# LA-NUREG-6563-MS

Informal Report

Ì y`





NRC-8

LARC-1: A Los Alamos Release Calculation Program for Fission Product Transport in HTGRs During the LOFC Accident



UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACT W-7405-ENG. 36 This work was supported by the US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Division of Reactor Safety Research. .

k

Printed in the United States of America. Available from National Technical Information Service U.S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161 Price: Printed Copy \$6.75 Microfiche \$2.25

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Nuclear Regulatory Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

LA-NUREG-6563-MS Informal Report NRC-8



# LARC-1: A Los Alamos Release Calculation Program for Fission Product Transport in HTGRs During the LOFC Accident

by

Lucy M. Carruthers Clarence E. Lee



Manuscript completed: October 1976 issued: November 1976

Prepared for the US Nuclear Regulatory Commission Office of Nuclear Regulatory Research

## LARC-1: A LOS ALAMOS RELEASE CALCULATION PROGRAM FOR FISSION PRODUCT TRANSPORT IN HTGRS DURING THE LOFC ACCIDENT

by

Lucy M. Carruthers and Clarence E. Lee

#### ABSTRACT

The theoretical and numerical data base development of the LARC-1 code is described. Four analytical models of fission product release from an HTGR core during the LOFC accident are developed. Effects of diffusion, adsorption and evaporation of the metallics and precursors are neglected in this first LARC model. Comparison of the analytic models indicates that the constant release-renormalized model is adequate to describe the processes involved.

The numerical data base for release constants, temperature modeling, fission product release rates, coated fuel particle failure fraction and aged coated fuel particle failure fractions is discussed. Analytic fits and graphic displays for these data are given for the Ft. St. Vrain and GASSAR models.

I. INTRODUCTION

In early 1975, a simplified model of fission product release from an HTGR (High-Temperature Gas-Cooled Reactor) core during the LOFC (Loss of Forced Circulation) accident was proposed by John E. Foley.<sup>1</sup> This simplified model was based on the following assumptions:

- 1. The entire core is at a uniform temperature.
- 2. All coated particles fail at the same time.
- 3. Fission products are released only from failed particles (no release from intact particles).

4. The release rate of an isotope from the failed particles is given by the release constant from the SORS report<sup>2</sup>.

5. There is no buildup of the isotope from precursor decay.

In December 1975 we began developing the LARC code (Los Alamos Release Calculation) with the goal of calculating analytically the fission product transport of noble gases and metallics in an HTGR during the LOFC accident. We have systematically removed the assumptions of the simplified model. We have also studied the simple analytical models relative to more complex analytical models so as to judge the relative accuracy of the simple models used as a basis for extending the theory.

In this report we review the models developed to the present time, discuss the data base as developed thus far, and illustrate the workings of the LARC code with preliminary results. The current version, LARC-1, neglects the effects of diffusion, adsorption and evaporation of the metallics, and precursors.

The effects of precursors have been solved theoretically. A one-dimensional analytical diffusion model has been derived, but not implemented into this program. These topics will be addressed in subsequent reports.

In Section II we derive and discuss the analytical models: the Simplified Model, the Constant Release-Renormalized Model, the Linear Release Renormalized Model, and the Linear Failure Self-Consistent Model.

In Section III we review and discuss the data base used for the temperature modeling of the core, the fission product release rates for BISO and TRISO fuels from SORS and GASSAR, particle coating failure fraction, and the algorithm for computing the aged fuel failure fraction.

Section IV discusses and compares the results of release calculations for different isotopes. The relative accuracy of the models is compared with the conclusion that the Constant Release-Renormalized Model is justified for further theory extensions, for example for precursors and diffusion processes.

The results presented here are the culmination of about 700 short computer runs. The LARC-1 code runs on either the CDC-7600 in the BATCH mode or on the CDC-6600 in NOS (formally KRONOS) time-sharing system.

We would also like to acknowledge the usage of MACSYMA, Version 258 (Project MAC's Symbolic Manipulation System for symbolic integration, differentiation, limiting and pattern recognition) that was of great help in the verification of many of the results presented in Appendices A and B.

The programs LARC-1 and PLOTS are discussed and listed in Appendices C and D.

#### II. ANALYTICAL MODELS

# A. Simplified Model Equations - A Review

Using assumptions 1-5, the four Simplified model equations are given by

$$\frac{dN(t)}{dt} = -\Lambda_{1}(t)N(t), \quad 0 \le t \le \tau, \quad (1)$$

$$R(\tau) = \int_{0}^{\tau} r_{1}(s)N(s)ds, \qquad (2)$$

$$\frac{dN'(t)}{dt} = S(t) - \Lambda^{*}(t)N'(t), \quad 0 \le t \le \tau, \quad (3)$$

$$R'(\tau) = \int_{O} L(s)N'(s)ds, \qquad (4)$$

where

N(t) is the number of atoms of the isotope in the core  
at time t in the interval 
$$0 \le t \le \tau$$
,  
 $\Lambda_1(t) = \lambda + r_1(t)$ , and  $\lambda$  is the isotope decay constant,  
 $r_1(t)$  is the release constant for failed particles,

Supported by the Defense Advanced Research Projects Agency work order #2095, under Office of Naval Research Contract N00014-75C-0661.

- $R(\tau)$  is the amount of isotope released in the core during the time interval  $\tau$ ,
- N'(t) is the number of atoms of the isotope in the containment building at time t,
- R'( $\tau$ ) is the amount of the isotope released from the containment building during the time interval  $\tau$ ,
- $\Lambda^*(t) = \lambda + V(t) + L(t)$  is the total decay constant for the containment building,
- V(t) is the containment building cleanup rate,
- L(t) is the containment building leakage rate, and
- S(t) is the source rate to the containment building from the core.

In the Simplified model we assume that  $r_1(t)$ , V(t), and L(t) are constant in the time interval  $0 \le t \le \tau$ . We further assume that the source rate can be taken as a constant average, namely

$$S(t) = \frac{R(t)}{t}, \quad 0 \le t \le \tau$$
 (5)

which is valid if all the time steps are equal <u>and</u> small. In the other models we use

$$S(t) = \frac{dR(t)}{dt} , \qquad (6)$$

which avoids that assumption.

The solutions to Eqs. (1-4), using Eq. (5), are given by  

$$N(\tau) = N(0)e^{-\Lambda_{\perp}\tau}$$
, (7)

$$R(\tau) = \frac{r_1 N(0)}{\Lambda_1} (1 - e^{-\Lambda_1 \tau}), \qquad (8)$$

N'(
$$\tau$$
) = N'(0) $e^{-\Lambda^* \tau} + \frac{R(\tau)}{\tau\Lambda^*}$  (1 -  $e^{-\Lambda^* \tau}$ ), and (9)

$$R'(\tau) = \frac{L}{\Lambda^{*}} N'(0) (1 - e^{-\Lambda^{*}\tau}) + \frac{LR(\tau)}{\tau \Lambda^{*2}} [e^{-\Lambda^{*}\tau} - (1 + \Lambda^{*}\tau)]. (10)$$

In order to find the release after a number of time steps  $k\tau$ , the activity is accumulated according to

$$A(k\tau) = A[(k-1)\tau]e^{-\lambda\tau} + R(\tau) \text{ and } (11)$$

$$A'(k\tau) = A[(k-1)\tau]e^{-\lambda\tau} + R'(\tau)$$
 (12)

In addition, the values of N(t) and  $N'(\tau)$  at the end of a time step become the initial values N(0), N'(0), respectively, for the next time step.

