FUEL RACKS

GROUP	MEDIAN	BETA	FRAG. PARAM.	FAILURE MODE	NOTES
GRP50A	.276	.471	FLOOR AC G	DESTRUCTION OF SHEAR CONNECTION BETWEEN MODULES	FREQ. 7-8 HZ
RES50A	.276	.471			GRPMODE LISTS GROUPS INCLUDED IN RES50A

6.2 DATA TABLES

Computer listings of the data tables that comprise the data base are presented in alphabetical order in this section along with explanations of the contents of each. The name assigned to each column of data and the data type are included in each description since this information is useful when using FRAMIS.

A. BRANCH

Table BRANCH contains load scale factors for branch connections of various representative pipes (see Table PIPE for other pipe elements). It consists of 10 columns as follows:

Column No.	Column name	Type	Contents
1	LINE	Integer	A reference line number.
2	SIZER	Floating	The nominal diameter of the pipe run (in.).
3	SIZEB	Floating	The nominal diameter of the pipe branch. (in.)
4	SCHED	Character	The pipe schedule.
5	MAT	Character	Material: SS = stainless steel; CS = carbon steel.
6	TEMP	Floating	Temperature (^{o}F)
7	FUPR	Floating	Unreinforced branch; scale factor for run.
8	FUPB	Floating	Unreinforced branch; scale factor for branch.
9	FRPR	Floating	Reinforced branch; scale factor for run.
10	FRPB	Floating	Reinforced branch; scale factor for branch.

BRANCH

LINE	SIZER	SIZEB	SCHED	MAT	TEMP	FUPR	FUPB	FRPR	FRPB
1	3.0	0.50	160	SS	300.	9.620	480.000	9.620	480.000
2	3.0	0.75	160	SS	300.	9.620	254.000	9.620	254.000
3	3.0	2.00	160	SS	300.	10.000	27.000	9.620	27.000
4	3.0	3.00	160	SS	300.	10.000	10.000	9.620	9.620
5	4.0	0.75	160	SS	300.	4.570	254.000	4.570	254.000
6	4.0	1.00	160	SS	300.	4.570	135.000	4.570	135.000
7	4.0	2.00	160	SS	300.	5.150	27.000	4.570	27.000
8	4.0	3.00	160	SS	300.	5.150	9.640	4.570	9.520
9	4.0	4.00	40S	SS	500.	21.000	21.000	10.630	10.630
10	4.0	4.00	120	CS	140.	4.740	4.740	3.630	3.630
11	4.0	4.00	120	SS	300.	6.720	6.720	5.270	5.270
12	4.0	4.00	120	SS	535.	8.210	8.210	6.310	6.310
13	6.0	3.00	160	CS	100.	1.220	6.190	1.000	6.190
14	6.0	4.00	120	CS	140.	1.850	8.210	1.270	3.630
15	6.0	6.00	120	CS	100.	1.280	1.280	1.000	1.000
16	8.0	2.00	40S	SS	500.	2.050	72.400	2.050	60.400
17	8.0	4.00	40S	SS	500.	5.200	19.700	2.050	10.630
18	8.0	8.00	40S	SS	400.	4.840	4.840	1.870	1.870
19	8.0	8.00	40S	SS	500.	5.200	5.200	2.050	2.050
20	10.0	8.00	40S	SS	400.	2.890	4.540	1.050	1.870
21	10.0	10.00	40S	SS	400.	2.890	2.890	1.050	1.050
22	12.0	8.00	40	SS	400.	1.920	4.270	0.670	1.870
23	12.0	12.00	40	SS	400.	1.920	1.920	0.670	0.670
24	14.0	12.00	40	SS	400.	1.510	1.810	0.515	0.671
25	14.0	14.00	TN=.375	CS	100.	1.180	1.180	0.365	0.365
26	14.0	14.00	40	CS	100.	1.020	1.020	0.310	0.310
27	14.0	14.00	60	SS	400.	0.237	0.237	0.186	0.186
28	16.0	3.00	R120,B160	CS	556.	0.124	8.050	0.124	8.050
29	18.0	14.00	40	SS	400.	0.711	1.170	0.244	0.515
30	27.5	4.00	2.38,.438	SS	535.	0.021	6.320	0.021	5.600
31	27.5	8.00	2.38,.812	SS	535.	0.021	0.920	0.021	0.870
32	27.5	10.00	2.38,1.125	SS	535.	0.034	0.438	0.021	0.438
33	29.0	8.00	2.50,.812	SS	595.	0.020	0.949	0.019	0.910
34	29.0	14.00	2.50,1.406	SS	595.	0.030	0.212	0.019	0.212
35	30.0	20.00	.5,.375	CS	100.	0.261	0.589	0.058	0.176
36	36.0	36.00	TN.5	CS	100.	0.203	0.203	0.	0.
37	43.0	20.00	T.625	CS	100.	0.096	0.557	0.	0.
38	48.0	30.00	.625, .5	CS	100.	0.096	0.247	0.	0.
39	48.0	48.00	.625, .5	CS	100.	0.096	0.096	0.	0.

B. CATEGORY

Table CATEGORY relates the descriptions of the generic categories of components to the numbers used to identify data for these categories. It consists of three columns of data as follows:

Column No.	Column name	Type	Contents
1	CATNO	Floating	A floating point number unique to this particular description (Note: CATNO is a subgrouping of CAT.)
2	CAT	Integer	An integer number unique to a class of generic components.
3	DES	Character	The description of the generic category or specific component represented uniquely by CATNO and generically by CAT.

CATEGORY

CATNO	CAT	DESCRIPTION
1.0	1	REACTOR CORE ASSEMBLY
2.0	2	REACTOR COOLANT SYSTEM VESSELS
2.1	2	REACTOR PRESSURE VESSEL
2.2	2	PRESSURIZER
2.3	2	STEAM GENERATOR
3.0	3	PRIMARY COOLANT PIPING
4.0	4	LARGE PIPING (>8IN.)
5.0	5	INTERMEDIATE PIPING (2IN. < D < 8IN.)
6.0	6	SMALL PIPES (< 2IN.)
7.0	7	LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS
8.0	8	LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS
9.0	9	LARGE HORIZONTAL VESSELS
10.0	10	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS
11.0	11	BURIED PIPE
12.0	12	REACTOR COOLANT PUMP
13.0	13	LARGE VERTICAL CENTRIFUGAL PUMPS WITH MOTOR DRIVE
14.0	14	LARGE VERTICAL PUMPS
15.0	15	MOTOR DRIVEN COMPRESSORS AND PUMPS
16.0	16	LARGE MOTOR OPERATED VALVES (> 4IN.)
17.0	17	LARGE RELIEF AND CHECK VALVES (> 4IN.)
18.0	18	SMALL MISCELLANEOUS VALVES (< 4IN.)
19.0	19	HORIZONTAL MOTORS
20.0	20	GENERATORS
21.0	21	BATTERIES
22.0	22	SWITCHGEAR
23.0	23	DRY TRANSFORMERS
24.0	24	AIR HANDLING UNITS
26.0	26	INSTRUMENT PANELS AND RACKS
27.0	27	CONTROL PANELS AND RACKS
28.0	28	AUXILIARY RELAY CABINETS
29.0	29	BREAKER PANELS
30.0	30	LOCAL INSTRUMENTS
31.0	31	MOTOR CONTROL CENTERS
33.0	33	LIGHT FIXTURES
34.0	34	COMMUNICATIONS EQUIPMENT
35.0	35	INVERTERS
36.0	36	CABLE TRAYS
37.0	37	DUCTING
38.0	38	HYDRAULIC SNUBBERS
39.0	39	SWITCHYARD EQUIPMENT
39.1	39	GENERAL SWITCHYARD EQUIP.
39.2	39	AIR BLAST CIRCUIT BREAKERS
39.3	39	H. V. TRANSFORMER (256 KV)
40.0	40	RELAYS
41.0	41	CIRCUIT BREAKERS
48.0	48	RECOMBINERS
49.0	49	CERAMIC INSULATORS
50.0	50	SPENT FUEL RACKS

C. GRPDEF

Table GRPDEF identifies the data used as input to program FRAGSTAT, which resulted in the data contained in Table GRPMODE. It consists of two columns as follows:

Column No.	Column name	Type	Contents
1	GRPNO	Character	An identifying code relating to a particular set of failure mode data (see Table GRPMODE).
2	EXPLAN	Character	A worded explanation of the data used in the computation of the associated GRPNO set of failure mode data. Usually a list (by OPNO) of those particular sets of expert opinions input to FRAGSTAT for one failure mode (see tables GRPMODE and OPINION).

GRPDEF

GRPNO	OPNO	EXPLAN
GRP01A	1	OPNO 1 ALONE
GRP01B	2	OPNO 2 ALONE
GRP01C	3	OPNO 3 ALONE
GRP01D	300	SMANO 1 ALONE
GRP01E	300	SMANO 2 ALONE
GRP02A	20	OPNO 20 ALONE
GRP02B	19	OPNO 19 ALONE
GRP02C	17	OPNO 17 ALONE
GRP02D	11	OPNO 11 ALONE
GRP02E	12	OPNO 12 ALONE
GRP02F	27	OPNO 27 ALONE
GRP02G	24	OPNO 24 ALONE
GRP02H	14	OPNO 14 ALONE
GRP02I	13	OPNO 13 ALONE
GRP02J	26	OPNO 26 AND 28 AS INDIVIDUAL SUBGROUPS
GRP02J	28	OPNO 26 AND 28 AS INDIVIDUAL SUBGROUPS
GRP02K	300	SMANO 60 ALONE
GRP03A	35	MASTER PIPING CURVE
GRP04A	300	MASTER PIPING CURVE
GRP05A	300	MASTER PIPING CURVE
GRP06A	300	MASTER PIPING CURVE
GRP07A	75	OPNO 75 ALONE
GRP07B	76	OPNO 76 ALONE
GRP08A	77	OPNO 77 ALONE
GRP08B	78	OPNO 78 ALONE
GRP08C	79	OPNO 79 ALONE
GRP09A	83	OPNO 83 AND 84 AS INDIVIDUAL SUBGROUPS
GRP09A	84	OPNO 83 AND 84 AS INDIVIDUAL SUBGROUPS
GRP10A	85	OPNO 85 ALONE
GRP10B	87	OPNO 87 ALONE
GRP10C	86	OPNO 86 AND 89 AS INDIVIDUAL SUBGROUPS
GRP10C	89	OPNO 86 AND 89 AS INDIVIDUAL SUBGROUPS
GRP10D	300	SMANO 10 ALONE
GRP11A	300	MASTER PIPING CURVE
GRP12A	92	OPNO 92 ALONE
GRP12B	93	OPNO 93 ALONE
GRP12C	300	SMANO 14 ALONE
GRP13A	94	OPNO 94 ALONE
GRP13B	95	OPNO 95 ALONE
GRP14A	99	OPNO 99 ALONE
GRP14B	100	OPNO 100 ALONE
GRP15A	300	SMANO 18 ALONE
GRP15B	300	SMANO 19 ALONE
GRP15C	300	SMANO 20 ALONE
GRP15D	300	SMANO 21 ALONE
GRP15E	300	SMANO 22 ALONE
GRP15F	300	SMANO 16 ALONE
GRP15G	300	SMANO 17 ALONE
GRP16A	124	OPNO 124 ALONE
GRP16B	123	OPNO 123 ALONE
GRP16C	122	OPNO 122 ALONE
GRP16D	121	OPNO 125 AND 121 AS INDIVIDUAL SUBGROUPS
GRP16D	125	OPNO 125 AND 121 AS INDIVIDUAL SUBGROUPS
GRP16E	300	SMANO 23 ALONE
GRP16F	300	SMANO 24 ALONE

GRPNO	OPNO	EXPLAN
GRP16G	128	OPNO 128 ALONE
GRP16H	129	OPNO 129 ALONE
GRP17C	130	OPNO 130 ALONE
GRP17D	131	OPNO 131 ALONE
GRP18A	132	OPNO 132 AND 133 AS ONE SUBGROUP
GRP18A	133	OPNO 132 AND 133 AS ONE SUBGROUP
GRP18B	134	OPNO 134 AND 135 AS ONE SUBGRP AND 136 AND 137 AS INDIVIDUAL SUBGRPS
GRP18B	135	OPNO 134 AND 135 AS ONE SUBGRP AND 136 AND 137 AS INDIVIDUAL SUBGRPS
GRP18B	136	OPNO 134 AND 135 AS ONE SUBGRP AND 136 AND 137 AS INDIVIDUAL SUBGRPS
GRP18B	137	OPNO 134 AND 135 AS ONE SUBGRP AND 136 AND 137 AS INDIVIDUAL SUBGRPS
GRP18C	138	OPNO 139 AND 140 AS ONE SUBGRP AND 138 AND 141 AS INDIVIDUAL SUBGRPS
GRP18C	139	OPNO 139 AND 140 AS ONE SUBGRP AND 138 AND 141 AS INDIVIDUAL SUBGRPS
GRP18C	140	OPNO 139 AND 140 AS ONE SUBGRP AND 138 AND 141 AS INDIVIDUAL SUBGRPS
GRP18C	141	OPNO 139 AND 140 AS ONE SUBGRP AND 138 AND 141 AS INDIVIDUAL SUBGRPS
GRP19A	147	OPNO 147 ALONE
GRP19B	148	OPNO 148 ALONE
GRP20A	149	OPNO 149 AND 150 AS ONE SUBGROUP
GRP20A	150	OPNO 149 AND 150 AS ONE SUBGROUP
GRP20B	151	OPNO 151 AND 155 AS ONE SUBGROUP
GRP20B	155	OPNO 151 AND 155 AS ONE SUBGROUP
GRP20C	153	OPNO 153 ALONE
GRP20D	154	OPNO 154 ALONE
GRP20E	300	SMANO 28 ALONE
GRP20F	300	SMANO 29 ALONE
GRP20G	300	SMANO 30 ALONE
GRP20H	300	SMANO 31 ALONE
GRP21A	156	OPNO 156 ALONE
GRP21B	159	OPNO 159 ALONE
GRP21C	300	SMANO 32 ALONE
GRP22A	161	OPNO 161, 165, AND 171 AS ONE SUBGROUP
GRP22A	165	OPNO 161, 165, AND 171 AS ONE SUBGROUP
GRP22A	171	OPNO 161, 165, AND 171 AS ONE SUBGROUP
GRP23A	174	OPNO 178 ALONE
GRP23B	177	OPNO 177 AND 225 AS INDIVIDUAL SUBGROUPS
GRP23B	225	OPNO 177 AND 225 AS INDIVIDUAL SUBGROUPS
GRP23C	176	OPNO 176 ALONE
GRP24A	179	OPNO 179 ALONE
GRP24B	300	SMANO 38 ALONE
GRP24C	300	SMANO 39 ALONE
GRP24D	300	SMANO 40 ALONE
GRP26A	180	OPNO 180 ALONE
GRP26B	181	OPNO 181 ALONE
GRP26C	300	SMANO 41 ALONE
GRP26D	300	SMANO 42 ALONE
GRP26E	300	SMANO 43 ALONE
GRP27B	185	OPNO 185 AND 186 AS INDIVIDUAL SUBGROUPS
GRP27B	186	OPNO 185 AND 186 AS INDIVIDUAL SUBGROUPS
GRP27C	187	OPNO 187 ALONE
GRP27D	188	OPNO 188 ALONE
GRP27F	300	SMANO 56 ALONE
GRP30A	189	OPNO 189 ALONE
GRP30B	190	OPNO 190 ALONE
GRP30C	191	OPNO 191 ALONE
GRP30D	192	OPNO 192 ALONE
GRP30E	193	OPNO 193 ALONE

GRPNO	OPNO	EXPLAN
GRP30F	194	OPNO 194 ALONE
GRP31A	198	OPNO 198 ALONE
GRP31B	199	OPNO 199 ALONE
GRP31C	200	OPNO 200 ALONE
GRP33A	201	OPNO 201 ALONE
GRP36A	206	OPNO 206 ALONE
GRP36B	207	OPNO 207 ALONE
GRP36C	300	SMANO 53 ALONE
GRP37A	208	OPNO 208 ALONE
GRP37B	209	OPNO 209, 211 AND 214 AS INDIVIDUAL SUBGROUPS
GRP37B	211	OPNO 209, 211 AND 214 AS INDIVIDUAL SUBGROUPS
GRP37B	214	OPNO 209, 211 AND 214 AS INDIVIDUAL SUBGROUPS
GRP37C	210	OPNO 210 AND 213 AS INDIVIDUAL SUBGROUPS
GRP37C	213	OPNO 210 AND 213 AS INDIVIDUAL SUBGROUPS
GRP37D	212	OPNO 212 ALONE
GRP37E	215	OPNO 215 ALONE
GRP39A	167	OPNO 167 ALONE
GRP39B	221	OPNO 221 AND 222 AS INDIVIDUAL SUBGROUPS
GRP39B	222	OPNO 221 AND 222 AS INDIVIDUAL SUBGROUPS
GRP39C	173	OPNO 173, 174, AND 175 AS INDIVIDUAL SUBGROUPS
GRP39C	174	OPNO 173, 174, AND 175 AS INDIVIDUAL SUBGROUPS
GRP39C	175	OPNO 173, 174, AND 175 AS INDIVIDUAL SUBGROUPS
GRP40A	182	OPNO 182,183 AND SMA45 AS INDIVIDUAL SUBGROUPS
GRP40A	183	OPNO 182,183 AND SMA45 AS INDIVIDUAL SUBGROUPS
GRP40B	300	SMANO 55 ALONE
GRP41A	300	SMANO 57 ALONE
GRP41B	300	SMANO 58 ALONE
GRP48A	223	OPNO 223 ALONE
GRP49A	226	OPNO 226 AND 227 AS INDIVIDUAL SUBGROUPS
GRP49A	227	OPNO 226 AND 227 AS INDIVIDUAL SUBGROUPS
GRP50A	224	OPNO 224 ALONE

D. GRPFAIL

Table GRPFAIL lists the predominant failure mode for the various groupings of data that are presented in Table GRPMODE. It consists of two columns as follows:

Column No.	Column name	Type	Contents
1	GRPNO	Character	An identifying code unique to this particular set of data and relatable to other tables.
2	MODE	Character	A description of the predominant failure mode for this particular set of data.