The release rate,  $\bar{r_1}$ , the leakage rate, L, and the cleanup rate,  $\bar{v}$ , are determined by

$$\bar{r}_{1} = \frac{1}{2} [r(0) + r(\tau)], \qquad (13)$$

$$\overline{L} = \frac{1}{2} [L(0) + L(\tau)], \text{ and}$$
 (14)

$$\bar{V} = \frac{1}{2} [V(0) + V(\tau)] . \qquad (15)$$

Currently we use the values  $\overline{L}$  and  $\overline{V}$  for all time intervals. The decay constant is an input quantity.

#### B. Constant Release - Renormalized Model

Whereas in the Simplified model we treated only failed particle release, we now assume a constant release  $r_i$  for failed (i=1) and intact (i=2) particles. In addition we calculate the release from BISO and TRISO particles separately and sum the releases using  $X_{TOTAL} = a \cdot X_{BISO} + (1-a) \cdot X_{TRISO}$  where a = 0.6and X is a release, either R or R'. Then the differential equations corresponding to Eqs. (1-4) and (6) are

$$\frac{dN_{i}(t)}{dt} = -\Lambda_{i}(t)N_{i}(t), \qquad (16)$$

$$R_{i}(\tau) = \int_{0}^{\tau} r_{i}(s) N_{i}(s) ds , \qquad (17)$$

$$\frac{dN_{i}(t)}{dt} = S_{i}(t) - \Lambda^{*}N_{i}(t), \qquad (18)$$

$$R'_{i}(\tau) = \int_{0}^{\tau} L(s) N'_{i}(s) ds, \text{ and}$$
(19)

$$S_{i}(t) = \frac{dR_{i}(t)}{dt} = r_{i}(t)N_{i}(t).$$
 (20)

Integrating Eqs.(16-17), using Eqs.(2) and (13-15) we find

$$N_{i}(\tau) = e^{-\Lambda_{i}\tau} N_{i}(0), \qquad (21)$$

$$R_{i}(\tau) = \frac{\bar{r}_{i}}{\Lambda_{i}} (1 - e^{-\Lambda_{i}\tau}) N_{i}(0), \qquad (22)$$

$$N_{i}'(\tau) = \begin{cases} e^{-\Lambda^{*}\tau} N_{i}'(0) + \frac{\bar{r}_{i}}{\Lambda^{*}-\Lambda_{i}} (e^{-\Lambda_{i}\tau} - e^{-\Lambda^{*}\tau}) N_{i}(0) \text{ if } \Lambda^{*} \neq \Lambda_{i}, \\ e^{-\Lambda^{*}\tau} N_{i}'(0) + \bar{r}_{i}\tau e^{-\Lambda^{*}\tau} N_{i}(0) \text{ if } \Lambda^{*} = \Lambda_{i}, \end{cases}$$
(23)

$$R_{i}'(\tau) = \begin{cases} \frac{\overline{L}}{\Lambda^{*}} (1 - e^{-\Lambda^{*}\tau}) N_{i}'(0) + \frac{\overline{L}\overline{r}_{i}}{\Lambda^{*} - \Lambda_{i}} \frac{1}{\Lambda_{i}} \left[ (1 - e^{-\Lambda_{i}\tau}) - \frac{1}{\Lambda^{*}} (1 - e^{-\Lambda^{*}\tau}) \right] N_{i}(0) & \text{if } \Lambda^{*} \neq \Lambda_{i}, \\ - \frac{1}{\Lambda^{*}} (1 - e^{-\Lambda^{*}\tau}) N_{i}(0) + \frac{\overline{L}\overline{r}_{i}}{\Lambda^{*}2} \left[ 1 - (1 + \Lambda^{*}\tau) e^{-\Lambda^{*}\tau} \right] N_{i}(0) & \text{if } \Lambda^{*} = \Lambda_{i}, \end{cases}$$

$$(24)$$

where  $\Lambda_i \equiv \lambda + \bar{r}_i$  and  $\Lambda^* = \lambda + \bar{L} + \bar{V}$ . Since  $\bar{r}_i$  is given as a function of temperature and implicitly as a function of time, the limiting cases  $\Lambda^* = \Lambda_i$  are distinctly possible and must be accounted for.

In the Simplified model where we treated the release only from failed particles, using the final value for  $N(\tau)$  of a time step as the initial value, N(0), for the next time step was justified. However, from a study of the intact-failed transition (Section D) it became clear that matching the failed fraction (for BISO and TRISO) as a function of time is crucial. The failed fraction is defined as

$$F(t) = \frac{N_{1}(t)}{N_{1}(t) + N_{2}(t)}$$
 (25)

Assuming that we know F(t), which we do, then we want to adjust the ratio  $N_1/N_2$  while maintaining the constancy of the sum  $N_1$  +  $N_2$ . This renormalization of  $N_i(\tau)$  at the end of a time step to  $N_i(0)$  at the beginning of the next time step is accomplished by the transformation

$$F(\tau) [N_{1}(\tau) + N_{2}(\tau)] \rightarrow N_{1}(0)$$
  
[1 - F(\tau)] [N\_{1}(\tau) + N\_{2}(\tau)] \rightarrow N\_{2}(0), (26)

for both BISO and TRISO particles using the  $F(\tau)$  specific to each type. The failed fraction is a function of temperature which is a function of time and of core volume fraction. Thus F(t) is implicitly a function of time.

The quantities  $N_i(t)$ ,  $R_i(\tau)$ ,  $N_i(t)$ ,  $R_i(\tau)$  are calculated separately and then summed for BISO and TRISO particles, failed (1) and intact (2) particle coating release, and various core volume fractions.

Although we use the averaging given by Eq. (13) for the  $\bar{r}_i$ , we also tried time centering  $\bar{r}_i$  defined by

$$\bar{r}_{i} = r_{i}[T(\tau/2)].$$
 (27)

Those results were not in as good agreement as using Eq. (13) in parameter studies involving time steps and core volume fraction.

# C. Linear Release - Renormalized Model

In the Constant Release-Renormalized model we assumed that the release rate for failed and intact particles was given by

$$\bar{r}_{i} = \frac{1}{2} [r_{i}(0) + r_{i}(\tau)] \quad i=1,2, \qquad (28)$$

over the time interval  $\tau$ .

Now we approximate the release function of time over the time interval  $\tau$ , given by suppressing the subscript i)

$$r(t) = \sum_{k=1} [a_k + b_k(t-t_k)] [\theta(t-t_k) - \theta(t-t_{k+1})], \quad (29)$$

where  $\theta(x)$  is the Heaviside step-function defined by

$$\theta(\mathbf{x}) = \begin{cases} 1, \ \mathbf{x} > 0 \\ 0, \ \mathbf{x} \le 0 \end{cases}$$
(30)

Denoting

$$r_{k} = r[T(t_{k})]$$
  

$$\tau = t_{k+1} - t_{k}$$
(31)

we solve for the  $a_k$  and  $b_k$  in Eq. (29) to obtain

$$a_{k} = r_{k}$$
 and (32)  
 $b_{k} = (r_{k+1} - r_{k})/\tau$ .