GRPFAIL

GRPNO	MODE
GRP01A	BINDING OF CONTROL RODS DUE TO SEISMICALLY INDUCED DEFORMATIONS
GRP01B	DEFORMATION OF GUIDE TUBES DUE TO SEISMIC IMPACT OF FUEL BUNDLE
GRP01C	FAILURE OF CORE SUPPORT STRUCTURE DUE TO INERTIA LOAD OF FUEL
GRP01D	DEFOR. OF GUIDE TUBES / GUIDE PLATE WELD
GRP01E	CONTROL ROD HOUSING DEFORMATION
GRP02A	BUCKLING OF SKIRT
GRP02B	FAILURE OF SKIRT ANCHOR BOLTS
GRP02C	STRESS INTENSITY AT VESSEL SUPPORT
GRP02D	FAILURE OF SKIRT ANCHOR BOLTS
GRP02E	BUCKLING OF SKIRT
GRP02F	RUPTURE AT PRIMARY INLET OR OUTLET NOZZLE, RUPTURE AT FEEDWATER NOZZLE
GRP02G	NOZZLE FAILURE
GRP02H	FAILURE OF STEAM GENERATOR LEG IMBEDMENT IN CONTAINMENT FLOOR
GRP02I	FAILURE OF CONNECTION BETWEEN SUPPORT LEG AND STEAM GENERATOR BODY
GRP02J	TUBING FAILURE
GRP02K	PRESSURE BOUNDARY FAILURE
GRP03A	RUPTURE AT CONNECTIONS TO COMPONENTS DUE TO COMPONENT SUPPORT FAILURE
GRP03B	RUPTURE AT CONNECTIONS TO COMPONENTS DUE TO PIPE OVERSTRESS
GRP07A	RUPTURE OF ANCHOR BOLTS
GRP07B	BUCKLING OF SUPPORT SKIRT OR LEGS
GRP08A	RUPTURE OF ANCHOR BOLTS
GRP08B	BUCKLING OF TANK WALL
GRP08C	TENSILE RUPTURE OF TANK WALL
GRP09A	SUPPORT SYSTEM FAILURE (BOLTS)
GRP10A	RUPTURE OF ANCHOR BOLTS
GRP10B	STRUCTURAL FAILURE
GRP10C	SUPPORT FAILURE
GRP10D	SUPPORT FAILURE
GRP12A	FAILURE OF CONNECTION TO SUPPORT LEGS
GRP12B	BUCKLING OF SUPPORT LEG
GRP12C	BUCKLING AND FRACTURE
GRP13A	RUPTURE OF CONNECTIONS TO SUPPORT STRUTS
GRP13B	TENSILE FAILURE OF SUPPORT STRUTS
GRP14A	RUPTURE OF ANCHOR BOLTS DUE TO LARGE MOMENTS FROM VERTICAL INTAKE COLUMN
GRP14B	RUPTURE OF VERTICAL INTAKE COLUMN
GRP15A	FLANGE BENDING
GRP15B	SHAFT BENDING
GRP15C	THRUST BEARING FAILURE
GRP15D	SHAFT DEFLECTION
GRP15E	GENERIC FUNCTION
GRP15F	IMPELLER DEFLECTION
GRP15G	MOUNTING BOLT FAILURE
GRP16A	BREAKS AT WELD ENDS
GRP16B	RUPTURE OF PIPE SUPPORT AT NOZZLE
GRP16C	LOSS OF CONTROL AIR
GRP16D	ELECTRICAL FAILURE IN ACTUATOR
GRP16E	OPERATOR DISTORTION
GRP16F	OIL RESERVOIR HOLD DOWN BOLTS
GRP16G	FRACTURE OF VALVE ACTUATOR TOP COVER AT CONNECTION TO VALVE BODY
GRP16H	FAILURE OF SPRING MECHANISM DUE TO EXCESSIVE PLASTIC DEFORMATION
GRP17C	DISC BECOMES DISENGAGED
GRP17D	DISC BECOMES BOUND
GRP17E	GENERIC FUNCTION
GRP18A	LEAKAGE
GRP18B	INTERNAL DAMAGE

GRPNO	MODE
GRP18C	STRUCTURAL FATIGUE
GRP19A	BINDING OF ROTATING PARTS
GRP19B	RUPTURE OF ANCHOR BOLTS
GRP20A	CONTROL FAILURE
GRP20B	OIL LEVEL REGULATOR
GRP20C	ANCHOR BOLT FAILURE
GRP20D	CRANKSHAFT LOCK UP
GRP20E	RELAY CHATTER
GRP20F	FAILED RELAY
GRP20G	VALVE TRIP
GRP20H	STRUCTURAL FAILURE
GRP21A	FAILURE OF BATTENS
GRP21B	CASE BREAKAGE DUE TO A BAD STAND
GRP21C	RUPTURE OF ANCHOR BOLTS
GRP22A	SPURIOUS OPERATION OF A PROTECTIVE RELAY
GRP23A	INTERNAL STRUCTURAL FAILURE, SHORT OF ELECTRICAL CONNECTION
GRP23B	FAILURE OF SUPPORT FRAME
GRP23C	RUPTURE OF ANCHOR BOLTS
GRP24A	STRUCTURAL FAILURE
GRP24B	RUBBING OF FAN ON HOUSING
GRP24C	RUBBING OF MOTOR ROTOR ON HOUSING
GRP24D	GENERIC FUNCTION
GRP26A	INSTRUMENT FAILURE
GRP26B	WELD FAILURE
GRP26C	RELAY CHATTER
GRP26D	BREAKER TRIP
GRP26E	STRUCTURAL FAILURE
GRP27B	COMPONENT MALFUNCTION
GRP27C	STRUCTURAL MOUNTING OF CABINETS
GRP27D	STRUCTURAL MOUNTING OF COMPONENTS
GRP27F	STRUCTURAL FAILURE
GRP30A	RELAY CHATTER
GRP30B	LOOSENING OF FASTENERS
GRP30C	BASE STRUCTURAL FATIGUE
GRP30D	SIGNAL DRIFT
GRP30E	CONTACT CHATTER
GRP30F	SET POINT DRIFT
GRP31A	CHATTER OF CONTACTS
GRP31B	STRUCTURAL ANCHORING OF CABINET BASE
GRP31C	STRUCTURAL MOUNTING OF COMPONENT IN CABINET
GRP33A	DISLODGING OF AIR DUCT BLANKING CLIPS
GRP36A	FAILURE OF SUPPORTS
GRP36B	RUPTURE OF PARTS BETWEEN SUPPORTS
GRP36C	CABLE SUPPORT SYSTEM
GRP37A	CORNER TEARING
GRP37B	SUPPORT FAILURE
GRP37C	JOINT SEPARTION
GRP37D	RUPTURE OF DUCT BETWEEN SUPPORTS
GRP37E	GROSS BENDING FIRM
GRP39A	PORCELAIN FRACTURE
GRP39B	A B CIRCUIT BREAKER FAILURE
GRP39C	H V TRANSFORMER STRUCTURAL FAILURE
GRP40A	RELAY CHATTER
GRP40B	RELAY TRIP
GRP41A	BREAKER TRIP

GRPNO	MODE
GRP41B	STRUCTURAL FAILURE
GRP48A	PIPE DEFORMATION
GRP49A	FRACTURE OF PORCELAIN INSULATION
GRP50A	DESTRUCTION OF SHEAR CONNECTION BETWEEN MODULES
SMA01	DEFOR. OF GUIDE TUBES / GUIDE PLATE WELD
SMA02	CONTROL ROD HOUSING DEFORMATION
SMA03	FRACTURE OF RPV OUTPUT NOZZLE SAFE END
SMA04	SUPPORT COLUMN FAILURE
SMA05	SUPPORT SKIRT BOLTING
SMA06	SUPPORT SKIRT COLLAPSE
SMA07	PLASTIC BUCKLING OF SHELL
SMA08	BUCKLING OF TANK WALLS AT BASE
SMA09	BENDING OF VERTICAL STIFFNER
SMA10	SUPPORT FAILURE
SMA11	SUPPORT LEG FAILURE
SMA12	BUCKLING AND FRACTURE
SMA13	BUCKLING AND FRACTURE
SMA14	SUPPORT COLUMN BOLTING
SMA15	BENDING OF PUMP CASING
SMA16	IMPELLER DEFLECTION
SMA17	MOUNTING BOLT FAILURE
SMA18	FLANGE BENDING
SMA19	SHAFT BENDING
SMA20	THRUST BEARING FAILURE
SMA21	SHAFT DEFLECTION
SMA22	GENERIC FUNCTION
SMA23	DISTORTION OF EXTENDED OPERATOR STRUCTURE
SMA24	OIL RESERVOIR HOLD DOWN BOLTS
SMA25	GENERIC FUNCTION
SMA26	GENERIC FUNCTION
SMA27	GENERIC FUNCTION
SMA28	RELAY CHATTER
SMA29	FAILED RELAY
SMA30	VALVE TRIP
SMA31	STRUCTURAL
SMA32	ANCHOR BOLTS
SMA33	CASE CRACKING & PLATE FAILURE
SMA34	RELAY CHATTER
SMA35	BREAKER TRIP
SMA36	STRUCTURAL
SMA37	STRUCTURAL
SMA38	RUBBING OF FAN ON HOUSING
SMA39	RUBBING OF MOTOR ROTOR ON HOUSING
SMA40	GENERIC FUNCTION
SMA41	RELAY CHATTER
SMA42	BREAKER TRIP
SMA43	STRUCTURAL
SMA44	ELECTRICAL MALFUNCTION
SMA45	RELAY CHATTER
SMA46	BREAKER TRIP
SMA47	STRUCTURAL
SMA48	ELECTRICAL FUNCTION
SMA49	RELAY CHATTER
SMA50	BREAKER TRIP
SMA51	STRUCTURAL

GRPNO	MODE
SMA52	RELAY TRIP
SMA53	CABLE SUPPORT SYSTEM
SMA54	RELAY CHATTER
SMA55	RELAY TRIP
SMA56	STRUCTURAL
SMA57	BREAKER TRIP
SMA58	STRUCTURAL
SMA59	FRACT OF INSULATORS
SMA60	OPERATOR DISTORTION
SMA61	RELAY TRIP
SMA62	BREAKER TRIP
SMA63	FRACTURE OF INSULATORS

E. GRPMODE

Table GRPMODE relates the grouping of data which brought about the resulting fragility data presented in Table RESULTS. Each row of data in the table contains the fragility data for a single failure mode, usually resulting from computations by program FRAGSTAT. It consists of seven columns as follows:

Column No.	Column name	Type	Contents
1	GRPNO	Character	An identifying code unique to this particular set of data for a particular failure mode.
2	RESNO	Character	An identifying code relating this set of data to the final resulting fragility data (see Table RESULTS.)
3	NMEAN	Floating	The statistical mean of the data assuming normal distribution.
4	NSIGMA	Floating	The standard deviation of the data assuming normal distribution.
5	LNMEAN	Floating	The statistical mean of the natural logs of the data (i.e., assuming lognormal distribution).
6	LNSIGMA	Floating	The standard deviations of the natural logs of the data (i.e., assuming lognormal distributions).
7	PARAM	Character	The fragility parameter.

GRPMODE

GRPNO	RESNO	NMEAN	NSIGMA	LNMEAN	LNSIGMA	PARAM
GRP01A	RES01A	5.000	3.971	1.365	0.708	SP ACCEL G
GRP01B	RES01A	7.333	6.216	1.731	0.757	SP ACCEL G
GRP01C	RES01A	9.333	8.501	1.901	0.823	SP ACCEL G
GRP02A	RES02A	4.333	1.241	1.426	0.275	SP ACCEL G
GRP02B	RES02A	5.667	1.763	1.692	0.289	SP ACCEL G
GRP02C	RES02A	6.833	2.378	1.866	0.325	SP ACCEL G
GRP02D	RES02B	3.333	1.241	1.134	0.361	SP ACCEL G
GRP02E	RES02B	5.667	1.763	1.692	0.289	SP ACCEL G
GRP02F	RES02C	1.933	0.423	0.637	0.208	SP MOMENTS
GRP02G	RES02D	5.000	1.562	1.551	0.339	FORCES
GRP02H	RES02E	4.000	0.781	1.360	0.201	SP ACCEL G
GRP02I	RES02E	3.000	0.781	1.060	0.275	SP ACCEL G
GRP02J	RES02E	8.670	3.540	2.100	0.422	SP ACCEL G
GRP03A	RES03A	220.000	89.140	5.310	0.406	MOM FT-KIP
GRP04A	RES04A	220.000	89.140	5.310	0.406	MOM FT-KIP
GRP05A	RES05A	220.000	89.140	5.310	0.406	MOM FT-KIP
GRP06A	RES06A	220.000	89.140	5.310	0.406	MOM FT-KIP
GRP07A	RES07A	1.330	0.881	0.501	0.445	SP ACCEL G
GRP07B	RES07A	2.833	1.706	0.903	0.536	SP ACCEL G
GRP08A	RES08A	2.167	0.620	0.732	0.275	SP ACCEL G
GRP08B	RES08A	3.433	1.181	1.180	0.319	SP ACCEL G
GRP08C	RES08A	5.583	1.807	1.670	0.305	SP ACCEL G
GRP09A	RES09A	4.370	2.645	1.364	0.609	FLOOR AC G
GRP10A	RES10A	2.167	0.620	0.732	0.275	ACCEL G
GRP10B	RES10A	13.667	4.758	2.547	0.359	ACCEL G
GRP10C	RES10A	2.800	1.116	0.955	0.452	ACCEL G
GRP11A	RES11A	220.000	89.140	5.310	0.406	MOM FT-KIP
GRP12A	RES12A	3.833	1.706	1.269	0.401	SP ACCEL G
GRP12B	RES12A	6.333	2.856	1.766	0.406	SP ACCEL G
GRP13A	RES13A	3.000	0.781	1.059	0.275	SP ACCEL G
GRP13B	RES13A	5.000	0.781	1.596	0.159	SP ACCEL G
GRP14A	RES14A	2.500	1.153	0.828	0.417	SP ACCEL G
GRP14B	RES14A	5.000	2.305	1.521	0.417	SP ACCEL G
GRP16A	RES16A	18.000	4.688	2.851	0.275	SP ACCEL G
GRP16B	RES16A	11.000	2.996	2.363	0.257	SP ACCEL G
GRP16C	RES16B	8.000	2.344	2.029	0.314	SP ACCEL G
GRP16D	RES16A	11.750	4.396	2.415	0.358	SP ACCEL G
GRP16G	RES16A	12.000	5.990	2.360	0.476	PK ACCEL G
GRP16H	RES16A	7.330	1.990	1.950	0.271	PK ACCEL G
GRP17C	RES17A	9.000	1.172	2.188	0.132	SP ACCEL G
GRP17D	RES17A	12.750	1.730	2.538	0.130	SP ACCEL G
GRP18A		10.367	3.322	2.303	0.329	SP ACCEL G
GRP18B	RES18A	19.042	14.874	2.770	0.620	SP ACCEL G
GRP18C	RES18A	27.417	28.836	3.071	0.714	SP ACELL G
GRP19A	RES19A	13.333	4.964	2.520	0.360	ACCEL G
GRP19B	RES19A	21.667	6.205	3.035	0.275	ACCEL G
GRP20A	RES20A	6.476	2.659	1.783	0.441	SP ACCEL G
GRP20B	RES20A	6.476	2.659	1.783	0.441	SP ACCEL G
GRP20C	RES20A	6.333	2.765	1.731	0.476	SP ACCEL G
GRP20D	RES20A	10.800	3.126	2.337	0.279	SP ACCEL G
GRP21A	RES21A	2.500	1.153	0.828	0.417	ACCEL G
GRP21B	RES21A	21.667	6.205	3.035	0.275	ACCEL G
GRP22A	RES22A	2.611	1.237	0.846	0.486	SP ACCEL G
GRP23A	RES23A	5.167	2.269	1.539	0.503	SP ACCEL G
GRP23B	RES23A	10.822	6.728	2.254	0.680	SP ACCEL G