Note that using Eq. (32) in (29), we obtain

$$r(t_{k} + \frac{1}{2}\tau) = \frac{1}{2}(r_{k} + r_{k+1}),$$
 (33)

which is equivalent to Eq. (28).

The same remarks concerning BISO and TRISO particles preceding Eq. (16) in the constant release model apply for the linear release model. The differential equations for the Linear Release-Renormalized model are

$$\frac{dN_{i}(t)}{dt} = -\Lambda_{i}(t)N_{i}(t), \qquad (34)$$

$$R_{i}(\tau) = \int_{0}^{\tau} r_{i}(s) N_{i}(s) ds , \qquad (35)$$

$$\frac{dN_{i}(t)}{dt} = S_{i}(t) - \Lambda^{*}N_{i}(t), \qquad (36)$$

$$R_{i}'(\tau) = \int_{\Omega}^{\tau} L(s)N_{i}(s)ds, \qquad (37)$$

$$S_{i}(t) = \frac{dR_{i}(t)}{dt} = r_{i}(t)N_{i}(t),$$
 (38)

$$\Lambda_{i}(t) = \lambda + r_{i}(t), \qquad (39)$$

$$r_{i}(s) = a_{i} + b_{i}s$$
,  $i = 1,2$  (40)

where  $a_i$  and  $b_i$  are determined for i = 1,2 (that is, failed and intact particles) over the time interval  $\tau$  using Eq. (32) as

$$a_{i} = r_{i}(0)$$
 and  
 $b_{i} = [r_{i}(\tau) - r_{i}(0)]/\tau.$  (41)

After solving Eqs. (34-38) we apply the same renormalization as discussed in the Constant Release-Renormalized model, namely Eq. (26).

The integration of Eqs. (34-38) is straightforward, using the methods developed in Appendices A and B, with the results that

$$N_{i}(\tau) = e^{-\overline{\Lambda}_{i}\tau} N_{i}(0), \qquad (42)$$

$$R_{i}(\tau) = [1-e^{-\overline{\Lambda}_{i}\tau} - \lambda P_{0}(\Lambda_{i},\beta,\tau)]N_{i}(0), \qquad (43)$$

$$N'_{i}(\tau) = e^{-\Lambda^{*}\tau}N'_{i}(0) + [(\bar{v} + \bar{L})P_{O}(\Lambda_{i} - \Lambda^{*}, \beta, \tau) + 1 - e^{-(\Lambda_{i} - \Lambda^{*})\tau}]e^{-\Lambda^{*}\tau}N_{i}(0), \quad (44)$$

$$R_{i}'(\tau) = \frac{\overline{L}}{\Lambda^{*}} (1 - e^{-\Lambda^{*}\tau}) N_{i}'(0) + \frac{\overline{L}}{\Lambda^{*}} [1 - e^{-\Lambda^{*}\tau} - \lambda P_{O}(\Lambda_{i}, \beta, \tau) + (\overline{v} + \overline{L}) e^{-\Lambda^{*}\tau} P_{O}(\Lambda_{i} - \Lambda^{*}, \beta, \tau)] N_{i}(0), \quad (45)$$

where

$$\overline{\Lambda}_{i} = \lambda + a_{i} + \frac{b_{i}\tau}{2} ,$$

$$\Lambda_{i} = \lambda + a_{i} , \qquad (46)$$

$$\beta = \frac{b_{i}}{2} ,$$

and

$$P_{k}(\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ s^{k} \ e^{-\gamma s - \beta s^{2}} = \left(-\frac{\partial}{\partial \gamma}\right)^{k} P_{0}(\gamma,\beta,\tau)$$
(47)

with

•

•

$$P_{O}(\gamma,\beta,\tau) = \frac{1}{2}\sqrt{\frac{\pi}{\beta}} e^{\gamma^{2}/4\beta} \left[ erf(\sqrt{\beta}\tau + \frac{\gamma}{2\sqrt{\beta}}) - erf(\frac{\gamma}{2\sqrt{\beta}}) \right]. \quad (48)$$

Various limiting forms of  $P_{_{O}}(\gamma,\beta,\tau)$  are derived in Appendix A where it is shown that

$$P_{O}(0,\beta,\tau) = \frac{1}{2} \sqrt{\frac{\pi}{\beta}} \quad \text{erf} \ (\sqrt{\beta\tau}) \quad \text{if} \ \gamma = 0, \ \beta \neq 0 \tag{49}$$

$$P_{0}(\gamma,0,\tau) = \frac{1}{\gamma}(1-e^{-\gamma\tau}) \quad \text{if } \gamma \neq 0, \ \beta = 0$$
(50)

and

$$P_{O}(0,0,\tau) = \tau \quad \text{if } \gamma = \beta = 0$$
 (51)

Also involved in the integration of Eqs. (34-38), and derived in Appendices A and B, are the integrals

$$P_{1}(\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ s \ e^{-\gamma s - \beta s^{2}} = -\frac{\gamma}{2\beta} P_{0}(\gamma,\beta,\tau) + \frac{1}{2\beta} (1 - e^{-\gamma \tau - \beta \tau^{2}}), \quad (52)$$

$$\int_{O}^{T} ds \ e^{-\Lambda^{*}s} \ P_{O}(\gamma,\beta,s) = \frac{1}{\Lambda^{*}} \left[ P_{O}(\Lambda^{*}+\gamma,\beta,\tau) - e^{-\Lambda^{*}\tau} P_{O}(\gamma,\beta,\tau) \right], (53)$$

and

$$\int_{O}^{\tau} ds \ e^{-\Lambda^{*}s} P_{1}(\gamma,\beta,s) = \frac{1}{2\beta\Lambda^{*}} \left[ -(\Lambda^{*}+\gamma) P_{O}(\Lambda^{*}+\gamma,\beta,\tau) + \gamma e^{-\Lambda^{*}\tau} P_{O}(\gamma,\beta,\tau) + 1 - e^{-\Lambda^{*}\tau} \right].$$
(54)

Using Eqs.(48-51), the various limiting forms may be written explicitly as

$$\frac{\gamma = \Lambda_{i} - \Lambda^{*}, \ \beta \neq 0}{N_{i}(\tau) = e^{-\Lambda^{*}\tau} N_{i}(0) + e^{-\Lambda^{*}\tau} [a_{i}P_{0}(0,\beta,\tau) + 1 - e^{-\beta\tau^{2}}]N_{i}(0)$$
(55)

$$R_{i}'(\tau) = \bar{L} \left\{ \frac{1 - e^{-\Lambda^{*}\tau}}{\Lambda^{*}} N_{i}'(0) + \frac{1}{\Lambda^{*}} \left[ (a_{i} - \Lambda^{*}) P_{o}(\Lambda^{*}, \beta, \tau) - a_{i} P_{o}(0, \beta, \tau) + 1 - e^{-\Lambda^{*}\tau} \right] N_{i}(0) \right\} .$$
(56)

$$\frac{\gamma = \Lambda_{i} - \Lambda^{*} \neq 0, \ \beta = 0}{N_{i}(\tau) = e^{-\Lambda^{*} \tau} N_{i}(0) + \frac{a_{i}}{\overline{\Lambda_{i}}} [1 - e^{-(\Lambda_{i} - \Lambda^{*})\tau}] e^{-\Lambda^{*} \tau} N_{i}(0)$$
(57)

$$R_{i}'(\tau) = \bar{L} \left\{ \frac{1 - e^{-\Lambda^{*}\tau}}{\Lambda^{*}} N_{i}'(0) + \frac{a_{i}}{\bar{\Lambda}_{i}} \left[ \frac{1}{\Lambda^{*}} (1 - e^{-\Lambda^{*}\tau}) - \frac{1}{\bar{\Lambda}_{i}} (1 - e^{-\bar{\Lambda}_{i}\tau}) \right] N_{i}(0) \right\}.$$
(58)

(59)

$$\frac{\gamma = \Lambda_{i} - \Lambda^{*} = 0, \ \beta = 0}{N_{i}(\tau) = e^{-\Lambda^{*} \tau} N_{i}(0) + a_{i} \tau e^{-\Lambda^{*} \tau} N_{i}(0)}$$

$$R'_{i}(\tau) = \bar{L} \left\{ \frac{1 - e^{-\Lambda^{*}\tau}}{\Lambda^{*}} N'_{i}(0) + \frac{a_{i}}{\Lambda^{*}2} \left[ 1 - (1 + \Lambda^{*}\tau) e^{-\Lambda^{*}\tau} \right] N_{i}(0) \right\}.$$
(60)

In the  $\beta = 0$  limit,  $a_i \rightarrow \bar{r}_i$  using Eq. (41), and Eq. (57) and Eq. (59) for  $N_i(\tau)$  and Eq. (58) and Eq. (60) for  $R_i(\tau)$  are seen to be identical with Eq. (23) and Eq. (24), respectively, for the Constant Release model described previously, as they should.

In terms of numerical evaluation it suffices to use the limiting forms for  $P_O(\gamma,\beta,\tau)$  given in Eqs. (48-51) in Eqs. (42-45) since there are no singularities.

## D. Intact - Failed Self-Consistent Fuel Transition

In order to investigate the accuracy of the simple renormalized intact-failed models, we now develop a self-consistent model for reference comparisons. We assume that the release rate, r(t), the containment building clean-up system removal rate, V(t), and the containment building leak rate, L(t), are constant over the time interval  $\tau$ . We assume that the failed fraction, F(t), is a linear function of time over the time interval  $\tau$ .

The transition of intact to failed fuel, including decay and release from failed (Eq.61) and intact (Eq.62) fuel particles can be represented by

$$\frac{dN_1}{dt} = -(\lambda + \bar{r}_1)N_1 + \dot{G}N_2 \quad (failed), \qquad (61)$$

$$\frac{dN_2}{dt} = -(\lambda + \bar{r}_2)N_2 - \dot{G}N_2 \quad (intact), \qquad (62)$$

where  $\lambda$  is the isotope decay constant and the  $\overline{r}_i$  are the release constants. We assume that the release constants are averaged

over the time interval  $\tau$  and are given by

$$\bar{r}_{i} \equiv \frac{1}{2} [r_{i}(0) + r_{i}(\tau)], \quad i = 1, 2.$$
 (63)

The transition rate,  $\dot{G}$ , in Eqs. (61) and (62), is determined from the definition of the failed fraction

$$F(t) \equiv \frac{N_1(t)}{N_1(t) + N_2(t)}$$
 (64)

Differentiating (  $\equiv \frac{d}{dt}$ ) Eq. (64), we obtain

$$\dot{F}(t) = [1 - F(t)] \frac{\dot{N}_{1}(t)}{N_{1}(t) + N_{2}(t)} - F(t) \frac{\dot{N}_{2}(t)}{N_{1}(t) + N_{2}(t)}, \quad (65)$$

where we have used Eq.(64). Defining

$$\Lambda_{i} = \lambda + \bar{r}_{i}, \quad i = 1,2 \tag{66}$$

and substituting Eqs(61) and (62) for  $\dot{N}_1(t)$  and  $\dot{N}_2(t)$  into Eq. (65), we find

$$\dot{\mathbf{F}}(t) = \mathbf{F}(t) [1 - \mathbf{F}(t)] (\Lambda_2 - \Lambda_1) + [1 - \mathbf{F}(t)] \dot{\mathbf{G}}$$
 (67)

Solving for  $\dot{G}(t)$  we obtain

$$\dot{G}(t) = \frac{\dot{F}(t)}{1 - F(t)} + (\Lambda_1 - \Lambda_2)F(t)$$
 (68)

Assuming that the failed fraction, F(t), is approximated as a linear function in the time interval  $\tau$ ,

$$F(t) = a + bt$$
,  $0 \le F(t) \le 1$  (69)

then

a = F(0)  
b = 
$$\frac{F(\tau) - F(0)}{\tau}$$
 (70)

and Eqs.(61) and (62) can be integrated, using Eq.(68) to give

$$N_{1}(\tau) = \sum_{k=0}^{3} A_{k} M_{k}(\tau)$$

and

$$N_{2}(\tau) = \sum_{k=4}^{5} A_{k} M_{k}(\tau),$$

where the functions  $\boldsymbol{M}_{k}^{}\left(\boldsymbol{\tau}\right)$  are defined as

$$M_{0}(\tau) = e^{-\Lambda_{1}\tau},$$

$$M_{k}(\tau) = e^{-\Lambda_{1}\tau} \int_{0}^{\tau} ds s^{k-1} e^{\alpha s - \beta s^{2}}, 1 \le k \le 3,$$

$$M_{4}(\tau) = e^{-\gamma \tau - \beta \tau^{2}}, \text{ and}$$

$$M_{5}(\tau) = \tau e^{-\gamma \tau - \beta \tau^{2}}.$$
(72)

The constants (in the time interval  $\tau)$   $\alpha,~\beta,~\gamma,$  and  $A_{\underset{\mbox{k}}{k}}$  are given by

•

$$\alpha = (\Lambda_1 - \Lambda_2) (1 - a),$$
  

$$\beta = (\Lambda_1 - \Lambda_2) b/2,$$
  

$$\gamma = \Lambda_1 a + \Lambda_2 (1 - a) = \Lambda_1 - \alpha,$$
(73)

and

(71)

$$A_{0} = N_{1}(0) ,$$

$$A_{1} = [b + (\Lambda_{1} - \Lambda_{2}) (1 - a)] \frac{N_{2}(0)}{1 - a} ,$$

$$A_{2} = (\Lambda_{1} - \Lambda_{2}) [b (1 - a) - ab] \frac{N_{2}(0)}{1 - a} ,$$

$$A_{3} = -(\Lambda_{1} - \Lambda_{2}) \frac{b^{2}N_{2}(0)}{1 - a} ,$$

$$A_{4} = N_{2}(0) , \text{ and}$$

$$(74)$$

$$A_5 = -\frac{bN_2(0)}{1-a}$$
.