GRPNO	RESNO	NMEAN	NSIGMA	LNMEAN	LNSIGMA	PARAM
GRP23C	RES23A	3.333	1.241	1.134	0.351	SP ACCEL G
GRP24A	RES24A	6.667	2.482	1.827	0.360	FLOOR AC G
GRP26A	RES26A	2.167	0.620	0.732	0.275	ACCEL G
GRP26B	RES26A	5.333	1.995	1.596	0.383	ACCEL G
GRP27B	RES27A	18.183	7.203	2.823	0.407	SP ACCEL G
GRP27C	RES27A	26.667	6.205	3.257	0.223	SP ACCEL G
GRP27D	RES27A	25.000	3.906	3.205	0.159	SP ACCEL G
GRP30A	RES30A	9.333	2.482	2.193	0.302	SP ACCEL G
GRP30B	RES30A	11.000	2.996	2.363	0.257	SP ACCEL G
GRP30C	RES30A	11.000	2.996	2.363	0.257	SP ACCEL G
GRP30D	RES30A	12.000	2.344	2.463	0.201	SP ACCEL G
GRP30E	RES30A	13.800	3.134	2.598	0.223	SP ACCEL G
GRP30F	RES30A	17.600	5.180	2.816	0.325	SP ACCEL G
GRP31A	RES31A	16.667	6.205	2.743	0.361	SP ACCEL G
GRP31B	RES31A	21.667	6.205	3.035	0.275	SP ACCEL G
GRP31C	RES31A	25.000	3.906	3.205	0.159	SP ACCEL G
GRP33A	RES33A	9.400	1.938	2.219	0.201	SP ACCEL G
GRP36A	RES36A	3.330	1.241	1.134	0.360	SP ACCEL G
GRP36B	RES36A	6.333	2.857	1.766	0.406	SP ACCEL G
GRP37A	RES37A	7.333	1.995	1.953	0.271	SP ACCEL G
GRP37B	RES37A	8.375	4.947	1.966	0.677	SP ACCEL G
GRP37C	RES37A	9.333	5.269	2.077	0.806	SP ACCEL G
GRP37D	RES37A	7.000	2.305	1.901	0.302	SP ACCEL G
GRP37E	RES37A	10.000	3.906	2.207	0.445	SP ACCEL G
GRP39A	RES39A	0.883	0.460	-0.266	0.517	Z PRD ACCE
GRP39B	RES39A	0.347	0.180	-1.150	0.449	Z PRD ACCE
GRP39C	RES39A	1.090	0.711	-0.090	0.610	Z PRD ACCE
GRP40A	RES40A	8.581	8.481	1.735	1.164	SP ACCEL G
GRP48A	RES48A	8.333	1.241	2.109	0.144	FLOOR AC G
GRP49A	RES49A	0.395	0.282	-1.102	0.807	BASE ACCEL
GRP50A	RES50A	0.310	0.142	-1.288	0.471	FLOOR AC G
SMA01	RES01A	2.750	0.808	1.010	0.369	SP ACCEL G
SMA02	RES01A	6.000	1.650	1.790	0.339	SP ACCEL G
SMA04	RES02E	3.300	1.750	1.190	0.440	SP ACCEL G
SMA10	RES10A	7.950	3.320	2.070	0.599	SP ACCEL G
SMA14	RES12A	3.300	1.110	1.190	0.440	SP ACCEL G
SMA16	RES15B	3.200	0.879	1.160	0.338	ACCEL G
SMA17	RES15B	11.700	3.790	2.460	0.419	ACCEL G
SMA18	RES15A	4.660	1.500	1.540	0.413	Z PRD AC G
SMA19	RES15A	7.190	1.680	1.970	0.278	Z PRD AC G
SMA20	RES15A	8.220	2.150	2.110	0.318	Z PRD AC G
SMA21	RES15A	39.600	9.970	3.680	0.304	Z PRD AC G
SMA22	RES15A	32.500	10.330	3.480	0.408	Z PRD AC G
SMA23	RES16A	7.560	3.320	2.020	0.646	SP ACCEL G
SMA24	RES16A	7.300	2.060	1.990	0.350	SP ACCEL G
SMA26	RES17A	47.500	16.900	3.860	0.474	SP ACCEL G
SMA28	RES20A	0.931	0.265	-0.071	0.354	SP ACCEL G
SMA29	RES20A	1.960	0.566	0.673	0.361	SP ACCEL G
SMA30	RES20A	0.735	0.229	-0.308	0.397	SP ACCEL G
SMA31	RES20A	8.910	3.500	2.190	0.546	SP ACCEL G
SMA32	RES21A	17.100	6.180	2.840	0.484	SP ACCEL G
SMA38	RES24A	2.740	0.875	1.010	0.410	SP ACCEL G
SMA39	RES24A	2.930	0.946	1.080	0.416	SP ACCEL G
SMA40	RES24A	11.900	3.890	2.470	0.424	SP ACCEL G
SMA41	RES26A	2.590	1.730	0.951	1.510	SP ACCEL G

GRPNO	RESNO	NMEAN	NSIGMA	LNMEAN	LNSIGMA	PARAM
SMA42	RES26A	9.630	4.880	2.260	0.818	SP ACCEL G
SMA43	RES26A	18.300	9.640	2.900	0.881	SP ACCEL G
SMA44	RES27A	15.700	5.240	2.750	0.436	SP ACCEL G
SMA45	RES40A	2.590	1.730	0.951	1.510	SP ACCEL G
SMA53	RES36A	2.820	1.140	1.040	0.570	Z PD PK AC
SMA57	RES41A	9.630	4.880	2.260	0.818	SP ACCEL G
SMA58	RES41A	18.300	9.640	2.900	0.881	SP ACCEL G

F. GRPNOTES

Table GRPNOTES contains qualifying comments pertinent to the various groupings of data in GRPMODE. Information such as predominant frequencies and specific equipment identification is included here. It consists of four columns of data as follows:

Column No.	Column name	Type	Contents
1	CATNO	Floating	A floating point number unique to a particular description of generic category or component description (see Table CATEGORY).
2	GRPNO	Character	An identifying code unique to a particular set of data for a particular failure mode (see Table GRPMODE).
3	LINE	Integer	A line number used for sorting and editing.
4	NOTE	Character	Qualifying comments.

GRPNOTES

CATNO	GRPNO	LINE	NOTE
1.0	GRP01A	1	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
1.0	GRP01B	1	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
1.0	GRP01C	1	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
1.0	SMA01	131	FREQUENCY 5-15 HZ , 5% DAMPING
1.0	SMA02	131	FREQUENCY 6 HZ , 5% DAMPING
2.1	GRP02A	32	ALL MODES: PREDOMINANT FREQUENCIES, MARK II 9-15 HZ,MARK III 3-5 HZ. MARK II & III REFER TO GE BWR CONTAIN-MENTS PRESS BOUND FAIL. ALL MODES.
2.1	GRP02B	32	ALL MODES: PREDOMINANT FREQUENCIES, MARK II 9-15 HZ,MARK III 3-5 HZ. MARK II & III REFER TO GE BWR CONTAIN-MENTS PRESS BOUND FAIL. ALL MODES.
2.1	GRP02C	26	POOL TYPE REACTOR VESSEL (LIQ. SODIUM) PREDOMINANT FREQUENCIES, MODE # 1-7 HZ MODE #2-7.5 HZ MODES #3--- PRESS. BOUND FAIL; ALL MODES.
2.1	SMA03	44	FREQUENCY 5 HZ , (NSSS SYSTEM)
2.2	GRP02D	42	PRESSURIZER. BOTH MODES PREDOMINANT FREQUENCY, 7.0 HZ. PERCENTILES INCLUDE LOCA. PRESS, BOUND. FAIL; ALL MODES.
2.2	GRP02E	42	PRESSURIZER. BOTH MODES PREDOMINANT FREQUENCY, 7.0 HZ. PERCENTILES INCLUDE LOCA. PRESS, BOUND. FAIL; ALL MODES.
2.2	SMA05	131	FREQUENCY 19-22 HZ , 3% DAMPING
2.3	GRP02F	60	STEAM GENERATOR. BOTH MODES: PREDOMINANT FREQUENCY, 10-15 HZ.

CATNO	GRPNO	LINE	NOTE
			MODE #1 FACTORS TIME SY (SY FROM PRESS. BOUND. FAIL; ALL MODES.
2.3	GRP02G	54	STEAM GENERATOR ALL MODES: PREDOMINANT FREQUENCIES:MODES # 1 10-30 MODES # 2 RIGID MODES # 3 20-100 HZ. PRESS. BOUND. FAIL; ALL MODES.
2.3	GRP02H	48	STEAM GENERATOR . ALL MODES: PREDOMINANT FREQUENCY 7.5 HZ ALL MODES: VERTICAL DIRECTION ACCELERATION PRESS. BOUND. FAIL; ALL MODES.
2.3	GRP02I	48	STEAM GENERATOR . ALL MODES: PREDOMINANT FREQUENCY 7.5 HZ ALL MODES: VERTICAL DIRECTION ACCELERATION PRESS. BOUND. FAIL; ALL MODES.
2.3	GRP02J	54	STEAM GENERATOR ALL MODES: PREDOMINANT FREQUENCIES:MODES # 1 10-30 MODES # 2 RIGID MODES # 3 20-100 HZ. PRESS. BOUND. FAIL; ALL MODES.
2.3	SMA04	44	FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP
2.3	SMA14	44	FREQUENCY 5 HZ , (NSSS SYSTEM) , 5% DAMP
3.0	GRP03A	1	MASTER PIPING CURVE
4.0	GRP04A	1	MASTER PIPING CURVE
5.0	GRP05A	1	MASTER PIPING CURVE
6.0	GRP06A	1	MASTER PIPING CURVE
7.0	GRP07A	119	ALL MODES: PREDOMINANT FREQUENCY 4-10 HZ
7.0	GRP07B	1	PREDOM. FREQ. 4-10 HZ
7.0	SMA06	131	FREQUENCY 20.7 HZ , 5% DAMPING
7.0	SMA07	131	FREQUENCY 6.3 HZ , 5% DAMPING
8.0	GRP08A	121	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
8.0	GRP08B	121	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
8.0	GRP08C	121	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
8.0	SMA08	44	RIGID TANK + SLOSH
8.0	SMA09	44	RIGID TANK + SLOSH
9.0	GRP09A	123	PREDOMINANT FREQUENCY: 12 TO 20 HZ. DIESEL FUEL TANK.
10.0	GRP10A	128	BOTH MODES: PREDOMINANT FREQUENCY 15-30 HORIZONTAL TANK AND HEAT EXCHANGERS.
10.0	GRP10B	131	PREDOMINANT FREQUENCY: GREATER THEN 20 H SMALL VESSELS.
10.0	GRP10C	128	BOTH MODES: PREDOMINANT FREQUENCY 15-30 HORIZONTAL TANK AND HEAT EXCHANGERS.
10.0	SMA10	131	FREQUENCY 6.9 HZ , 5% DAMPING
10.0	SMA11	131	FREQUENCY 12.8 HZ , 5% DAMPING
10.0	SMA15	131	FREQUENCY 7 HZ , 5% DAMPING
11.0	GRP11A	1	MASTER PIPING CURVE
11.0	SMA12	44	ZION BURIED PIPE
11.0	SMA13	44	ZION BURIED PIPE
12.0	GRP12A	140	BOTH MODES,PREDOMINANT FREQUENCIES: 4.5 PERCENTILES INCLUDE LOCA.
12.0	GRP12B	140	BOTH MODES,PREDOMINANT FREQUENCIES: 4.5 PERCENTILES INCLUDE LOCA.

CATNO	GRPNO	LINE	NOTE
13.0	GRP13A	143	PREDOMINANT FREQUENCY 4.5 HZ. ALL MODES.
13.0	GRP13B	143	PREDOMINANT FREQUENCY 4.5 HZ. ALL MODES.
14.0	GRP14A	149	BOTH MODES: PREDOMINANT FREQUENCY, 3HZ. PERCENTILE 90 IS TENTATIVE
14.0	GRP14B	149	BOTH MODES: PREDOMINANT FREQUENCY, 3HZ. PERCENTILE 90 IS TENTATIVE
15.0	SMA16	44	FREQUENCY 7 HZ , 5% DAMPING
15.0	SMA17	44	FREQUENCY 7 HZ , 5% DAMPING
15.0	SMA18	44	ZION SAFETY INJECTION PUMP , RIGID
15.0	SMA19	44	ZION SAFETY INJECTION PUMP, RIGID
15.0	SMA20	44	ZION CENTR. CHARGING PUMP, RIGID
15.0	SMA21	44	ZION CENTR. CHARGING PUMP, RIGID
15.0	SMA22	44	GENERIC PUMPS & COMPR., RIGID
16.0	GRP16A	184	PREDOMINANT FREQUENCY: MODE #1, 10-20 HZ. MODE #2, 30-50 HZ. MODE #3, 30-50HZ.
16.0	GRP16B	189	ALL MODES: PREDOMINANT FREQUENCIES 2-10 HZ.
16.0	GRP16C	192	BUTTERFLY VALVE PREDOMINANT FREQUENCY: RIGID.
16.0	GRP16D	168	ALL MODES. PREDOMINANT FREQUENCY RIGID. BALL VALVE WITH ACTUATOR AND LOGIC CABINET
16.0	GRP16G	195	PREDOMINANT FREQUENCY: MODE #1 VALVE ACTUATOR 27.7 HZ. MODE " SPRING MECHANISM 10-12 HZ. RUGGLES KLINGEMAN TRIP VALVE.
16.0	GRP16H	195	PREDOMINANT FREQUENCY: MODE #1 VALVE ACTUATOR 27.7 HZ. MODE " SPRING MECHANISM 10-12 HZ. RUGGLES KLINGEMAN TRIP VALVE.
16.0	SMA23	44	RIGID
16.0	SMA24	44	RIGID
16.0	SMA25	44	RIGID
17.0	GRP17C	200	PREDOMINANT FREQUENCIES BOTH MODES: RIGID
17.0	GRP17D	200	PREDOMINANT FREQUENCIES BOTH MODES: RIGID
17.0	SMA26	44	RIGID
18.0	GRP18A	205	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
18.0	GRP18B	205	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
18.0	GRP18C	205	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
18.0	SMA27	44	RIGID
19.0	GRP19A	230	PREDOMINANT FREQUENCIES ARE > 33 HZ.
19.0	GRP19B	230	PREDOMINANT FREQUENCIES ARE > 33 HZ.
20.0	GRP20A	233	PREDOMINANT RESPONSE FREQUENCIES: 1ST MODE 7.0 TO 20.6 HZ. 2ND MODE 8.3 TO 13.8 HZ. DIESEL GENERATORS.

CATNO	GRPNO	LINE	NOTE
20.0	GRP20B	233	PREDOMINANT RESPONSE FREQUENCIES: 1ST MODE 7.0 TO 20.6 HZ. 2ND MODE 8.3 TO 13.8 HZ. DIESEL GENERATORS.
20.0	GRP20C	241	PREDOMINANT RESPONSE FREQUENCIES: 15 HZ. DIESEL GENERATORS.
20.0	GRP20D	241	PREDOMINANT RESPONSE FREQUENCIES: 15 HZ. DIESEL GENERATORS.
20.0	SMA28	44	FREQUENCY 30 HZ , 5% DAMPING
20.0	SMA29	44	FREQUENCY 11 HZ , 5% DAMPING
20.0	SMA30	44	FREQUENCY 22 HZ , 5% DAMPING
20.0	SMA31	44	RIGID
21.0	GRP21A	244	PREDOMINANT FREQUENCY IS >25 HZ. BATTERY RACKS
21.0	GRP21B	247	PREDOMINANT FREQUENCY >15 HZ. DC POWER BATTERIES.
21.0	SMA32	44	FREQUENCY 8 HZ , 5% DAMPING
21.0	SMA33	44	FREQUENCY 8 HZ , 5% DAMPING
22.0	GRP22A	250	FREQUENCIES: SIDE TO SIDE = 6-11 HZ. FRONT TO BACK = 16-20 HZ. VERTICAL = >30 HZ. 26" WIDE METALCLAD SWITCHGEAR.
22.0	SMA34	44	FREQUENCY 5-10 HZ , 5% DAMPING
22.0	SMA35	44	FREQUENCY 5-10 HZ , 5% DAMPING
22.0	SMA36	44	FREQUENCY 5-10 HZ , 5% DAMPING
23.0	GRP23A	20	FRAGILITY PARAMETER AT FLOOR TO TRANSFORMER INTERFACE PREDOMINANT FREQUENCIES: COOLER UNIT: 7.5, 7.7 HZ. INTERNAL STRUCTURE: 7.2, 7.6 HZ. HV PORCELAIN: 8.1, 10.8 HZ.
23.0	GRP23B	27	PREDOMINANT FREQUENCY FOR ALL MODES: >10 HZ.
23.0	GRP23C	27	PREDOMINANT FREQUENCY FOR ALL MODES: >10 HZ.
23.0	SMA37	44	FREQUENCY 5-10 HZ , 5% DAMPING
24.0	GRP24A	30	PREDOMINANT RESPONSE FREQUENCY IS 21 HZ. HVAC FANS.
24.0	SMA38	44	FREQUENCY 4.3 HZ , 5% DAMPING
24.0	SMA39	44	FREQUENCY 4.3 HZ , 5% DAMPING
24.0	SMA40	44	FREQUENCY 10-30 HZ , 5% DAMPING
26.0	GRP26A	33	PREDOMINANT FREQUENCIES: MODE #1 RIGID MODE #2 11 HZ. PERCENTILES ARE FACTORS TIMES SSE. INSTRUMENT RACKS.
26.0	GRP26B	33	PREDOMINANT FREQUENCIES: MODE #1 RIGID MODE #2 11 HZ. PERCENTILES ARE FACTORS TIMES SSE. INSTRUMENT RACKS.
26.0	SMA41	44	FREQ 5-10 HZ , 5% DAMPING
26.0	SMA42	44	FREQ 5-10 HZ , 5% DAMPING
26.0	SMA43	44	FREQ 5-10 HZ , 5% DAMPING

CATNO	GRPNO	LINE	NOTE
27.0	GRP27B	50	PREDOMINANT FREQUENCY IS >20 HZ. STRUCTURAL FAILURE UNLIKELY WITH MODERN DESIGN.
27.0	GRP27C	42	PREDOMINANT FREQUENCY FOR ALL MODES >12 HZ. THESE MODES OF FAILURE ALSO APPLY TO BREAKER PANELS, AUXILIARY RELAY PANELS, INSTRUMENT RACKS AND DIESEL GENERATORS.
27.0	GRP27D	42	PREDOMINANT FREQUENCY FOR ALL MODES >12 HZ. THESE MODES OF FAILURE ALSO APPLY TO BREAKER PANELS, AUXILIARY RELAY PANELS, INSTRUMENT RACKS AND DIESEL GENERATORS.
27.0	SMA44	44	FREQUENCY 5-10 HZ , 5% DAMPING
27.0	SMA46	44	FREQUENCY 5-10 HZ , 5% DAMPING
27.0	SMA47	44	FREQUENCY 5-10 HZ , 5% DAMPING
30.0	GRP30A	54	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
30.0	GRP30B	54	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
30.0	GRP30C	54	PREDOMINANT RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
30.0	GRP30D	59	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
30.0	GRP30E	59	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
30.0	GRP30F	59	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
30.0	SMA48	44	RIGID
31.0	GRP31A	69	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
31.0	GRP31B	69	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
31.0	GRP31C	69	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
31.0	SMA49	44	FREQUENCY 5-10 HZ , 5% DAMPING

CATNO	GRPNO	LINE	NOTE
31.0	SMA50	44	FREQUENCY 5-10 HZ , 5% DAMPING
31.0	SMA51	44	FREQUENCY 5-10 HZ , 5% DAMPING
33.0	GRP33A	1	FREQ. 4.5-6.5 HZ , DAMP 2%
35.0	SMA52	44	FREQUENCY 5-10 HZ , 5% DAMPING
36.0	GRP36A	87	PREDOMINANT RESPONSE FREQUENCY IS 5-10 HZ. FOR ALL MODES.
36.0	GRP36B	87	PREDOMINANT RESPONSE FREQUENCY IS 5-10 HZ. FOR ALL MODES.
36.0	SMA53	44	REFERENCED TO ZPA
37.0	GRP37A	90	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
37.0	GRP37B	90	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
37.0	GRP37C	90	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
37.0	GRP37D	95	PREDOMINANT FREQUENCY FOR RESPONSE 5 - 10 HZ. ALL MODES
37.0	GRP37E	98	PREDOMINANT FREQUENCY FOR RESPONSE 10 HZ. ALL MODES.
39.0	GRP39A	7	FREQUENCIES: 1ST MODE = 1.5-4.0 HZ. 2ND MODE = 4.5-8.0 HZ.
39.0	GRP39B	111	IN-SITU TESTING. FRAGILITY PARAMETER AT CIRCUIT BREAKER FOOTING. THESE ARE SWITCHYARD CIRCUIT BREAKERS. TORSIONAL FAILURE. MODES OF VIBRATION: 1ST 2.4 - 3.4 HZ. 2ND 7.8 - 12.2 HZ. AIR BLAST CIRCUIT BREAKERS.
39.0	GRP39C	20	FRAGILITY PARAMETER AT FLOOR TO TRANSFORMER INTERFACE PREDOMINANT FREQUENCIES: COOLER UNIT: 7.5, 7.7 HZ. INTERNAL STRUCTURE: 7.2, 7.6 HZ. HV PORCELAIN: 8.1, 10.3 HZ.
40.0	GRP40A	39	PREDOMINANT RESPONSE FREQUENCY 20 TO 33 HZ.
40.0	SMA45	44	5-10 HZ , 5% DAMPING
41.0	SMA54	44	5-10 HZ , 5% DAMPING
41.0	SMA55	45	FREQUENCY 5-10 HZ , 5% DAMPING
41.0	SMA56	44	FREQUENCY 5-10 HZ , 5% DAMPING
41.0	SMA57	44	FREQUENCY 5-10 HZ , 5% DAMPING
41.0	SMA58	44	FREQUENCY 5-10 HZ , 5% DAMPING
48.0	GRP48A	121	THE TEST WERE NOT TAKEN TO FAILURE. PREDOMINANT FREQUENCIES: MODE #1 9.5 HZ.

CATNO	GRPNO	LINE	NOTE
			MODE #2 21.5 HZ.
49.0	GRP49A	1	FREQ. 1-4 HZ
49.0	SMA59	44	REFERENCED TO ZPA
50.0	GRP50A	1	FREQ. 7-8 HZ

G. GRPRES

Table GRPRES contains the lognormal results for each failure mode in each generic category along with other pertinent information. It consists of seven columns as follows:

Column No.	Column name	Type	Contents
1	CATNO	Floating	A floating point number unique to a particular description of generic category or component descriptions (see Table CATEGORY).
2	DES	Character	The description of the generic category or specific component (see Table CATEGORY).
3	GRPNO	Character	An identifying code unique to a particular set of data for a particular failure mode (see Table GRPMODE).
4	MEDIAN	Floating	The median of the data assuming lognormal distribution.
5	BETA	Floating	The standard deviation of the natural logs of the data.
6	PARAM	Character	The fragility parameter.
7	MODE	Character	A description of the failure mode.

GRPRES

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
1.0	REACTOR CORE ASSEMBLY	GRP01A	3.916	0.708	SP ACCEL G	BINDING OF CONTROL RODS DUE TO SEISMICALLY INDUCED DEFORMATIONS
1.0	REACTOR CORE ASSEMBLY	GRP01B	5.646	0.757	SP ACCEL G	DEFORMATION OF GUIDE TUBES DUE TO SEISMIC IMPACT OF FUEL BUNDLE
1.0	REACTOR CORE ASSEMBLY	GRP01C	6.693	0.823	SP ACCEL G	FAILURE OF CORE SUPPORT STRUCTURE DUE TO INERTIA LOAD OF FUEL
1.0	REACTOR CORE ASSEMBLY	SMA01	2.746	0.369	SP ACCEL G	DEFOR. OF GUIDE TUBES / GUIDE PLATE WELD
1.0	REACTOR CORE ASSEMBLY	SMA02	5.989	0.339	SP ACCEL G	CONTROL ROD HOUSING DEFORMATION
2.1	REACTOR PRESSURE VESSEL	GRP02A	4.162	0.275	SP ACCEL G	BUCKLING OF SKIRT
2.1	REACTOR PRESSURE VESSEL	GRP02B	5.430	0.289	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS
2.1	REACTOR PRESSURE VESSEL	GRP02C	6.462	0.325	SP ACCEL G	STRESS INTENSITY AT VESSEL SUPPORT
2.2	PRESSURIZER	GRP02D	3.108	0.361	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS
2.2	PRESSURIZER	GRP02E	5.430	0.289	SP ACCEL G	BUCKLING OF SKIRT
2.2	PRESSURIZER	SMA05	2.000	0.398	SP ACCEL G	SUPPORT SKIRT BOLTING
2.3	STEAM GENERATOR	GRP02F	1.891	0.208	SP MOMENTS	RUPTURE AT PRIMARY INLET OR OUTLET NOZZLE, RUPTURE AT FEEDWATER NOZZLE
2.3	STEAM GENERATOR	GRP02G	4.716	0.339	FORCES	NOZZLE FAILURE
2.3	STEAM GENERATOR	GRP02H	3.896	0.201	SP ACCEL G	FAILURE OF STEAM GENERATOR LEG IMBEDMENT IN CONTAINMENT FLOOR
2.3	STEAM GENERATOR	GRP02I	2.886	0.275	SP ACCEL G	FAILURE OF CONNECTION BETWEEN SUPPORT LEG AND STEAM GENERATOR BODY
2.3	STEAM GENERATOR	GRP02J	8.166	0.422	SP ACCEL G	TUBING FAILURE
2.3	STEAM GENERATOR	SMA04	3.287	0.440	SP ACCEL G	SUPPORT COLUMN FAILURE
2.3	STEAM GENERATOR	SMA04	3.287	0.440	SP ACCEL G	SUPPORT COLUMN FAILURE
3.0	PRIMARY COOLANT PIPING	GRP03A	202.350	0.406	MOM FT-KIP	RUPTURE AT CONNECTIONS TO COMPONENTS DUE TO COMPONENT SUPPORT FAILURE
7.0	LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS	GRP07A	1.650	0.445	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
7.0	LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS	GRP07B	2.467	0.536	SP ACCEL G	BUCKLING OF SUPPORT SKIRT OR LEGS
7.0	LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS	SMA06	21.977	0.407	SP ACCEL G	SUPPORT SKIRT COLLAPSE
7.0	LARGE VERTICAL STORAGE VESSELS WITH FORMED HEADS	SMA07	7.925	0.519	SP ACCEL G	PLASTIC BUCKLING OF SHELL
8.0	LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS	GRP08A	2.079	0.275	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
8.0	LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS	GRP08B	3.254	0.319	SP ACCEL G	BUCKLING OF TANK WALL
8.0	LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS	GRP08C	5.312	0.305	SP ACCEL G	TENSILE RUPTURE OF TANK WALL
8.0	LARGE VERTICAL STORAGE TANKS WITH FLAT BOTTOMS	SMA08	0.828	0.389	PK GD AC G	BUCKLING OF TANK WALLS AT BASE

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
8.0	LARGE VERTICAL STORAGE TANKS W ITH FLAT BOTTOMS	SMA09	3.597	0.436	PK GD AC G	BENDING OF VERTICAL STIFFNER
9.0	LARGE HORIZONTAL VESSELS	GRP09A	3.912	0.609	FLOOR AC G	SUPPORT SYSTEM FAILURE (BOLTS)
10.0	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS	GRP10A	2.079	0.275	ACCEL G	RUPTURE OF ANCHOR BOLTS
10.0	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS	GRP10B	12.769	0.359	ACCEL G	STRUCTURAL FAILURE
10.0	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS	GRP10C	2.599	0.452	ACCEL G	SUPPORT FAILURE
10.0	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS	SMA10	7.925	0.599	SP ACCEL G	SUPPORT FAILURE
10.0	SMALL-MEDIUM VESSELS AND HEAT EXCHANGERS	SMA11	7.171	0.516	PK ACCEL G	SUPPORT LEG FAILURE
11.0	BURIED PIPE	SMA12	1.399	0.601	PK GD AC G	BUCKLING AND FRACTURE
11.0	BURIED PIPE	SMA13	1.399	0.601	PK GD AC G	BUCKLING AND FRACTURE
12.0	REACTOR COOLANT PUMP	GRP12A	3.557	0.401	SP ACCEL G	FAILURE OF CONNECTION TO SUPPORT LEGS
12.0	REACTOR COOLANT PUMP	GRP12B	5.847	0.406	SP ACCEL G	BUCKLING OF SUPPORT LEG
12.0	REACTOR COOLANT PUMP	SMA14	3.287	0.440	SP ACCEL G	SUPPORT COLUMN BOLTING
12.0	REACTOR COOLANT PUMP	SMA14	3.287	0.440	SP ACCEL G	SUPPORT COLUMN BOLTING
13.0	LARGE VERTICAL CENTRIFUGAL PUMPS WITH MOTOR DRIVE	GRP13A	2.883	0.275	SP ACCEL G	RUPTURE OF CONNECTIONS TO SUPPORT STRUTS
13.0	LARGE VERTICAL CENTRIFUGAL PUMPS WITH MOTOR DRIVE	GRP13B	4.933	0.159	SP ACCEL G	TENSILE FAILURE OF SUPPORT STRUTS
13.0	LARGE VERTICAL CENTRIFUGAL PUMPS WITH MOTOR DRIVE	SMA15	3.490	0.342	SP ACCEL G	BENDING OF PUMP CASING
14.0	LARGE VERTICAL PUMPS	GRP14A	2.289	0.417	SP ACCEL G	RUPTURE OF ANCHOR BOLTS DUE TO LARGE MOMENTS FROM VERTICAL INTAKE COLUMN
14.0	LARGE VERTICAL PUMPS	GRP14B	4.577	0.417	SP ACCEL G	RUPTURE OF VERTICAL INTAKE COLUMN
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA16	3.190	0.338	ACCEL G	IMPELLER DEFLECTION
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA16	3.190	0.338	SP ACCEL G	IMPELLER DEFLECTION
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA17	11.705	0.419	SP ACCEL G	MOUNTING BOLT FAILURE
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA17	11.705	0.419	ACCEL G	MOUNTING BOLT FAILURE
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA18	4.665	0.413	Z PRD AC G	FLANGE BENDING
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA19	7.171	0.278	Z PRD AC G	SHAFT BENDING
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA20	8.248	0.318	Z PRD AC G	THRUST BEARING FAILURE
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA21	39.646	0.304	Z PRD AC G	SHAFT DEFLECTION
15.0	MOTOR DRIVEN COMPRESSORS AND PUMPS	SMA22	32.460	0.408	Z PRD AC G	GENERIC FUNCTION

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16A	17.305	0.275	SP ACCEL G	BREAKS AT WELD ENDS
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16B	10.623	0.257	SP ACCEL G	RUPTURE OF PIPE SUPPORT AT NOZZLE
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16C	7.606	0.314	SP ACCEL G	LOSS OF CONTROL AIR
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16D	11.190	0.358	SP ACCEL G	ELECTRICAL FAILURE IN ACTUATOR
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16G	10.591	0.476	PK ACCEL G	FRACTURE OF VALVE ACTUATOR TOP COVER AT CONNECTION TO VALVE BODY
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	GRP16H	7.029	0.271	PK ACCEL G	FAILURE OF SPRING MECHANISM DUE TO EXCES SIVE PLASTIC DEFORMATION
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	SMA23	7.538	0.646	SP ACCEL G	DISTORTION OF EXTENDED OPERATOR STRUCTUR E
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	SMA23	7.538	0.646	PK ACCEL G	DISTORTION OF EXTENDED OPERATOR STRUCTUR E
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	SMA24	7.316	0.350	SP ACCEL G	OIL RESERVOIR HOLD DOWN BOLTS
16.0	LARGE MOTOR OPERATED VALVES (> 4IN.)	SMA25	43.816	0.468	Z PD PK AC	GENERIC FUNCTION
17.0	LARGE RELIEF AND CHECK VALVES (> 4IN.)	GRP17C	8.917	0.132	SP ACCEL G	DISC BECOMES DISENGAGED
17.0	LARGE RELIEF AND CHECK VALVES (> 4IN.)	GRP17D	12.654	0.130	SP ACCEL G	DISC BECOMES BOUND
17.0	LARGE RELIEF AND CHECK VALVES (> 4IN.)	SMA26	47.465	0.474	Z PD PK AC	GENERIC FUNCTION
17.0	LARGE RELIEF AND CHECK VALVES (> 4IN.)	SMA26	47.465	0.474	SP ACCEL G	GENERIC FUNCTION
17.0	LARGE RELIEF AND CHECK VALVES (> 4IN.)	SMA60	9.875	0.650	Z PD PK AC	OPERATOR DISTORTION
18.0	SMALL MISCELLANEOUS VALVES (< 4IN.)	GRP18B	15.959	0.620	SP ACCEL G	INTERNAL DAMAGE
18.0	SMALL MISCELLANEOUS VALVES (< 4IN.)	GRP18C	21.563	0.714	SP ACELL G	STRUCTURAL FATIGUE
19.0	HORIZONTAL MOTORS	GRP19A	12.429	0.360	ACCEL G	BINDING OF ROTATING PARTS
19.0	HORIZONTAL MOTORS	GRP19B	20.801	0.275	ACCEL G	RUPTURE OF ANCHOR BOLTS
20.0	GENERATORS	GRP20A	5.948	0.441	SP ACCEL G	CONTROL FAILURE
20.0	GENERATORS	GRP20B	5.948	0.441	SP ACCEL G	OIL LEVEL REGULATOR
20.0	GENERATORS	GRP20C	5.646	0.476	SP ACCEL G	ANCHOR BOLT FAILURE
20.0	GENERATORS	GRP20D	10.350	0.279	SP ACCEL G	CRANKSHAFT LOCK UP
20.0	GENERATORS	SMA28	0.931	0.354	SP ACCEL G	RELAY CHATTER
20.0	GENERATORS	SMA29	1.960	0.361	SP ACCEL G	FAILED RELAY
20.0	GENERATORS	SMA29	1.960	0.361	SP ACCEL G	FAILED RELAY
20.0	GENERATORS	SMA30	0.735	0.397	SP ACCEL G	VALVE TRIP