The release from intact and failed particles is given by

$$R_{i}(\tau) = \int_{0}^{\tau} ds r_{i} N_{i}(s), i = 1, 2$$
 (75)

or

$$R_{1}(\tau) = \sum_{R=0}^{3} B_{k} \hat{P}_{k}(\tau)$$

$$R_{2}(\tau) = \sum_{R=4}^{5} B_{k} \hat{P}_{k}(\tau) , \qquad (76)$$

where the functions  $\hat{\bar{P}}_k^{}(\tau)$  are defined by

$$\hat{P}_{k}(\tau) = \int_{0}^{\tau} ds M_{k}(s)$$
(77)

and the constants  ${\ensuremath{\mathtt{B}_k}}$  are related to the  ${\ensuremath{\mathtt{A}_k}}$  's by

$$B_{k} = \bar{r}_{1} A_{k} \quad 0 \le k \le 3$$

$$B_{k} = \bar{r}_{2} A_{k} \quad k = 4,5.$$
(78)

The functions  $M_k(\tau)$  and  $\hat{P}_k(\tau)$  are derived explicitly in Appendix A. They are all expressible in terms of exponentials and combinations of exponentials with error functions. If we define the function  $P_O(\gamma,\beta,\tau)$ , c.f. Eq. (A-8), by

$$P_{O}(\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\gamma s - \beta s^{2}}$$
$$= \frac{1}{2} \sqrt{\frac{\pi}{\beta}} e^{\gamma^{2}/2\beta} \left[ erf(\sqrt{\beta}\tau + \frac{\gamma}{2\sqrt{\beta}}) - erf(\frac{\gamma}{2\sqrt{\beta}}) \right], \quad (79)$$

then by integration and differentiation [with respect to the parameters of  $P_0(\gamma,\beta,\tau)$ ], the  $M_k(\tau)$  functions for  $\beta \neq 0$  are given by

$$\begin{split} \mathsf{M}_{\mathsf{O}}(\Lambda_{1},\tau) &= e^{-\Lambda_{1}\tau} ,\\ \mathsf{M}_{1}(\Lambda_{1},\alpha,\beta,\tau) &= e^{-\Lambda_{1}\tau} \mathsf{P}_{\mathsf{O}}(-\alpha,\beta,\tau) ,\\ \mathsf{M}_{2}(\Lambda_{1},\alpha,\beta,\tau) &= \frac{e^{-\Lambda_{1}\tau}}{2\beta} \left[ \alpha \mathsf{P}_{\mathsf{O}}(-\alpha,\beta,\tau) + 1 - e^{\alpha\tau - \beta\tau^{2}} \right] ,\\ \mathsf{M}_{3}(\Lambda_{1},\alpha,\beta,\tau) &= \frac{e^{-\Lambda_{1}\tau}}{4\beta^{2}} \left[ (\alpha^{2} + 2\beta) \mathsf{P}_{\mathsf{O}}(-\alpha,\beta,\tau) + \alpha(1 - e^{\alpha\tau - \beta\tau^{2}}) \right] ,\\ \mathsf{M}_{4}(\gamma,\beta,\tau) &= e^{-\gamma\tau - \beta\tau^{2}} , \end{split}$$

and

$$M_{5}(\gamma,\beta,\tau) = \tau e^{-\gamma\tau - \beta\tau^{2}} .$$
(80)

The functions  $M_2(\tau)$  and  $M_3(\tau)$  are expressible as

$$M_{2}(\Lambda_{1},\alpha,\beta,\tau) = \frac{M_{0}(\Lambda_{1},\tau) - M_{4}(\Lambda_{1}-\alpha,\beta,\tau) + \alpha M_{1}(\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$
(81)

and

$$M_{3}(\Lambda_{1},\alpha,\beta,\tau) = \frac{M_{1}(\Lambda_{1},\alpha,\beta,\tau) - M_{5}(\Lambda_{1}-\alpha,\beta,\tau) + \alpha M_{2}(\Lambda_{1},\alpha,\beta,\tau)}{2\beta} . \quad (82)$$

The limiting forms are given in Appendix A. In particular we note that the integrals for  $M_2(\tau)$  and  $M_3(\tau)$  in the  $\beta = 0$  limit are finite and independent of  $\beta$ . The contribution from  $A_k M_k(\tau)$ , k = 2,3, is therefore zero since  $A_2$  and  $A_3$  have a factor of  $\beta$  in them.

Similarly, integration of Eq. (77), using Eq. (80), as derived in Appendix A, yields for the  $\hat{P}_k(\tau)$  functions the results

$$\hat{P}_{o}(\Lambda_{1},\tau) = \frac{1}{\Lambda_{1}} (1-e^{-\Lambda_{1}\tau}),$$

$$\hat{P}_{1}(\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{\Lambda_{1}} [P_{o}(\Lambda_{1}-\alpha,\beta,\tau)-e^{-\Lambda_{1}\tau} P_{o}(-\alpha,\beta,\tau)],$$

$$\hat{P}_{2}(\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{2\beta\Lambda_{1}} \left[ (\Lambda_{1}-\alpha)P_{o}(\Lambda_{1}-\alpha,\beta,\tau)+\alpha e^{-\Lambda_{1}\tau} P_{o}(-\alpha,\beta,\tau) \right],$$

$$\hat{P}_{3}(\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{4\beta^{2}} \left\{ -\frac{(2\beta+(\Lambda_{1}-\alpha)^{2})}{\Lambda_{1}} P_{o}(\Lambda_{1}-\alpha,\beta,\tau) + \frac{(-2\beta+\Lambda_{1}^{2})}{\Lambda_{1}} e^{-\Lambda_{1}\tau} \right\}$$

$$P_{o}(-\alpha,\beta,\tau) + (1-e^{-\beta\tau^{2}-(\Lambda_{1}-\alpha)\tau}) - \frac{\alpha}{\Lambda_{1}} (1-e^{-\Lambda_{1}\tau}) \right\}$$

$$\hat{P}_{4}(\gamma,\beta,\tau) = P_{0}(\gamma,\beta,\tau), \text{ and}$$

$$\hat{P}_{5}(\gamma,\beta,\tau) = -\frac{\gamma}{2\beta} P_{0}(\gamma,\beta,\tau) + \frac{1}{2\beta} (1 - e^{-\gamma\tau - \beta\tau^{2}}), \quad (83)$$

where the limiting forms for  $\hat{P}_{k}(\tau)$  are given in Appendix A. The functions  $\hat{P}_{k}(\tau)$  are expressible as