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
20.0	GENERATORS	SMA31	8.935	0.546	SP ACCEL G	STRUCTURAL
21.0	BATTERIES	GRP21A	2.289	0.417	ACCEL G	FAILURE OF BATTENS
21.0	BATTERIES	GRP21B	20.801	0.275	ACCEL G	CASE BREAKAGE DUE TO A BAD STAND
21.0	BATTERIES	SMA32	17.116	0.484	SP ACCEL G	ANCHOR BOLTS
21.0	BATTERIES	SMA33	5.259	0.385	SP ACCEL G	CASE CRACKING & PLATE FAILURE
22.0	SWITCHGEAR	GRP22A	2.330	0.486	SP ACCEL G	SPURIOUS OPERATION OF A PROTECTIVE RELAY
22.0	SWITCHGEAR	SMA34	2.588	1.510	SP ACCEL G	RELAY CHATTER
22.0	SWITCHGEAR	SMA35	9.583	0.818	SP ACCEL G	BREAKER TRIP
22.0	SWITCHGEAR	SMA36	18.174	0.881	SP ACCEL G	STRUCTURAL
23.0	DRY TRANSFORMERS	GRP23A	4.660	0.503	SP ACCEL G	INTERNAL STRUCTURAL FAILURE, SHORT OF EL ECTRICAL CONNECTION
23.0	DRY TRANSFORMERS	GRP23B	9.526	0.680	SP ACCEL G	FAILURE OF SUPPORT FRAME
23.0	DRY TRANSFORMERS	GRP23C	3.108	0.351	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
23.0	DRY TRANSFORMERS	SMA37	13.330	0.408	SP ACCEL G	STRUCTURAL
24.0	AIR HANDLING UNITS	GRP24A	6.215	0.360	FLOOR AC G	STRUCTURAL FAILURE
24.0	AIR HANDLING UNITS	SMA38	2.746	0.410	SP ACCEL G	RUBBING OF FAN ON HOUSING
24.0	AIR HANDLING UNITS	SMA39	2.945	0.416	SP ACCEL G	RUBBING OF MOTOR ROTOR ON HOUSING
24.0	AIR HANDLING UNITS	SMA40	11.822	0.424	SP ACCEL G	GENERIC FUNCTION
24.0	AIR HANDLING UNITS	SMA40	11.822	0.424	SP ACCEL G	GENERIC FUNCTION
26.0	INSTRUMENT PANELS AND RACKS	GRP26A	2.079	0.275	ACCEL G	INSTRUMENT FAILURE
26.0	INSTRUMENT PANELS AND RACKS	GRP26B	4.933	0.383	ACCEL G	WELD FAILURE
26.0	INSTRUMENT PANELS AND RACKS	SMA41	2.588	1.510	SP ACCEL G	RELAY CHATTER
26.0	INSTRUMENT PANELS AND RACKS	SMA42	9.583	0.818	SP ACCEL G	BREAKER TRIP
26.0	INSTRUMENT PANELS AND RACKS	SMA42	9.583	0.818	SP ACCEL G	BREAKER TRIP
26.0	INSTRUMENT PANELS AND RACKS	SMA43	18.174	0.881	SP ACCEL G	STRUCTURAL
27.0	CONTROL PANELS AND RACKS	GRP27B	16.827	0.407	SP ACCEL G	COMPONENT MALFUNCTION
27.0	CONTROL PANELS AND RACKS	GRP27C	25.972	0.223	SP ACCEL G	STRUCTURAL MOUNTING OF CABINETS
27.0	CONTROL PANELS AND RACKS	GRP27D	24.655	0.159	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENTS

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
27.0	CONTROL PANELS AND RACKS	SMA44	15.643	0.436	SP ACCEL G	ELECTRICAL MALFUNCTION
27.0	CONTROL PANELS AND RACKS	SMA46	9.583	0.818	SP ACCEL G	BREAKER TRIP
27.0	CONTROL PANELS AND RACKS	SMA47	18.174	0.881	SP ACCEL G	STRUCTURAL
28.0	AUXILIARY RELAY CABINETS	SMA61	7.614	0.710	SP ACCEL G	RELAY TRIP
30.0	LOCAL INSTRUMENTS	GRP30A	8.962	0.302	SP ACCEL G	RELAY CHATTER
30.0	LOCAL INSTRUMENTS	GRP30B	10.623	0.257	SP ACCEL G	LOOSENING OF FASTENERS
30.0	LOCAL INSTRUMENTS	GRP30C	10.623	0.257	SP ACCEL G	BASE STRUCTURAL FATIGUE
30.0	LOCAL INSTRUMENTS	GRP30D	11.740	0.201	SP ACCEL G	SIGNAL DRIFT
30.0	LOCAL INSTRUMENTS	GRP30E	13.437	0.223	SP ACCEL G	CONTACT CHATTER
30.0	LOCAL INSTRUMENTS	GRP30F	16.710	0.325	SP ACCEL G	SET POINT DRIFT
30.0	LOCAL INSTRUMENTS	SMA48	47.465	0.474	Z PRD AC G	ELECTRICAL FUNCTION
31.0	MOTOR CONTROL CENTERS	GRP31A	15.534	0.361	SP ACCEL G	CHATTER OF CONTACTS
31.0	MOTOR CONTROL CENTERS	GRP31B	20.801	0.275	SP ACCEL G	STRUCTURAL ANCHORING OF CABINET BASE
31.0	MOTOR CONTROL CENTERS	GRP31C	24.655	0.159	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENT IN CABINET
31.0	MOTOR CONTROL CENTERS	SMA49	2.588	1.510	SP ACCEL G	RELAY CHATTER
31.0	MOTOR CONTROL CENTERS	SMA50	9.583	0.818	SP ACCEL G	BREAKER TRIP
31.0	MOTOR CONTROL CENTERS	SMA51	18.174	0.881	SP ACCEL G	STRUCTURAL
31.0	MOTOR CONTROL CENTERS	SMA62	7.614	0.710	SP ACCEL G	BREAKER TRIP
33.0	LIGHT FIXTURES	GRP33A	9.198	0.201	SP ACCEL G	DISLODGING OF AIR DUCT BLANKING CLIPS
35.0	INVERTERS	SMA52	15.643	0.436	SP ACCEL G	RELAY TRIP
36.0	CABLE TRAYS	GRP36A	3.108	0.360	SP ACCEL G	FAILURE OF SUPPORTS
36.0	CABLE TRAYS	GRP36B	5.847	0.406	SP ACCEL G	RUPTURE OF PARTS BETWEEN SUPPORTS
36.0	CABLE TRAYS	SMA53	2.829	0.570	Z PD PK AC	CABLE SUPPORT SYSTEM
37.0	DUCTING	GRP37A	7.050	0.271	SP ACCEL G	CORNER TEARING
37.0	DUCTING	GRP37B	7.142	0.677	SP ACCEL G	SUPPORT FAILURE
37.0	DUCTING	GRP37C	7.980	0.806	SP ACCEL G	JOINT SEPARTION
37.0	DUCTING	GRP37D	6.693	0.302	SP ACCEL G	RUPTURE OF DUCT BETWEEN SUPPORTS

CATNO	DES	GRPNO	MEDIAN	BETA	PARAM	MODE
37.0	DUCTING	GRP37E	9.088	0.445	SP ACCEL G	GROSS BENDING FIRM
39.0	SWITCHYARD EQUIPMENT	GRP39A	0.766	0.517	Z PRD ACCE	PORCELAIN FRACTURE
39.0	SWITCHYARD EQUIPMENT	GRP39B	0.317	0.449	Z PRD ACCE	A B CIRCUIT BREAKER FAILURE
39.0	SWITCHYARD EQUIPMENT	GRP39C	0.914	0.610	Z PRD ACCE	H V TRANSFORMER STRUCTURAL FAILURE
40.0	RELAYS	GRP40A	5.669	1.164	SP ACCEL G	RELAY CHATTER
40.0	RELAYS	SMA45	2.588	1.510	SP ACCEL G	RELAY CHATTER
41.0	CIRCUIT BREAKERS	SMA54	2.588	1.510	SP ACCEL G	RELAY CHATTER
41.0	CIRCUIT BREAKERS	SMA55	9.583	0.818	SP ACCEL G	RELAY TRIP
41.0	CIRCUIT BREAKERS	SMA56	18.174	0.881	SP ACCEL G	STRUCTURAL
41.0	CIRCUIT BREAKERS	SMA57	9.583	0.818	SP ACCEL G	BREAKER TRIP
41.0	CIRCUIT BREAKERS	SMA57	9.583	0.818	SP ACCEL G	BREAKER TRIP
41.0	CIRCUIT BREAKERS	SMA58	18.174	0.881	SP ACCEL G	STRUCTURAL
48.0	RECOMBINERS	GRP48A	8.240	0.144	FLOOR AC G	PIPE DEFORMATION
49.0	CERAMIC INSULATORS	GRP49A	0.332	0.807	BASE ACCEL	FRACTURE OF PORCELAIN INSULATION
49.0	CERAMIC INSULATORS	SMA59	4.998	0.353	PK GD AC G	FRACT OF INSULATORS
49.0	CERAMIC INSULATORS	SMA63	0.200	0.353	PK GD AC G	FRACTURE OF INSULATORS
50.0	SPENT FUEL RACKS	GRP50A	0.276	0.471	FLOOR AC G	DESTRUCTION OF SHEAR CONNECTION BETWEEN MODULES

H. OPINION

Table OPINION contains most elements of the expert opinion data used by the SSMRP in computing component fragilities. This table was structured for convenient input into program FRAGSTAT (Ref. 6). It consists of eight columns of data as follows:

Column No.	Column name	Type	Contents
1	OPNO	Integer	A unique number assigned to each expert opinion.
2	IDENT	Character	A ten character code assigned to the expert to preserve anonymity.
3	CAT	Floating	An integer identifying the generic category of component (see Table CATEGORY).
4	WEIGHT	Floating	The subjective weighting factor applied to the data.
5	TEN	Floating	The estimated 10th percentile probability of failure value of fragility parameter.
6	FIFTY	Floating	The estimated 50th percentile probability of failure value of fragility parameter.
7	NINETY	Floating	The estimated 90th percentile probability of failure value of fragility parameter.
8	MODE	Character	A description of the failure mode.

OPINION

OPNO	IDENT	CAT	WEIGHT	TEN	FIFTY	NINETY	PARAM	MODE
1	3201031916	1	1.500	2.000	3.000	10.000	SP ACCEL G	BINDING OF CONTROL RODS
2	3201031916	1	1.500	3.000	4.000	15.000	SP ACCEL G	DEFORMATION OF GUIDE TUBES
3	3201031916	1	1.500	3.000	5.000	20.000	SP ACCEL G	FAILURE OF CORE SUPPORT STRUCTURE
4	4101022009	1	1.000	0.500	0.700	1.000	SP ACCEL G	INTERFERENCE BETWEEN MOVING PARTS WITHIN UNIT
5	3201041907	1	1.500	2.000	2.500	7.000	SP ACCEL G	BINDING OF CONTROL RODS
6	3201041907	1	1.500	2.000	3.000	10.000	SP ACCEL G	DEFORMATION OF GUIDE TUBES
7	3201041907	1	1.500	3.000	4.000	12.000	SP ACCEL G	FAILURE OF CORE SUPPORT STRUCTURE
8	3201012005	1	1.500	0.330	0.360	0.450	SP ACCEL G	SLOW SCRAM TIME OF CONTROL RODS
9	3201012005	1	1.500	0.	2.000	0.	SP ACCEL G	LIFTING FUEL AND DISARRANGING CORE CONFIGURATION
10	3201012005	1	1.500	0.390	0.450	0.760	SP ACCEL G	PLASTIC DISTORTION PREVENTING FULL ROD INSERTION
11	3202071913	2	2.250	2.000	3.000	5.000	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS
12	3202071913	2	2.250	4.000	5.000	8.000	SP ACCEL G	BUCKLING OF SKIRT
13	3202061910	2	2.250	2.000	3.000	4.000	SP ACCEL G	CONNECTION BETWEEN SUP. LEG AND S.G. BODY FAILS
14	3202061910	2	2.250	3.000	4.000	5.000	SP ACCEL G	FAILURE OF S.G. LEG IMBEDMENT IN FLOOR
15	3202061910	2	2.250	3.000	4.000	5.000	SP ACCEL G	BUCKLING OF STEAM GENERATOR LEG
16	3202032004	2	2.250	4.950	6.000	6.750	SP ACCEL G	BUCKLING DUE TO HORIZONTAL ACCERELATION
17	3202032004	2	2.250	4.500	6.000	10.000	SP ACCEL G	STRESS INTENSITY AT VESSEL SUPPORT
18	3202032004	2	2.250	0.	0.	0.	NOZZ LOADS	NOZZLE RUPTURE
19	3202051909	2	2.250	3.000	4.000	6.000	SP ACCEL G	FAILURE OF SKIRT ANCHOR BOLTS
20	3202051909	2	2.250	4.000	5.000	8.000	SP ACCEL G	BUCKLING OF SKIRT
21	3202041908	2	2.250	3.000	4.000	5.000	SP ACCEL G	ATTACHED PIPE FAILURE DUE TO SUPPORT DEFORMATION
24	3202022002	2	1.500	3.000	5.000	7.000	FORCE	NOZZLES
25	3202022002	2	1.500	5.000	7.000	9.000	ACCEL	SUPPORTS
26	3202022002	2	1.500	7.000	10.000	13.000	SP ACCEL G	TUBING
27	3202011108	2	0.750	1.500	1.800	2.500	SP ACCEL G	RUPTURE AT PRIMARY INLET OR OUTLET NOZZLE
28	3202011108	2	0.750	4.500	6.000	7.500	SP ACCEL G	FAILURE OF TUBES IN BUNDLE
29	1303022601	3	0.750	2.000	3.000	4.000	SP ACCEL G	FAILURE AT WELDED JOINTS, ESPECIALLY AT NOZZLES
30	1303022601	3	0.750	2.000	3.000	4.000	SP ACCEL G	DUCTILE RUPTURE DUE TO HANGER/SNUBBER FAILURE
31	1303022601	3	0.750	3.000	4.000	5.000	SP ACCEL G	ELBOW COLLAPSE DUE TO EXCESSIVE FORCES
32	3203032006	3	3.000	3.000	4.000	5.000	%ALLOWABLE	PIPE SUPPORT RUPTURE OR COLLAPSE
33	3203032006	3	3.000	5.000	7.000	12.000	%ALLOWABLE	EXCESSIVE PIPE DEFORMATION
34	3203032006	3	3.000	7.000	10.000	15.000	%ALLOWABLE	OPENING A CRACK IN AN UNFLAWED PIPE
35	3203051914	3	1.500	2.000	3.000	4.000	SP ACCEL G	SUPPORT FAILURE
36	3203051914	3	1.500	5.000	8.000	12.000	SP ACCEL G	RUPTURE AT CONNECTIONS DUE TO PIPE OVERSTRESS
40	3203042012	3	2.400	0.	0.	0.	SP ACCEL G	PIPE YIELDING
41	3203042012	3	2.400	0.	0.	0.	SP ACCEL G	CRACK PROPAGATION RESULTING IN A SMALL LEAK
42	1303010502	3	0.750	1.500	3.000	4.000	ACCEL G	ANCHOR BOLT FAILURE
43	1303010502	3	3.000	3.000	5.000	6.000	ACCEL G	FAILURE AT CONNECTION OF SMALL AND LARGE PIPE
44	1303010502	3	3.000	4.000	7.000	8.000	ACCEL G	SUPPORT FAILURE CAUSING LARGE DISPLACEMENTS
45	1205060235	4	2.250	0.	0.	0.	SP ACCEL G	JOINT LEAKAGE
46	1205060235	4	2.250	0.	0.	0.	SP ACCEL G	PIPE SUPPORT RUPTURE
47	1205060235	4	2.250	0.	0.	0.	SP ACCEL G	PIPE FAILURE
48	3204032013	4	3.000	1.200	2.000	2.400	MOMENT CAP	YIELDING
49	3204032013	4	3.000	0.	0.	0.	SP ACCEL G	SMALL LEAK OR BRANCH CONNECTIONS BREAKING
50	3204032013	4	3.000	0.	0.	0.	SP ACCEL G	LARGE CRACK RESULTING IN LEAK OR SEVERANCE
51	3204041915	4	2.250	2.500	3.000	5.000	SP ACCEL G	RUPTURE AT NOZZLE CONN. DUE TO SUPPORT FAIL.
52	3204041915	4	2.250	4.000	5.000	7.000	SP ACCEL G	FAILURE OF PIPE SUPPORTS
53	3204041915	4	2.250	5.000	8.000	10.000	SP ACCEL G	OVERSTRESS OF PIPE
54	3204011109	4	2.250	1.500	1.800	2.500	MOMENT	RUPTURE AT NOZZLE/EQUIPMENT CONNECTIONS
55	3204020302	4	3.000	1.200	2.000	4.000	SP ACCEL G	FAILURE OF CONNECTION AT BUILDING INTERFACE
56	3204020302	4	3.000	2.400	4.000	8.000	SP ACCEL G	FAILURE OF FIELD WELDS
57	1204050236	5	2.250	0.	0.	0.	SP ACCEL G	JOINT LEAKAGE
58	1204050236	5	2.250	0.	0.	0.	SP ACCEL G	PIPE SUPPORT RUPTURE
59	1204050236	5	2.250	0.	0.	0.	SP ACCEL G	PIPE FAILURE
60	3205051916	5	2.250	2.000	3.000	4.000	SP ACCEL G	RUPTURE AT NOZZLE CONN. DUE TO COMPONENT FAIL.

OPNO	IDENT	CAT	WEIGHT	TEN	FIFTY	NINETY	PARAM	MODE
61	3205051916	5	2.250	3.000	4.000	6.000	SP ACCEL G	FAILURE OF PIPE SUPPORTS
62	3205051916	5	2.250	5.000	6.000	8.000	SP ACCEL G	OVERSTRESS OF PIPE
63	3205011110	5	0.750	1.500	1.800	2.500	MOMENT	MOMMENT AT NOZZLES
64	3205020303	5	3.000	1.200	2.000	4.000	%YLD MOMNT	FAILURE OF CONNECTION AT BUILDING INTERFACE
65	3205020303	5	3.000	2.400	4.000	8.000	%YLD MOMNT	FAILURE OF FIELD WELDS
66	3206022011	6	3.000	0.	0.	0.	SP ACCEL G	SMALL LEAK
67	3206022011	6	3.000	0.	0.	0.	SP ACCEL G	YIELDING
68	3205051916	6	2.250	2.000	3.000	4.000	SP ACCEL G	RUPTURE AT NOZZLE CONN. DUE TO SUPPORT FAIL.
69	3205051916	6	2.250	3.000	4.000	6.000	SP ACCEL G	FAILURE OF PIPE SUPPORTS
70	3205051916	6	2.250	5.000	6.000	8.000	SP ACCEL G	OVERSTRESS OF PIPE
71	3206010304	6	3.000	1.200	2.000	4.000	%YLD MOMNT	FAILURE OF CONNECTION AT BUILDING INTERFACE
72	3206010304	6	3.000	2.400	4.000	8.000	%YLD MOMNT	FAILURE OF FIELD WELDS
73	3207012010	7	2.250	0.	0.	0.	SP ACCEL G	PLASTIC DEFORMATION OF VESSEL NEAR SUPPORT LOC.
74	3207012010	7	3.000	1.500	2.400	12.000	%YLD MOMNT	SMALL LEAK IN VESSEL AT NOZZLE ATTACHMENT
75	3207021918	7	2.250	1.000	1.500	3.000	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
76	3207021918	7	2.250	1.500	2.000	5.000	SP ACCEL G	BUCKLING OF SUPPORT SKIRT OR LEGS
77	3208021917	8	1.500	1.500	2.000	3.000	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
78	3208021917	8	1.500	2.300	3.000	5.000	SP ACCEL G	BUCKLING OF TANK WALL
79	3208021917	8	1.500	3.750	5.000	8.000	SP ACCEL G	TENSILE RUPTURE OF TANK WALL
80	1208011905	8	0.750	0.	0.	0.	SP ACCEL G	GROSS STRUCTURAL BUCKLING
81	1208011905	8	0.750	0.	0.	0.	SP ACCEL G	LOCAL STRUCTURAL BUCKLING
82	1208011905	8	0.750	0.	0.	0.	SP ACCEL G	FATIGUE
83	3239011112	9	1.500	1.900	2.720	3.600	FLOOR AC G	SUPPORT SYSTEM FAILURE (BOLTS)
84	3209011111	9	1.500	4.000	6.000	8.000	FLOOR AC G	SUPPORT FAILURE (BOLTS)
85	3209021919	10	2.250	1.500	2.000	3.000	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
86	3209021919	10	2.250	2.500	3.000	4.500	SP ACCEL G	YIELDING OF SUPPORT SADDLES
87	3210021118	10	2.250	8.000	13.000	20.000	PK ACCEL G	STRUCTURAL FAILURE
89	3210031119	10	2.250	1.300	2.000	3.500	SP ACCEL G	SUPPORT FAILURE
90	3211010301	11	3.000	1.500	3.000	4.000	Z PD PK AC	FAILURE AT CONNECTION TO BUILDING INTERFACE
91	3211010301	11	3.000	2.500	4.000	8.000	Z PD PK AC	FAILURE AT COUPLING
92	3212011911	12	1.500	2.500	3.000	6.000	SP ACCEL G	FAILURE OF CONNECTION TO SUPPORT LEGS
93	3212011911	12	1.500	4.000	5.000	10.000	SP ACCEL G	BUCKLING OF SUPPORT LEG
94	3249011912	13	1.500	2.000	3.000	4.000	SP ACCEL G	RUPTURE OF CONNECTIONS TO SUPPORT STRUTS
95	3249011912	13	1.500	4.000	5.000	6.000	SP ACCEL G	TENSILE FAILURE OF SUPPORT STRUTS
96	3215011302	14	2.250	0.	0.500	0.	SP ACCEL G	FAILURE OF HOLD DOWN BOLTS
97	3215011302	14	2.250	0.	0.500	0.	SP ACCEL G	OVERSTRESS AT NOZZLE
98	3215011302	14	2.250	0.	2.000	0.	SP ACCEL G	ROTOR SEIZURE
99	3213011920	14	2.250	1.500	2.000	4.000	ACCEL G	RUPTURE OF ANCHOR BOLTS
100	3213011920	14	2.250	3.000	4.000	8.000	ACCEL G	RUPTURE OF VERTICAL INTAKE COLUMN
101	1248021403	14	2.250	1.500	2.000	2.500	SP ACCEL G	INTERNAL ROTOR SEIZURE
102	1248021403	14	2.250	2.000	2.500	3.000	SP ACCEL G	FAILURE OF SUPPORT STRUCTURE OR BOLTING
103	1248021403	14	2.250	0.	0.	0.	SP ACCEL G	INTERNAL SEIZURE DUE TO LOSS OF FLUID
104	1215041401	15	2.250	1.300	1.500	2.000	FORCE/MOMT	INTERNAL SEIZURE OF ROTOR
105	1215041401	15	2.250	1.500	2.000	2.500	FORCE/MOMT	FAILURE OF DRIVE SHAFT COUPLINGS
106	1215041401	15	2.250	2.000	2.500	3.000	FORCE/MOMT	BREAK OF HOLD DOWN BOLTS-SHEAR PINS
107	3215011302	15	3.000	0.	0.500	0.	SP ACCEL G	HOLD DOWN BOLTS BREAK
108	3215011302	15	3.000	0.	0.500	0.	SP ACCEL G	OVERSTRESS AT NOZZLE
109	3215011302	15	3.000	0.	2.000	0.	SP ACCEL G	ROTOR SEIZURE
110	1215051803	15	2.250	0.	0.	0.	SP ACCEL G	SYSTEM INLET, OUTLET NOZZLE CONNECTION
111	1215051803	15	2.250	0.	0.	0.	SP ACCEL G	ANCHOR BOLT LOOSENING
112	1215051803	15	3.000	0.	0.	0.	SP ACCEL G	MALFUNCTION OF SYSTEM VALVES
113	3217011116	16	3.000	50.000	80.000	120.000	SP ACCEL G	STRUCTURAL FAILURE
114	3216031116	16	3.000	5.000	15.000	40.000	SP ACCEL G	STRUCTURAL FAILURE
115	3216041117	16	3.000	8.000	20.000	40.000	SP ACCEL G	FAILURE OF STRUCTURAL MEMBERS
116	1316022602	16	3.000	9.000	12.000	18.000	SP ACCEL G	STEM AND BONNET FAILURE

OPNO	IDENT	CAT	WEIGHT	TEN	FIFTY	NINETY	PARAM	MODE
117	1116050201	16	3.000	8.250	10.500	13.500	SP ACCEL G	MECHANICAL BINDING OF THE VALVE
118	1316022602	16	3.000	15.000	18.000	24.000	SP ACCEL G	FUNCTIONAL FAILURE OF INTERNALS
119	3216031922	16	2.250	6.000	8.000	12.000	SP ACCEL G	DEFORMATION OF VALVE STEM OR YOKE
120	1217032001	16	3.000	9.000	15.000	18.000	SP ACCEL G	ACTUATOR COMPONENTS FAIL AND JAM
121	1116050201	16	3.000	7.500	9.000	12.000	SP ACCEL G	LOSS OF ELECTRICAL CONTROLS OR ELECTRICAL COMPONEN
122	1216091804	16	2.250	5.000	8.000	11.000	SP ACCEL G	LOSS OF CONTROL AIR
123	3216031922	16	2.250	8.000	10.000	15.000	SP ACCEL G	RUPTURE OF PIPE SUPPORT AT NOZZLE
124	1316022602	16	3.000	12.000	18.000	24.000	SP ACCEL G	BREAKS AT WELD ENDS
125	1217032001	16	3.000	9.000	15.000	18.000	SP ACCEL G	ELECTRICAL FAILURE IN ACTUATOR
126	1217032001	16	3.000	9.000	15.000	18.000	SP ACCEL G	FAILURE OF MAJOR ACTUATOR/VALVE COMPONENT
127	1116050201	16	0.750	6.750	7.500	12.000	SP ACCEL G	LOSS OF PIPE ANCHORAGE
128	3216011102	16	3.000	6.000	10.000	20.000	SP ACCEL G	FRACTURE OF ACTUATOR COVER AT VALVE BODY
129	3216011102	16	3.000	5.000	7.000	10.000	SP ACCEL G	FAILURE OF SPRING MECHANISM
130	1117020202	17	2.250	7.500	9.000	10.500	SP ACCEL G	DISC BECOMES DISENGAGED
131	1117020202	17	2.250	11.250	12.000	15.000	SP ACCEL G	DISC BECOMES BOUND
132	3118021106	18	3.000	10.000	12.000	15.000	SP ACCEL G	LEAKAGE
133	3118070403	18	3.000	6.600	7.800	10.800	SP ACCEL G	INTERNAL SEAT LEAKAGE
134	3118021106	18	3.000	12.000	15.000	20.000	SP ACCEL G	GAULING OF STEM
135	1218081802	18	1.500	6.000	7.500	8.500	SP ACCEL G	STEM BINDING
136	3218011101	18	3.000	15.000	30.000	50.000	SP ACCEL G	INTERNAL DAMAGE
137	1118050203	18	1.500	10.500	12.000	14.250	SP ACCEL G	MECHANICAL BINDING OF THE VALVE
138	3218041115	18	3.000	10.000	18.000	30.000	SP ACCEL G	STRUCTURAL FAILURE
139	3118021106	18	3.000	12.000	15.000	20.000	SP ACCEL G	STRUCTURAL FATIGUE AT NECK
140	1218062007	18	3.000	12.000	18.000	24.000	SP ACCEL G	TOP STRUCTURE OF VALVE
141	3218011101	18	3.000	20.000	50.000	100.000	SP ACCEL G	FRACTURE OF VALVE BODY
142	3118070403	18	3.000	9.000	10.200	12.000	SP ACCEL G	OPERATOR ACCESSORY MALFUNCTION
143	1118050203	18	1.500	10.500	12.000	13.500	SP ACCEL G	LOSS OF PIPE ANCHORAGE
144	1118050203	18	1.500	9.000	10.500	11.250	SP ACCEL G	LOSS OF VALVE CONTROLS
145	3218011101	18	3.000	8.000	10.000	20.000	SP ACCEL G	FAILURE OF VALVE ACTUATOR
146	3118070403	18	3.000	12.000	15.000	18.000	SP ACCEL G	OPERATOR MALFUNCTION
147	3219041921	19	1.500	8.000	12.000	20.000	SP ACCEL G	BINDING OF ROTATING PARTS
148	3219041921	19	1.500	15.000	20.000	30.000	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
149	4120042009	20	1.000	4.000	8.000	10.000	SP ACCEL G	CONNECTION BETWEEN CONTROL PANEL AND ENGINE
150	3220051923	20	0.750	3.000	5.000	8.000	ACCEL G	MALFUNCTION OF CONTROL SYSTEM
151	4120042009	20	1.000	4.000	8.000	10.000	SP ACCEL G	OIL LEVEL REGULATOR
153	3220011114	20	2.250	3.000	6.000	10.000	FLOOR AC G	ANCHOR BOLT FAILURE
154	3220011114	20	2.250	7.400	10.000	15.000	FLOOR AC G	CRANKSHAFT LOCK UP
155	3220051923	20	0.750	5.000	8.000	10.000	ACCEL G	RUPTURE OF ATTACHED OIL LINES
156	3221041923	21	2.250	1.500	2.000	4.000	ACCEL G	FAILURE OF BATTENS
157	3221041923	21	2.250	3.000	4.000	8.000	ACCEL G	LONGITUDINAL FAILURE OF FRAME
158	3121011902	21	3.000	15.000	20.000	30.000	ACCEL G	SUPPORT STAND FAILURE
159	3121011902	21	3.000	15.000	20.000	30.000	ACCEL G	CASE BREAKAGE DUE TO A BAD STAND
160	3121011902	21	3.000	25.000	30.000	35.000	ACCEL G	CASE BREAKAGE WITH GOOD STAND
161	1322050602	22	3.000	1.500	2.500	4.000	SP ACCEL G	SPURIOUS OPERATION OF A PROTECTIVE RELAY
162	1322050602	22	3.000	2.000	3.500	4.000	SP ACCEL G	STRUCTURAL FAILURE
163	4122082003	22	0.250	0.	2.000	0.	SP ACCEL G	CONTACT ALLIGNMENT
164	4122082008	22	1.000	2.000	2.000	4.000	SP ACCEL G	SUPPORT ANCHORAGE OF UNIT
165	1322040601	22	3.000	1.000	2.000	3.000	SP ACCEL G	SPURIOUS OPERATION OF A PROTECTIVE RELAY
166	1322040601	22	3.000	2.000	3.000	3.500	SP ACCEL G	STRUCTURAL FAILURE
167	3222011103	39	3.000	0.400	0.750	1.500	SP ACCEL G	FRACTURE OF PORCELAIN INSULATOR COLUMNS
168	3122031904	22	3.000	10.000	15.000	25.000	SP ACCEL G	CHATTER OF CONTACTS
169	3122031904	22	3.000	15.000	20.000	30.000	SP ACCEL G	STRUCTURAL ANCHORING OF CABINET BASE
170	3122031904	22	3.000	20.000	25.000	30.000	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENTS IN CABINET
171	1322060602	22	3.000	1.500	3.000	5.000	SP ACCEL G	SPURIOUS OPERATION OF A PROTECTIVE RELAY
172	1322060602	22	3.000	3.000	5.000	6.000	SP ACCEL G	STRUCTURAL FAILURE

OPNO	IDENT	CAT	WEIGHT	TEN	FIFTY	NINETY	PARAM	MODE
173	3223021105	39	1.500	0.400	0.600	1.000	SP ACCEL G	COOLER UNIT PIPE FAILURE AND OIL LOSS
174	3223021105	39	1.500	0.500	1.000	2.000	SP ACCEL G	INTERNAL STRUCTURAL FAILURE
175	3223021105	39	1.500	0.600	1.250	2.500	SP ACCEL G	FAILURE OF PORCELAIN HV BUSHINGS
176	3223051924	23	1.500	2.000	3.000	5.000	SP ACCEL G	RUPTURE OF ANCHOR BOLTS
177	3223051924	23	1.500	4.000	5.000	8.000	SP ACCEL G	FAILURE OF SUPPORT FRAME
178	3223051924	23	1.500	4.000	5.000	8.000	SP ACCEL G	ELECTRICAL MALFUNCTION
179	3219021113	24	1.500	4.000	6.000	10.000	FLOOR AC G	STRUCTURAL FAILURE
180	3226022003	26	3.000	1.500	2.000	3.000	FLOOR AC G	INSTRUMENT FAILURE
181	3226022003	26	3.000	3.000	5.000	8.000	FLOOR AC G	WELD FAILURE
182	1327022001	40	3.000	3.000	5.000	8.000	SP ACCEL G	RELAY CHATTER
183	3126011903	40	3.000	12.000	15.000	25.000	ACCEL G	CHATTER OF CONTACTS
184	SMAN000045	40	3.000	0.730	2.590	5.910	SP ACCEL G	
185	3127031901	27	3.000	12.000	20.000	30.000	ACCEL G	COMPONENT MALFUNCTION
186	SMAN000044	27	3.000	8.980	15.700	22.420	SP ACCEL G	
187	3125011903	27	3.000	20.000	25.000	35.000	ACCEL G	STRUCTURAL MOUNTING OF CABINETS
188	3126011903	27	3.000	20.000	25.000	30.000	ACCEL G	STRUCTURAL MOUNTING OF COMPONENTS
189	3130011107	30	3.000	6.000	10.000	12.000	SP ACCEL G	RELAY CHATTER
190	3130011107	30	3.000	8.000	10.000	15.000	SP ACCEL G	LOOSENING OF FASTENERS
191	3130011107	30	3.000	8.000	10.000	15.000	SP ACCEL G	BASE STRUCTURAL FATIGUE
192	3130020401	30	3.000	9.000	12.000	15.000	SP ACCEL G	SIGNAL DRIFT
193	3130020401	30	3.000	10.200	13.200	18.000	SP ACCEL G	CONTACT CHATTER
194	3130020401	30	3.000	10.800	18.000	24.000	SP ACCEL G	SET POINT DRIFT
198	3131011904	31	3.000	10.000	15.000	25.000	SP ACCEL G	CHATTER OF CONTACTS
199	3131011904	31	3.000	15.000	20.000	30.000	SP ACCEL G	STRUCTURAL ANCHORING OF CABINET BASE
200	3131011904	31	3.000	20.000	25.000	30.000	SP ACCEL G	STRUCTURAL MOUNTING OF COMPONENT IN CABINET
201	3133030402	33	3.000	7.200	9.000	12.000	SP ACCEL G	DISLODGING OF AIR DUCT BLANKING CLIPS
202	3236010305	36	3.000	1.200	2.000	3.500	SP ACCEL G	FAILURE AT CONNECTION TO BUILDING INTERFACE
203	3236010305	36	3.000	2.000	3.000	6.000	SP ACCEL G	FAILURE OF FIELD WELDS
204	3237020306	36	3.000	1.200	2.000	3.500	SP ACCEL G	FAILURE AT CONNECTION TO BUILDING INTERFACE
205	3237020306	36	3.000	2.000	3.000	6.000	SP ACCEL G	FAILURE OF FIELD WELDS
206	3236021925	36	1.500	2.000	3.000	5.000	SP ACCEL G	FAILURE OF SUPPORTS
207	3236021925	36	1.500	4.000	5.000	10.000	SP ACCEL G	RUPTURE OF PARTS BETWEEN SUPPORTS
208	2137051404	37	3.000	5.000	7.000	10.000	SP ACCEL G	CORNER TEARING
209	2137051404	37	3.000	8.000	10.000	16.000	SP ACCEL G	SUPPORT FAILURE
210	2137051404	37	3.000	8.000	10.000	16.000	SP ACCEL G	JOINT SEPARTION
211	3237061926	37	1.500	3.000	4.000	6.000	SP ACCEL G	SUPPORT FAILURE
212	3237061926	37	1.500	5.000	6.000	10.000	SP ACCEL G	RUPTURE OF DUCT BETWEEN SUPPORTS
213	3237021119	37	1.500	2.000	4.000	10.000	SP ACCEL G	JOINT SEPARTION
214	3237021119	37	1.500	2.500	5.000	12.000	SP ACCEL G	DUCT ANCHOR AND SUPPORT FAILURE
215	3237021119	37	1.500	5.000	10.000	15.000	SP ACCEL G	GROSS BENDING FIRM
216	6137041201	37	3.000	2.000	2.500	3.000	SP ACCEL G	CORNER CRIPPLING
217	6137041201	37	3.000	2.200	3.000	3.500	SP ACCEL G	DUCT SUPPORT FAILURE
218	6137041201	37	3.000	2.500	3.300	4.000	SP ACCEL G	DUCT RUPTURE
219	1337010501	38	0.750	1.200	1.500	1.800	LOADS	WELD FAILURE AT EMBEDMENT TO CLEVIS JUNCTURE
220	1337010501	38	0.750	1.600	2.000	2.800	LOADS	TENSILE FAILURE IN PISTON ROD
221	3222021104	39	3.000	0.180	0.250	0.500	SP ACCEL G	RUPTURE OF GASKET SEALS, VENTING OF CONDUCTING GAS
222	3222021104	39	3.000	0.250	0.300	0.600	SP ACCEL G	FRACTURE OF PORCELAIN INSULATION COLUMNS
223	1205040404	48	3.000	7.000	8.000	10.000	SP ACCEL G	PIPE DEFORMATION
224	4140011120	50	0.750	0.150	0.280	0.500	SP ACCEL G	DESTRUCTION OF SHEAR CONNECTION BETWEEN MODULES
225	SMAN000037	23	3.000	7.950	13.400	18.850	SP ACCEL G	STRUCTURAL FAILURE
226		49	3.000	0.400	0.580	0.750	SP ACCEL G	FRACTURE OF PORCELAIN INSULATION
227		49	3.000	0.110	0.250	0.280	SP ACCEL G	FRACT. OF PORCELAIN INSUL. (JAPANESE COMP.)