$$\begin{split} \hat{\mathbf{P}}_{o}(\Lambda_{1},\tau) &= \frac{1-M_{o}(\Lambda_{1},\tau)}{\Lambda_{1}} , \\ \hat{\mathbf{P}}_{1}(\Lambda_{1},\alpha,\beta,\tau) &= \frac{\hat{\mathbf{P}}_{4}(\Lambda_{1}-\alpha,\beta,\tau) - M_{1}(\Lambda_{1},\alpha,\beta,\tau)}{\Lambda_{1}} , \\ \hat{\mathbf{P}}_{2}(\Lambda_{1},\alpha,\beta,\tau) &= \frac{\hat{\mathbf{P}}_{o}(\Lambda_{1},\tau) - \hat{\mathbf{P}}_{4}(\Lambda_{1}-\alpha,\beta,\tau) + \alpha \hat{\mathbf{P}}_{1}(\Lambda_{1},\alpha,\beta,\tau)}{2\beta} , \\ \hat{\mathbf{P}}_{3}(\Lambda_{1},\alpha,\beta,\tau) &= \frac{\hat{\mathbf{P}}_{1}(\Lambda_{1},\alpha,\beta,\tau) - \hat{\mathbf{P}}_{5}(\Lambda_{1}-\alpha,\beta,\tau) + \alpha \mathbf{P}_{2}(\Lambda_{1},\alpha,\beta,\tau)}{2\beta} , \end{split}$$

$$P_{4}(\gamma,\beta,\tau) = P_{0}(\gamma,\beta,\tau) , \text{ and}$$

$$\hat{P}_{5}(\gamma,\beta,\tau) = \frac{1 - \gamma P_{4}(\gamma,\beta,\tau) - M_{4}(\gamma,\beta,\tau)}{2\beta} .$$
(84)

In particular we note that the integrals for  $\hat{P}_2(\tau)$ ,  $\hat{P}_3(\tau)$ , and  $\hat{P}_5(\tau)$  in the  $\beta = 0$  limit are finite and independent of  $\beta$ . The contribution from  $A_k \hat{P}_k(\tau)$  for k = 2,3, and 5 therefore vanishes for  $\beta = 0$ . The other limiting forms are automatically accounted for using Eq. (84) and the limiting forms for  $P_0(\gamma,\beta,\tau)$  given in Appendix A.

The number of isotope particles,  $N_i(t)$ , from failed or intact particles released in the containment building is governed by

$$\frac{dN_{i}}{dt} = S_{i}(t) - \Lambda^{*}N_{i}(t) , \qquad (85)$$

where the source,  $S_i(t)$ , is taken as the release rate from failed or intact particles,

$$S_{i}(t) = \frac{dR_{i}}{dt} = r_{i}N_{i}(t)$$
 (86)

The decay constant,  $\Lambda^*$ , is defined as

$$\Lambda^{*} = \lambda + \overline{V} + \overline{L} , \qquad (87)$$

where  $V(\tau)$  represents the containment building cleanup system removal rate and  $L(\tau)$  represents the containment building leakage rate. We assume averaged values over the time interval  $\tau$  and define

$$\overline{V} \equiv \frac{1}{2} [V(0) + V(\tau)]$$
 and  
 $\overline{L} \equiv \frac{1}{2} [L(0) + L(\tau)]$ .
(88)

The release from the containment building is given by

$$R_{i}'(\tau) = \int_{0}^{\tau} ds L(s)N_{i}'(s).$$
 (89)

(90)

Integrating Eqs. (85) and (89), using Eq. (86), we may express the solutions in the form

$$N'_{i}(\tau) = e^{-\Lambda^{*}\tau} N'_{i}(0) + \overline{r}_{i}e^{-\Lambda^{*}\tau} \int_{0}^{\tau} ds e^{\Lambda^{*}s} N_{i}(s)$$

and

$$R_{i}'(\tau) = \overline{L} \begin{bmatrix} \frac{(1-e^{-\Lambda^{*}\tau})}{\Lambda^{*}} N_{i}'(0) + \overline{r}_{i} \int ds \ e^{-\Lambda^{*}s} \int ds' e^{\Lambda^{*}s'} N_{i}(s') \end{bmatrix}'$$

where  $\bar{r}_{i}$ ,  $\Lambda^{*}$ , and  $\bar{L}$  are given by Eqs.(63), (87), and (88), respectively.

Substituting Eq. (71) and (78) into Eq. (90), we may express the solutions as

$$N'_{1}(\tau) = e^{-\Lambda^{*}\tau} N'_{1}(0) + e^{-\Lambda^{*}\tau} \sum_{R=0}^{3} B_{k} Q_{k}(\tau),$$

$$N'_{2}(\tau) = e^{-\Lambda^{*}\tau} N'_{2}(0) + e^{-\Lambda^{*}\tau} \sum_{R=4}^{5} B_{k} Q_{k}(\tau),$$
(91)

and

$$\frac{R_{1}'(\tau)}{L} = \frac{1 - e^{-\Lambda^{*}\tau}}{\Lambda^{*}} N_{1}'(0) + \sum_{k=0}^{3} B_{k} V_{k}(\tau) , \qquad (92)$$

$$\frac{R_{2}'(\tau)}{L} = \frac{1 - e^{-\Lambda^{*}\tau}}{\Lambda^{*}} N_{2}'(0) + \sum_{k=4}^{5} B_{k} V_{k}(\tau),$$

where the functions  $\boldsymbol{Q}_{k}^{}\left(\boldsymbol{\tau}\right)$  and  $\boldsymbol{V}_{k}^{}\left(\boldsymbol{\tau}\right)$  are defined by

$$Q_{k}(\tau) = \int_{0}^{\tau} ds \ e^{\Lambda^{*}s} M_{k}(s),$$

$$V_{k}(\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} Q_{k}(s).$$
(93)

The  $\boldsymbol{Q}_k(\tau)$  and  $\boldsymbol{V}_k(\tau)$  functions are derived explicitly in Appendix B.

For the general case of  $Q_k(\tau)$  we obtain the results that  $Q_0(\Lambda^*,\Lambda_1,\tau) = \frac{1}{\Lambda_1 - \Lambda^*} [1 - e^{-(\Lambda_1 - \Lambda^*)\tau}]$ ,

$$Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{\Lambda_{1}-\Lambda^{*}} \left[P_{0}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau) - e^{-(\Lambda_{1}-\Lambda^{*})\tau} P_{0}(-\alpha,\beta,\tau)\right]$$

$$Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{2\beta(\Lambda_{1}-\Lambda^{*})} \left[(\Lambda_{1}-\Lambda^{*}-\alpha)P_{0}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau) + \alpha e^{-(\Lambda_{1}-\Lambda^{*})\tau} P_{0}(-\alpha,\beta,\tau) + \alpha e^{-(\Lambda_{1}-\Lambda^{*})\tau} P_{0}(-\alpha,\beta,\tau)\right],$$