I. OPNOTES

Table OPNOTES contains additional information related to various expert opinions, such as the predominant frequencies related to the estimated spectral accelerations, limitations in the application of the estimates, etc. It consists of four columns as follows:

Column No.	Column name	Type	Contents
1	LINE	Integer	A reference line number.
2	IDENT	Character	A ten character code identifying the particular expert (see Table OPINION).
3	CAT	Integer	An integer identifying the generic category of component (see Table CATEGORY).
4	NOTE	Character	The notes pertinent to the identified expert opinion.

OPNOTES

LINE	IDENT	CAT	NOTE
1	3201031916	1	PREDOMINANT FREQUENCIES MODE #1,3HZ; MODE #2,3 HZ; AND MODE #3,5 HZ. PRECENTILES INCLUDE LOCA. PWR, ALL MODES. FUNCTIONAL FAILURE ALL MODES. FRAGILITY PARAMETER ACCELERATION AT CORE SUPPORT ATTACHMENT TO REACTOR VESSEL.
10	4101022009	1	PREDOMINANT FREQUENCY, 3-5 HZ; BWR, FUNCTIONAL FAILURE.
13	3201041907	1	ALL MODES: PREDOMINANT FREQUENCY MODES #1,3 HZ; MODES #2,3 HZ; MODES # 3,5 HZ. ALL MODES PRECENTILES INCLUDE LOCA. BWR, ALL MODES. FUNCTIONAL FAILURE ; ALL MODES ACCELERATION INDUCED DISPLACEMENTS
21	3201012005	1	PREDOMINANT FREQUENCY GIVEN FOR MODE #1 ONLY AND IT IS 4-10 HZ. BWR, ALL MODES. FUNCTIONAL FAILURE ALL MODES.
26	3202032004	2	POOL TYPE REACTOR VESSEL (LIQ. SODIUM) PREDOMINANT FREQUENCIES, MODE # 1-7 HZ MODE #2-7.5 HZ MODES #3--- PRESS. BOUND FAIL; ALL MODES.
32	3202051909	2	ALL MODES: PREDOMINANT FREQUENCIES, MARK II 9-15 HZ,MARK III 3-5 HZ. MARK II & III REFER TO GE BWR CONTAIN-MENTS PRESS BOUND FAIL. ALL MODES.
38	3202041908	2	PERCENTILES INCLUDE EFFECTS OF ALL LOCA. PREDOMINANT FREQUENCY 15 HZ. PRESS. BOUND. FAILURE.
42	3202071913	2	PRESSURIZER. BOTH MODES PREDOMINANT FREQUENCY, 7.0 HZ. PERCENTILES INCLUDE LOCA. PRESS, BOUND. FAIL; ALL MODES.
48	3202061910	2	STEAM GENERATOR . ALL MODES: PREDOMINANT FREQUENCY 7.5 HZ ALL MODES: VERTICAL DIRECTION ACCELERATION PRESS. BOUND. FAIL; ALL MODES.
54	3202022002	2	STEAM GENERATOR ALL MODES: PREDOMINANT FREQUENCIES:MODES # 1 10-30 HZ MODES # 2 RIGID MODES # 3 20-100 HZ. PRESS. BOUND. FAIL; ALL MODES.
60	3202011108	2	STEAM GENERATOR. BOTH MODES: PREDOMINANT FREQUENCY, 10-15 HZ. MODE #1 FACTORS TIME SY (SY FROM PRESS. BOUND. FAIL; ALL MODES.
66	1303022601	3	ALL MODES: PREDOMINANT FREQUENCY 25-50 HZ ALL PERCENTILES ARE FACTOR TIME SSE

LINE	IDENT	CAT	NOTE
			PRESS. BOUND. FAIL; ALL MODES.
70	3203032006	3	ALL MODES: PREDOMINANT FREQUENCY 5-25 HZ. BWR PIPING PRESS. BOUND. FAIL; ALL MODES. % OF ALLOWABLE PER ASME CODE SEC III EQ. 9
77	1303010502	3	PERCENTILES: FACTOR TIMES SSE PREDOMINANT FREQUENCIES MODES#1 AND #2, 8-30 HZ.; MODE #3, 2-5 HZ. PRESS. BOUND. FAIL; ALL MODES.
83	3204032013	4	FRAGILITY PARAMETER IS YIELD MOMENT PREDOMINANT FREQ. >2 HZ.
86	3204041915	4	ALL MODES: PREDOMINANT FREQUENCY, 4-8 HZ. PRESS. BOUND. FAIL; ALL MODES.
89	3204011109	4	PREDOMINANT FREQUENCY, 10-30 HZ. FRAGILITY PARAMETER IS YIELD MOMENT TIMES PERCENTILE FACTOR. PRESS. BOUND. FAIL; ALL MODES.
94	3204020302	4	PREDOMINANT FREQUENCY, ALL MODES 2-10 HZ. PRESS. BOUND. FAIL; ALL MODES. % OF YIELD MOMENT.
98	3205051916	5	ALL MODES: PREDOMINANT FREQUENCY, 4-10 HZ. PRESS. BOUND. FAIL; ALL MODES.
101	3205011110	5	PREDOMINANT FREQUENCY 10-30 HZ. PRESS. BOUND. FAIL; ALL MODES. PERCENTILES; FACTOR TIMES YIELD MOMENT.
105	3205020303	5	ALL MODES: PREDOMINANT FREQUENCY 2-10 HZ. PRESS. BOUND. FAIL; ALL MODES. % OF YIELD MOMENT.
109	3205051916	6	ALL MODES: PREDOMINANT FREQUENCY 4-10 HZ. PRESS. BOUND. FAIL; ALL MODES.
112	3206010304	6	ALL MODES: PREDOMINANT FREQUENCY 2-10 HZ. PRESS BOUNDS. FAIL; ALL MODES. % OF YIELD MOMENT.
116	3207012010	7	PREDOMINANT FREQUENCY MODE #1, 6 HZ. PERCENTILES: FACTOR TIMES YIELD MOMENT.
119	3207021918	7	ALL MODES: PREDOMINANT FREQUENCY 4-10 HZ.
121	3208021917	8	ALL MODES: PREDOMINANT FREQUENCY 3-8 HZ.
123	3239011112	9	PREDOMINANT FREQUENCY: 12 TO 20 HZ. DIESEL FUEL TANK.
126	3209011111	9	PREDOMINANT FREQUENCY: GREATER THEN 12 HZ.
128	3209021919	10	BOTH MODES: PREDOMINANT FREQUENCY 15-30 HZ. HORIZONTAL TANK AND HEAT EXCHANGERS.
131	3210021118	10	PREDOMINANT FREQUENCY: GREATER THEN 20 HZ. SMALL VESSELS.
134	3210031119	10	PREDOMINANT FREQUENCY: 25-45 HZ. SMALL MEDIUM HEAT EXCHANGERS.
137	3211010301	11	PERCENTILES IN TERMS OF PEAK GROUND ACCELERATION.
140	3212011911	12	BOTH MODES,PREDOMINANT FREQUENCIES: 4.5 HZ. PERCENTILES INCLUDE LOCA.
143	3249011912	13	PREDOMINANT FREQUENCY 4.5 HZ. ALL MODES.
145	3215011302	14	PERCENTILE: 50% OF Y. S. PERCENTILE: 50% OF Y. S. PERCENTILE: FACTOR TIMES SSE
149	3213011920	14	BOTH MODES: PREDOMINANT FREQUENCY, 3HZ.

LINE	IDENT	CAT	NOTE
			PERCENTILE 90 IS TENTATIVE
152	1248021403	14	PERCENTILE: FACTOR TIMES SSE PREDOMINANT FREQUENCY >33 HZ. FOR MODES #1 AND #2. FAILURE IN THIS MODE DEPENDS ON ASSOCIATED PIPING SYSTEM
158	1215041401	15	ALL MODES: PREDOMINANT FREQUENCY RIGID. PERCENTILES: FACTOR TIMES SSE SPECIFIED LOADS
162	3215011302	15	ALL MODES: FREQUENCIES, HORIZONTAL 33 HZ. VERTICAL 1-33 HZ. PERCENTAGES PERCENT OF NOZZLE LOADS. PERCENTILES FOR MODE #3: FACTOR TIMES SSE LOADS.
168	1217032001	16	ALL MODES. PREDOMINANT FREQUENCY RIGID. BALL VALVE WITH ACTUATOR AND LOGIC CABINET
172	3216031116	16	PREDOMINANT FREQUENCY > 15HZ. TO RIGID.
175	3217011116	16	PREDOMINANT FREQUENCY, RIGID.
177	3216041117	16	PREDOMINANT FREQUENCY > 20 HZ.
179	1116050201	16	GATE AND GLOBE VALVES. PREDOMINANT FREQUENCY: MODE #1 ABOVE 33 HZ.; MODE #2 8-20 HZ. MODE #3 ABOVE 27 HZ.
184	1316022602	16	PREDOMINANT FREQUENCY: MODE #1, 10-20 HZ. MODE #2, 30-50 HZ. MODE #3, 30-50HZ.
189	3216031922	16	ALL MODES: PREDOMINANT FREQUENCIES 2-10 HZ.
192	1216091804	16	BUTTERFLY VALVE PREDOMINANT FREQUENCY: RIGID.
195	3216011102	16	PREDOMINANT FREQUENCY: MODE #1 VALVE ACTUATOR 27.7 HZ. MODE " SPRING MECHANISM 10-12 HZ. RUGGLES KLINGEMAN TRIP VALVE.
200	1117020202	17	PREDOMINANT FREQUENCIES BOTH MODES: RIGID
205	3118021106	18	PREDOMINANT FREQUENCIES ARE 20-30 HZ. DAMPING IS 5%
208	1118050203	18	AVERAGE CAPACITY 8-10 G'S. PREDOMINANT FREQUENCY: RIGID ALL MODES. GATE, GLONE AND CHECK VALVES.
213	3218041115	18	PREDOMINANT FREQUENCIES ARE >20 HZ. TO RIGID
216	3218011101	18	PREDOMINANT FREQUENCIES ARE MODE #1 25-50 HZ. MODE #2 > 50 HZ. MODE #3 > 50 HZ.
221	3118070403	18	PREDOMINANT FREQUENCIES MODE #1 12 TO 15 HZ. MODE #2 17 TO 21 HZ. MODE #3 27 TO 35 HZ.

LINE	IDENT	CAT	NOTE
226	1218081802	18	PREDOMINANT FREQUENCY IS > 40 HZ. TO 140 HZ. GLOBE VALUE
230	3219041921	19	PREDOMINANT FREQUENCIES ARE > 33 HZ.
233	4120042009	20	PREDOMINANT RESPONSE FREQUENCIES: 1ST MODE 7.0 TO 20.6 HZ. 2ND MODE 8.3 TO 13.8 HZ. DIESEL GENERATORS.
238	3220051923	20	PREDOMINANT RESPONSE FREQUENCIES: >15 HZ. DIESEL GENERATORS.
241	3220011114	20	PREDOMINANT RESPONSE FREQUENCIES: 15 HZ. DIESEL GENERATORS.
244	3221041923	21	PREDOMINANT FREQUENCY IS >25 HZ. BATTERY RACKS
247	3121011902	21	PREDOMINANT FREQUENCY >15 HZ. DC POWER BATTERIES.
250	1322050602	22	FREQUENCIES: SIDE TO SIDE = 6-11 HZ. FRONT TO BACK = 16-20 HZ. VERTICAL = >30 HZ. 26" WIDE METALCLAD SWITCHGEAR.
0	4122082008	22	FREQUENCY: HORIZONAL = 5.6 HZ. 10.6 HZ. 16.5 HZ. (X) AND 7.8 HZ. 22.9 HZ. (Y) VERTICAL =RIGID.
5	1322040601	22	36" WIDE METALCLAD SWITCHGEAR.
7	3222011103	39	FREQUENCIES: 1ST MODE = 1.5-4.0 HZ. 2ND MODE = 4.5-8.0 HZ.
10	3122031904	22	PREDOMINANT FREQUENCIES FOR ALL MODES >15 HZ. RESPONSE IS WITH DAMPING OF 5 %
14	1322060602	22	POWER VAC METALCLAD SWITCHGEAR. PREDOMINANT FREQUENCIES SIDE TO SIDE = 6 - 11 HZ. FRONT TO BACK = 16 - 20 HZ. VERTICAL = > 30 HZ.
20	3223021105	39	FRAGILITY PARAMETER AT FLOOR TO TRANSFORMER INTERFACE PREDOMINANT FREQUENCIES: COOLER UNIT: 7.5, 7.7 HZ. INTERNAL STRUCTURE: 7.2, 7.6 HZ. HV PORCELAIN: 8.1, 10.8 HZ.
27	3223051924	23	PREDOMINANT FREQUENCY FOR ALL MODES: >10 HZ.
30	3219021113	24	PREDOMINANT RESPONSE FREQUENCY IS 21 HZ. HVAC FANS.
33	3226022003	26	PREDOMINANT FREQUENCIES: MODE #1 RIGID MODE #2 11 HZ. PERCENTILES ARE FACTORS TIMES SSE. INSTRUMENT RACKS.
39	1327022001	27	PREDOMINANT RESPONSE FREQUENCY 20 TO 33 HZ.

LINE	IDENT	CAT	NOTE
42	3126011903	27	PREDOMINANT FREQUENCY FOR ALL MODES >12 HZ. THESE MODES OF FAILURE ALSO APPLY TO BREAKER PANELS, AUXILIARY RELAY PANELS, INSTRUMENT RACKS AND DIESEL GENERATORS.
50	3127031901	27	PREDOMINANT FREQUENCY IS >20 HZ. STRUCTURAL FAILURE UNLIKELY WITH MODERN DESIGN.
54	3130011107	30	~~PREDOMINANT~~ RESPONSE FREQUENCY IS 5 - 35 HZ DAMPING IS 5%. THIS APPLIES TO ALL FAILURE MODES.
59	3130020401	30	PREDOMINANT FREQUENCIES MODE #1 10-15 HZ. MODE #2 29-30 HZ. MODE #3 NOT GIVEN
65	3122031904	31	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
69	3131011904	31	DAMPING IS 5% FOR ALL MODES. PREDOMINANT FREQUENCY FOR ALL MODES >15 HZ.
77	3236010305	36	PREDOMINANT RESPONSE FREQUENCY IS 1-5 HZ. FOR ALL MODES PERCENTILES ARE PERCENTAGES OF DESIGN SSE SPECTRUM.
82	3237020306	36	PREDOMINANT RESPONSE FREQUENCY IS 1-5 HZ. FOR ALL MODES PERCENTILES ARE PERCENTAGES OF DESIGN SSE SPECTRUM.
87	3236021925	36	PREDOMINANT RESPONSE FREQUENCY IS 5-10 HZ. FOR ALL MODES.
90	2137051404	37	PREDOMINANT FREQUENCY FOR RESPONSE 8.5 - 11.0 HZ. DAMPING AT 7% HVAC DUCTS.
95	3237061926	37	PREDOMINANT FREQUENCY FOR RESPONSE 5 - 10 HZ. ALL MODES
98	3237021119	37	PREDOMINANT FREQUENCY FOR RESPONSE 10 HZ. ALL MODES.
101	6137041201	37	PREDOMINANT FREQUENCY FOR RESPONSE 15 - 20 HZ. ALL MODES. PERCENTILES: FACTOR TIMES SSE. A FRAGILITY CURVE WAS INCLUDED WITH THIS QUESTIONAIRE.
107	1337010501	38	THESE NUMBERS ARE THE MULTIPLICATIVE FACTOR OF THE UNIT RATED LOAD.
111	3222021104	39	IN-SITU TESTING. FRAGILITY PARAMETER AT CIRCUIT BREAKER FOOTING. THESE ARE SWITCHYARD CIRCUIT BREAKERS. TORSIONAL FAILURE. MODES OF

LINE	IDENT	CAT	NOTE
			VIBRATION: 1ST 2.4 - 3.4 HZ. 2ND 7.8 - 12.2 HZ. AIR BLAST CIRCUIT BREAKERS.
121	1205040404	48	THE TEST WERE NOT TAKEN TO FAILURE. PREDOMINANT FREQUENCIES: MODE #1 9.5 HZ. MODE #2 21.5 HZ.
127	4150011120	50	RESPONDENT INDICATED GOOD CONFIDENCE IN RESPONSE. PREDOMINANT FREQUENCY: 7 - 8 HZ.
131	BLANK	1	

J. PIPE

Table PIPE contains load scale factors for various pipe elements other than branches. (See Table BRANCH for branch elements.) It consists of nine columns as follows:

Column No.	Column name	Type	Contents
1	LINE	Integer	A reference line number.
2	SIZE	Floating	The nominal pipe diameter (in.).
3	SCHED	Character	The pipe schedule.
4	MAT	Character	Material: SS = Stainless Steel, CS = Carbon Steel
5	TEMP	Floating	Temperature (^{o}F).
6	ELBOW	Floating	Scale factor for elbow.
7	MITER	Floating	Scale factor for miter joint.
8	RUN	Floating	Scale factor for pipe run.
9	WELD	Floating	Scale factor for butt weld.

PIPE

LINE	SIZE	SCHED	MAT	TEMP	ELBOW	MITER	RUN	WELD
1	0.50	160	SS	300.	492.00	0.	298.00	480.00
2	0.75	160	SS	300.	259.00	0.	157.00	254.00
3	1.00	160	SS	300.	138.00	0.	83.50	135.00
4	2.00	160	SS	300.	27.70	0.	43.50	27.00
5	2.00	40	SS	500.	107.00	0.	37.50	60.40
6	3.00	160	CS	100.	4.80	0.	3.85	6.19
7	3.00	160	CS	140.	4.93	0.	3.96	6.39
8	3.00	160	SS	300.	9.85	0.	5.95	9.62
9	3.00	160	CS	556.	6.24	0.	4.99	8.05
10	4.00	40S	SS	200.	15.81	0.	5.12	8.25
11	4.00	40S	SS	300.	17.65	0.	5.69	9.19
12	4.00	40S	SS	500.	20.54	0.	6.60	10.63
13	4.00	140	CS	140.	3.35	0.	2.26	3.63
14	4.00	140	SS	300.	6.47	0.	3.27	5.27
15	4.00	140	SS	535.	7.72	0.	3.90	6.31
16	4.00	160	SS	300.	4.87	0.	2.83	4.57
17	4.00	160	SS	535.	5.97	0.	3.47	5.60
18	6.00	120	CS	100.	1.27	0.	0.76	1.24
19	6.00	40	CS	100.	3.77	0.	1.40	2.26
20	6.00	120	CS	140.	1.30	0.	0.79	1.27
21	6.00	160	CS	100.	0.86	0.	0.63	1.00
22	8.00	40	CS	100.	2.09	0.	0.71	1.15
23	8.00	40S	SS	200.	3.92	0.	0.99	1.60
24	8.00	40S	SS	300.	4.36	0.	1.11	1.78
25	8.00	40S	SS	350.	4.47	0.	1.13	1.73
26	8.00	40S	SS	400.	4.58	0.	1.16	1.87
27	8.00	40S	SS	500.	5.04	0.	1.28	2.05
28	8.00	140	SS	535.	1.16	0.	0.57	0.92
29	8.00	160	SS	535.	0.99	0.	0.54	0.87
30	8.00	160	SS	595.	1.03	0.	0.56	0.91
31	10.00	40	CS	100.	1.26	2.21	0.40	0.65
32	10.00	40S	SS	400.	2.74	0.	0.65	1.05
33	10.00	160	SS	535.	0.51	0.	0.27	0.44
34	12.00	SW	CS	100.	0.95	0.	0.27	0.44
35	12.00	40S	SS	200.	1.78	0.	0.38	0.62
36	12.00	40S	SS	300.	1.98	0.	0.43	0.69
37	12.00	40S	SS	500.	2.30	0.	0.50	0.80
38	12.00	40	SS	400.	1.83	0.	0.42	0.67
39	14.00	TN=.375	CS	100.	0.84	1.47	0.23	0.37
40	14.00	40	CS	100.	0.64	0.	0.20	0.31
41	14.00	40	SS	400.	1.42	0.	0.32	0.52
42	14.00	160	SS	400.	0.23	0.	0.12	0.19
43	14.00	160	SS	595.	0.26	0.	0.13	0.21
44	16.00	120	CS	140.	0.11	0.	0.06	0.10
45	16.00	120	CS	556.	0.14	0.	0.08	0.12
46	18.00	SW	CS	100.	0.59	0.	0.14	0.22
47	18.00	SW	SS	200.	1.11	0.	0.19	0.30
48	18.00	SW	SS	300.	1.24	0.	0.21	0.34
49	18.00	SW	SS	500.	1.43	0.	0.24	0.39
50	18.00	40	SS	400.	0.67	0.	0.15	0.24
51	20.00	SW	CS	100.	0.52	0.	0.11	0.18
52	20.00	SW	SS	200.	0.97	0.	0.15	0.25
53	20.00	SW	SS	300.	1.07	0.	0.17	0.27
54	20.00	SW	SS	500.	1.24	0.	0.20	0.32
55	20.00	TN = .5	CS	100.	0.32	0.	0.08	0.13

LINE	SIZE	SCHED	MAT	TEMP	ELBOW	MITER	RUN	WELD
56	24.00	SW	CS	100.	0.40	0.	0.08	0.12
57	27.50	TN =2.38	SS	535.	0.03	0.	0.01	0.02
58	29.00	TN = 2.5	SS	595.	0.03	0.	0.01	0.02
59	30.00	TN = .5	CS	100.	0.18	0.	0.04	0.06
60	31.00	TN=2.66	SS	530.	0.02	0.	0.01	0.02
61	36.00	TN = .5	CS	100.	0.	0.26	0.03	0.04
62	48.00	TN=.625	CS	100.	0.	0.12	0.01	0.02

K. RESULTS

Table RESULTS contains the descriptions of the fragility data for generic categories which result from certain groupings and subsequent reduction of expert opinions and other data as computed by program FRAGSTAT. It consists of eight columns of data as follows:

Column No.	Column name	Type	Contents
1	RESNO	Character	An identifying code unique to this particular set of data.
2	CATNO	Floating	A floating point number unique to a particular description of generic category or component description (see Table CATEGORY).
3	NMEAN	Floating	The statistical mean of the data assuming normal distribution.
4	NSIGMA	Floating	The standard deviation of the data assuming normal distribution.
5	LNMEAN	Floating	The statistical mean of the natural logs of the data (i.e., assuming lognormal distribution).
6	LNSIGMA	Floating	The standard deviation of the natural logs of the data (i.e., assuming lognormal distribution).
7	MEDIAN	Floating	The median of the data assuming lognormal distributions.
8	BETA	Floating	Same as LNSIGMA, repeated for convenience in data extraction.

RESULTS

RESNO	CATNO	NMEAN	NSIGMA	LNMEAN	LNSIGMA	MEDIAN	BETA
RES01A	1.0	1.578	2.848	0.721	0.396	2.056	0.396
RES02A	2.1	3.835	1.168	1.344	0.230	3.833	0.230
RES02B	2.2	3.197	1.176	1.106	0.333	3.022	0.333
RES02C	2.3	1.933	0.423	0.637	0.208	1.890	0.208
RES02D	2.3	5.000	1.562	1.551	0.339	4.718	0.339
RES02E	2.3	2.424	0.991	0.894	0.263	2.445	0.263
RES03A	3.0	220.000	89.140	5.310	0.406	201.000	0.406
RES04A	4.0	220.000	89.140	5.310	0.406	201.000	0.406
RES05A	5.0	220.000	89.140	5.310	0.406	201.000	0.406
RES06A	6.0	220.000	89.140	5.310	0.406	201.000	0.406
RES07A	7.0	1.515	0.928	0.378	0.399	1.459	0.399
RES08A	8.0	2.038	0.619	0.700	0.254	2.013	0.254
RES09A	9.0	4.370	2.645	1.364	0.609	3.910	0.609
RES10A	10.0	1.908	0.668	0.610	0.275	1.841	0.275
RES11A	11.0	220.000	89.140	5.310	0.406	201.000	0.406
RES12A	12.0	2.626	1.150	0.971	0.336	2.640	0.336
RES13A	13.0	2.995	0.766	1.054	0.269	2.868	0.269
RES14A	14.0	2.300	1.154	0.792	0.387	2.207	0.387
RES15A	15.0	4.464	1.369	1.462	0.340	4.315	0.340
RES15B	15.0	3.186	0.886	1.158	0.337	3.185	0.337
RES16A	16.0	4.892	2.081	1.575	0.317	4.829	0.317
RES16B	16.0	8.000	2.347	2.029	0.315	7.606	0.315
RES17A	17.0	8.960	1.200	2.190	0.130	8.900	0.130
RES18A	18.0	11.193	16.768	2.523	0.544	12.466	0.544
RES19A	19.0	12.598	4.613	2.472	0.325	12.078	0.325
RES20A	20.0	0.658	0.228	-0.430	0.330	0.651	0.330
RES21A	21.0	2.486	1.169	0.827	0.418	2.287	0.418
RES22A	22.0	2.610	1.240	0.846	0.486	2.330	0.486
RES23A	23.0	2.800	1.480	1.020	0.327	2.780	0.327
RES24A	24.0	2.288	0.766	0.806	0.337	2.238	0.337
RES26A	26.0	1.631	1.107	0.141	0.759	1.151	0.759
RES27A	27.0	13.550	6.430	2.440	0.499	11.460	0.499
RES30A	30.0	7.747	1.937	2.039	0.203	7.683	0.203
RES31A	31.0	15.228	5.105	2.662	0.291	14.331	0.291
RES33A	33.0	9.400	1.938	2.219	0.201	9.196	0.201
RES36A	36.0	2.290	1.014	0.802	0.392	2.229	0.392
RES37A	37.0	4.322	2.578	1.378	0.407	3.966	0.407
RES39A	39.0	0.285	0.214	-1.210	0.416	0.298	0.416
RES40A	40.0	5.700	5.770	1.380	0.893	3.990	0.893
RES41A	41.0	8.500	4.950	2.030	0.710	7.630	0.710
RES48A	48.0	8.333	1.241	2.109	0.144	8.243	0.144
RES49A	49.0	0.395	0.282	-1.102	0.807	0.332	0.807
RES50A	50.0	0.310	0.142	-1.288	0.471	0.276	0.471

L. SMADATA

Table SMADATA contains fragility information derived from data presented in Ref. 4. The calculation of the values in this table is discussed in Sec. 3.2. It consists of eight columns as follows:

Column No.	Column name	Type	Contents
1	SMANO	Integer	A unique number assigned to each set of data in the table.
2	CATNO	Floating	A floating point number unique to a particular category of component (see Table CATEGORY).
3	CAT	Integer	An integer unique to a class of generic components (see Table CATEGORY).
4	NMEAN	Floating	The statistical mean of the data assuming normal distribution.
5	NSIGMA	Floating	The standard deviation of the data assuming normal distribution.
6	LNEAN	Floating	The statistical mean of the natural logs of the data (i.e., assuming lognormal distribution).
7	LNSIGMA	Floating	The standard deviation of the natural logs of the data (i.e., assuming lognormal distribution).
8	PARAM	Character	The fragility parameter.

SMADATA

GRPNO	CATNO	CAT	NMEAN	NSIGMA	LNMEAN	LNSIGMA	PARAM
SMA01	1.0	1	2.75	0.81	1.01	0.37	SP ACCEL G
SMA02	1.1	1	6.00	1.65	1.79	0.34	SP ACCEL G
SMA04	2.3	2	3.30	1.75	1.19	0.44	SP ACCEL G
SMA05	2.2	2	2.00	0.62	0.69	0.40	SP ACCEL G
SMA06	7.0	7	21.90	6.95	3.09	0.41	SP ACCEL G
SMA07	7.0	7	7.90	3.00	2.07	0.52	SP ACCEL G
SMA08	8.0	8	8.28	0.25	-0.19	0.39	PK GD AC G
SMA09	8.0	8	3.60	1.20	1.28	0.44	PK GD AC G
SMA10	10.0	10	7.95	3.32	2.07	0.60	SP ACCEL G
SMA11	10.0	10	7.20	2.72	1.97	0.52	PK ACCEL G
SMA12	11.0	11	1.40	0.59	0.34	0.60	PK GD AC G
SMA13	11.0	11	1.40	0.59	0.34	0.60	PK GD AC G
SMA14	12.0	12	3.30	1.11	1.19	0.44	SP ACCEL G
SMA15	13.0	13	3.48	0.96	1.25	0.34	SP ACCEL G
SMA16	15.0	15	3.20	0.88	1.16	0.34	SP ACCEL G
SMA17	15.0	15	11.70	3.79	2.46	0.42	SP ACCEL G
SMA18	15.0	15	4.66	1.50	1.54	0.41	Z PRD AC G
SMA19	15.0	15	7.19	1.68	1.97	0.28	Z PRD AC G
SMA20	15.0	15	8.22	2.15	2.11	0.32	Z PRD AC G
SMA21	15.0	15	39.60	9.97	3.68	0.30	Z PRD AC G
SMA22	15.0	15	32.50	10.33	3.48	0.41	Z PRD AC G
SMA23	16.0	16	7.56	3.32	2.02	0.65	PK ACCEL G
SMA24	16.1	16	7.30	2.06	1.99	0.35	Z PD PK AC
SMA25	16.0	16	43.80	15.40	3.78	0.47	Z PD PK AC
SMA26	17.0	17	47.50	16.90	3.86	0.47	Z PD PK AC
SMA27	18.2	18	47.50	16.70	3.86	0.47	Z PD PK AC
SMA28	20.0	20	0.93	0.27	-0.07	0.35	SP ACCEL G
SMA29	20.0	20	1.96	0.57	0.67	0.36	SP ACCEL G
SMA30	20.0	20	0.74	0.23	-0.31	0.40	SP ACCEL G
SMA31	20.0	20	8.91	3.50	2.19	0.55	SP ACCEL G
SMA32	21.0	21	17.10	6.18	2.84	0.48	SP ACCEL G
SMA33	21.0	21	5.25	1.60	1.66	0.39	SP ACCEL G
SMA34	22.0	22	2.59	1.73	0.95	1.51	SP ACCEL G
SMA35	22.0	22	9.63	4.88	2.26	0.82	SP ACCEL G
SMA36	22.0	22	18.30	9.64	2.90	0.88	SP ACCEL G
SMA37	23.0	23	13.40	4.25	2.59	0.41	SP ACCEL G
SMA38	24.0	24	2.74	0.88	1.01	0.41	SP ACCEL G
SMA39	24.0	24	2.93	0.95	1.08	0.42	SP ACCEL G
SMA40	24.0	24	11.90	3.89	2.47	0.42	SP ACCEL G
SMA41	26.0	26	2.59	1.73	0.95	1.51	SP ACCEL G
SMA42	26.0	26	9.63	4.88	2.26	0.82	SP ACCEL G
SMA43	26.0	26	18.30	9.64	2.90	0.88	SP ACCEL G
SMA44	27.0	27	15.70	5.24	2.75	0.44	SP ACCEL G
SMA45	40.0	40	2.59	1.73	0.95	1.51	SP ACCEL G
SMA46	27.0	27	9.63	4.88	2.26	0.82	SP ACCEL G
SMA47	27.0	27	18.30	9.64	2.90	0.88	SP ACCEL G
SMA48	30.0	30	47.30	16.80	3.86	0.47	Z PRD AC G
SMA49	31.0	31	2.59	1.73	0.95	1.51	SP ACCEL G
SMA50	31.0	31	9.63	4.88	2.26	0.82	SP ACCEL G
SMA51	31.0	31	18.30	9.64	2.90	0.88	SP ACCEL G
SMA52	35.0	35	15.70	5.24	2.75	0.44	SP ACCEL G
SMA53	36.0	36	2.82	1.14	1.04	0.57	Z PD PK AC
SMA54	41.0	41	2.59	1.73	0.95	1.51	SP ACCEL G
SMA55	41.0	41	9.63	4.88	2.26	0.82	SP ACCEL G
SMA56	41.0	41	18.30	9.64	2.90	0.88	SP ACCEL G

GRPNO	CATNO	CAT	NMEAN	NSIGMA	LNMEAN	LNSIGMA	PARAM
SMA57	41.0	41	9.63	4.88	2.26	0.82	SP ACCEL G
SMA58	41.0	41	18.30	9.64	2.90	0.88	SP ACCEL G
SMA59	49.0	49	0.20	0.06	1.61	0.35	PK GD AC G
SMA60	17.0	17	9.84	5.56	2.29	0.65	Z PD PK AC
SMA61	28.0	28	8.50	4.95	2.03	0.71	SP ACCEL G
SMA62	31.0	31	8.50	4.95	2.03	0.71	SP ACCEL G
SMA63	49.0	49	0.20	0.06	-1.61	0.35	PK GD AC G

7.0 COMPUTER FILES

All of the files used in the data base and several useful data reduction and manipulation files have been grouped together into a file library in the LLNL Computer Center. This library permits easy storage, access, and maintenance of the files, and reduction or analysis of the data. Access information and explanations of the functions of the files in the library can be obtained from the SSMRP at LLNL.

8.0 REFERENCES

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