,

,

$$Q_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{4\beta^{2}} \begin{cases} \frac{[2\beta + (\Lambda_{1} - \Lambda^{*} - \alpha)^{2}]}{\Lambda_{1} - \Lambda^{*}} P_{0}(\Lambda_{1} - \Lambda^{*} - \alpha,\beta,\tau) \\ - \frac{(2\beta + \alpha^{2})}{\Lambda_{1} - \Lambda^{*}} e^{-(\Lambda_{1} - \Lambda^{*})\tau} P_{0}(-\alpha,\beta,\tau) \\ - \frac{(2\beta + \alpha^{2})}{\Lambda_{1} - \Lambda^{*}} e^{-(\Lambda_{1} - \Lambda^{*})\tau} P_{0}(-\alpha,\beta,\tau) \\ - [1 - e^{-\beta\tau^{2} - (\Lambda_{1} - \Lambda^{*} - \alpha)\tau}] \\ + \frac{\alpha}{\Lambda_{1} - \Lambda^{*}} [1 - e^{-(\Lambda_{1} - \Lambda^{*})\tau}] \end{cases} \end{cases}$$

$$Q_{4}(\Lambda^{*},\gamma,\beta,\tau) = P_{0}(\gamma-\Lambda^{*},\beta,\tau), \text{ and}$$

$$Q_{5}(\Lambda^{*},\gamma,\beta,\tau) = P_{1}(\gamma-\Lambda^{*},\beta,\tau).$$

$$P_{1}(\gamma,\beta,\tau) \text{ is defined in Appendix A.}$$
(94)

The expressions for  $Q_2^{}(\tau)$  ,  $Q_3^{}(\tau)$  can be expressed in a functionally simpler manner as

$$Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{Q_{0}(\Lambda^{*},\Lambda_{1},\tau) - Q_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$

$$Q_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) - Q_{5}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$
(95)

Again, the integrals for  $Q_2(\tau)$ ,  $Q_3(\tau)$ , and  $Q_5(\tau)$  in the  $\beta = 0$ limit are finite and independent of  $\beta$ . The contribution from  $B_k Q_k(\tau)$  for k = 2,3, and 5 therefore vanishes for  $\beta = 0$  since those  $B_k$  have a factor  $\beta$  in them. The other limiting forms are handled correctly using the limiting forms for  $P_0(\gamma,\beta,\tau)$ ,  $P_1(\gamma,\beta,\tau)$ and  $Q_0(\tau)$  given in Appendices A and B.

For the general case of  $V_k(\tau)$  we obtain the results that

$$\begin{split} \mathbf{V}_{O}(\Lambda^{*},\Lambda_{1},\tau) &= \frac{1}{\Lambda_{1}-\Lambda^{*}} \left[\frac{1}{\Lambda^{*}} \left(1-\mathrm{e}^{-\Lambda^{*}\tau}\right) - \frac{1}{\Lambda_{1}} \left(1-\mathrm{e}^{-\Lambda}\mathbf{1}^{\tau}\right)\right] ,\\ \mathbf{V}_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) &= \frac{1}{\Lambda_{1}\Lambda^{*}} \mathbf{P}_{O}(\Lambda_{1}-\alpha,\beta,\tau) - \frac{1}{\Lambda_{1}-\Lambda^{*}} \left[\frac{\mathrm{e}^{-\Lambda^{*}\tau}}{\Lambda^{*}} \mathbf{P}_{O}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau) - \frac{\mathrm{e}^{-\Lambda_{1}\tau}}{\Lambda_{1}} \mathbf{P}_{O}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau)\right] , \end{split}$$

$$V_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = + \frac{(\Lambda_{1}-\Lambda^{*}-\alpha)}{2\beta(\Lambda_{1}-\Lambda^{*})} \frac{1}{\Lambda^{*}} \left[P_{0}(\Lambda_{1}-\alpha,\beta,\tau) - e^{-\Lambda^{*}\tau}P_{0}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau)\right]$$

.

$$+ \frac{\alpha}{2\beta(\Lambda_{1} - \Lambda^{*})} \frac{1}{\Lambda_{1} - \Lambda^{*}} \left[ P_{O}(\Lambda_{1} - \Lambda^{*} - \alpha, \beta, \tau) - e^{(\Lambda_{1} - \Lambda^{*})\tau} P_{O}(-\alpha, \beta, \tau) \right]$$

$$-\frac{1}{2\beta(\Lambda_{1}-\Lambda^{\star})}\left[\frac{1}{\Lambda^{\star}}\left(1-\mathrm{e}^{-\Lambda^{\star}\tau}\right)-\frac{1}{\Lambda_{1}}\left(1-\mathrm{e}^{-\Lambda}\mathbf{1}^{\tau}\right)\right],$$

$$V_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{4\beta^{2}} \left[ \frac{2\beta + (\Lambda_{1} - \Lambda^{*} - \alpha)^{2}}{\Lambda^{*}(\Lambda_{1} - \Lambda^{*})} - \frac{(2\beta + \alpha^{2})}{\Lambda_{1}(\Lambda_{1} - \Lambda^{*})} + 1 \right] P_{0}(\Lambda_{1} - \alpha,\beta,\tau)$$

+ 
$$\frac{1}{4\beta^2} \frac{2\beta + \alpha^2}{\Lambda_1(\Lambda_1 - \Lambda^*)} e^{-\Lambda_1 \tau_{P_0}(-\alpha, \beta, \tau)}$$

$$-\frac{1}{4\beta^2}\frac{2\beta+(\Lambda_1-\Lambda^*-\alpha)^2}{\Lambda^*(\Lambda_1-\Lambda^*)} e^{-\Lambda^*\tau}P_{O}(\Lambda_1-\Lambda^*-\alpha,\beta,\tau)$$

$$-\frac{1}{4\beta^2} \quad \frac{1}{\Lambda^*} \quad (1-e^{-\Lambda^*\tau})$$

$$+ \frac{1}{4\beta^2} \frac{\alpha}{\Lambda_1 - \Lambda^*} \left[ \frac{1}{\Lambda^*} (1 - e^{-\Lambda^* \tau}) - \frac{1}{\Lambda_1} (1 - e^{-\Lambda} 1^\tau) \right],$$

$$V_{4}(\Lambda^{*},\gamma,\beta,\tau) = \frac{1}{\Lambda^{*}} \left[P_{0}(\gamma,\beta,\tau) - e^{-\Lambda^{*}\tau}P_{0}(\gamma-\Lambda^{*},\beta,\tau)\right], \text{ and}$$

$$V_{5}(\Lambda^{*},\gamma,\beta,\tau) = -\frac{\gamma}{2\beta\Lambda^{*}}P_{0}(\gamma,\beta,\tau) + \frac{\gamma-\Lambda^{*}}{2\beta\Lambda^{*}}e^{-\Lambda^{*}\tau}P_{0}(\gamma-\Lambda^{*},\beta,\tau)$$

+ 
$$\frac{1}{2\beta\Lambda^{*}}$$
 (1-e<sup>- $\Lambda^{*}\tau$</sup> ) • (96)

The expressions for  $V_1(\tau)$ ,  $V_2(\tau)$ ,  $V_3(\tau)$ ,  $V_4(\tau)$  and  $V_5(\tau)$  can be expressed in a functionally simpler manner as

$$v_{1}(\Lambda^{*},\Lambda_{1},\tau) = \frac{v_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) - e^{-\Lambda^{*}\tau}Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{\Lambda_{1}},$$

$$v_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{v_{0}(\Lambda^{*},\Lambda_{1},\tau) - v_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha v_{1}(\Lambda^{*},\Lambda_{1},\tau)}{2\beta},$$

$$v_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{v_{1}(\Lambda^{*},\Lambda_{1},\tau) - v_{5}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha v_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$

$$V_{4}(\Lambda^{*},\gamma,\beta,\tau) = \frac{P_{0}(\gamma,\beta,\tau) - e^{-\Lambda^{*}\tau} Q_{4}(\Lambda^{*},\gamma,\beta,\tau)}{\Lambda^{*}}, \text{ and}$$

$$V_{5}(\Lambda^{*},\gamma,\beta,\tau) = \frac{\hat{P}_{0}(\Lambda^{*},\tau) - \gamma V_{4}(\Lambda^{*},\gamma,\beta,\tau) - e^{-\Lambda^{*}\tau} Q_{4}(\Lambda^{*},\gamma,\beta,\tau)}{2\beta}$$
 (97)

where we have used the identity  $\gamma = \Lambda_1 - \alpha$  from Eq. (73).

Finally we remark that the integrals for  $V_2(\tau)$ ,  $V_3(\tau)$  and  $V_5(\tau)$  given in Eq. (97) in the  $\beta = 0$  limit are finite and independent of  $\beta$ . The contribution from  $B_k V_k(\tau)$  for k = 2,3,5 therefore vanishes for  $\beta = 0$  since those  $B_k$  have a factor  $\beta$  in them. The other limiting forms are handled correctly using the limiting forms for  $P_0(\gamma,\beta,\tau)$  and  $V_0(\Lambda^*,\Lambda_1,\tau)$  given in Appendices A and B.

As we shall see in Section IV, comparison of these four models indicates that the Constant Release-Renormalized model is adequate for the calculation of the release to the coolant and from the containment building.

#### III. CALCULATIONAL DATA BASE

The calculational data base for LARC-1 is composed of the following: (a) Temperature modeling, (b) Fission product release rates, (c) Particle coating fuel failure fractions, and (d) Aged particle coating fuel fracture fraction. Each of these is discussed in detail including the form and parameters used in the analytic fits as well as the graphic representations generated from the fits.

#### A. Temperature Modeling

The temperature modeling of LARC-1 is represented as a function of core volume fraction (x) and time (t). Four different models are available at present.

The first three models are based on data obtained from  $3^{2}$  CORCON, and AYER.<sup>4,5</sup> These models involve three different calculations of the maximum and average temperature as a function of the time from the beginning of an LOFC. The temperature shape as a function of core volume fraction was obtained graphically from GASSAR.<sup>6</sup> A simple scaling law is used to construct T(x,t) from T(t) and T(x).

The fourth model is obtained from an inversion of the data made available from recent AYER calculations.<sup>7</sup> The core volume fraction at time t with temperature above T is transformed into T(x,t).

#### 1. Temperature vs Core Volume Fraction

The fuel temperature, T(x), vs the core volume fraction x, or "fraction of the fuel volume above indicated temperature at rated power" is given graphically in the GASSAR report.<sup>6</sup> That graph was read and interpolated for a number of core volume fraction points, given in Table I.

#### TABLE I

GASSAR DATA T(x) vs x

| x       | <u> </u> |
|---------|----------|
| 0       | 1699.82  |
| 0.01    | 1588.71  |
| 0.03333 | 1479.26  |
| 0.06666 | 1402.59  |
| 0.1     | 1347.59  |
| 0.2     | 1255.37  |
| 0.3     | 1205.37  |
| 0.4     | 1173.41  |
| 0.5     | 1147.04  |
| 0.6     | 1127.59  |
| 0.7     | 1104.26  |
| 0.8     | 1079.08  |
| 0.9     | 1044.26  |
| 1.0     | 922.04   |
| •       |          |

Originally a simple analytic polynominal fit to the data was used. That technique had an accuracy of about 1% in T(x), but did not have dT/dx continuous across fit boundaries, of which there were several. However, with the implementation of a general onedimensional spline method,  $^{8-10}$  the accuracy of the fits is maintained, dT/dx is smooth, and  $d^2T/dx^2$  is continuous.

The average temperature  $\overline{T}$  is used in scaling and is determined from numerical integration of the spline representation as

$$\overline{T} = \int_{O}^{1} T(x) dx = 1174.4 \text{ K} \cdot$$
(98)

A graphic display of the spline representation of T(x) is given in Fig. 1.

#### 2. SORS Data

The maximum and average temperature,  $T_{MAX}(t)$  and  $T_{AVG}(t)$ , are displayed graphically in Fig. 6-2 of the SORS report<sup>2</sup> for a 3000 MW(t) reactor for lumped fuel/graphite temperature vs time. That graph was read and interpolated for  $T_{MAX}(t)$  and  $T_{AVG}(t)$  at a number of time points given in Table II.



Fig. 1. Temperature vs core volume fraction.

#### TABLE II

| t(h) | T <sub>MAX</sub> (K) | t(h) | T <sub>AVG</sub> (K) |
|------|----------------------|------|----------------------|
| 0    | 1227.59              | 0    | 1088.71              |
| 1.3  | 1644.26              | 1.1  | 1366.48              |
| 2.3  | 1922.04              | 2.5  | 1644.26              |
| 3.5  | 2199.82              | 4.2  | 1922.04              |
| 5    | 2477.59              | 6.3  | 2199.82              |
| 6.92 | 2755.37              | 10.0 | 2477.59              |
| 9.42 | 3033.15              | 14.8 | 2755.37              |
| 12.3 | 3310.93              | 22.5 | 3033.15              |
| 17.3 | 3588.71              | 34.6 | 3310.93              |
| 26.5 | 3922.04              | 40.0 | 3374.42              |
| 40.0 | 3922.04              | 50.0 | 3459.08              |

#### SORS TEMPERATURE DATA

We note that the SORS data as given in Ref. (2) does not have a maximum temperature exceeding the graphite sublimation temperature (3925 K).

The results of the spline representation <sup>9</sup>of the data of Table II are displayed in Fig. 2.

3. CORCON Data

The maximum and average temperature,  $T_{MAX}(t)$  and  $T_{AVG}(t)$ , are given in Table 6-4 of the CORCON report.<sup>3</sup> This data is reproduced in LARC-1 units in Table III.

The results of the spline representation of the data of Table III are displayed in Fig. 3.

We note that in Fig. 3 there is a depression of the  $T_{MAX}(t)$  and  $T_{AVG}(t)$  curves in the time range 1 < t < 5 h of the







TABLE III

| CORCON TEMPERATURE DATA |                      |                      |
|-------------------------|----------------------|----------------------|
| t(h)                    | T <sub>MAX</sub> (K) | T <sub>AVG</sub> (K) |
| 0                       | 1192.59              | 1052.59              |
| 0.0083                  | 1192.59              | 1052.59              |
| 0.2167                  | 1280.37              | 1134.82              |
| 1.45                    | 1618.15              | 1413.71              |
| 5.25                    | 2379.26              | 1920.37              |
| 10.25                   | 2969.82              | 2338.71              |
| 15.25                   | 3358.71              | 2608.71              |
| 20.25                   | 3630.37              | 2793.71              |
| 25.25                   | 3665.37              | 2938.15              |
| 30.25                   | 3665.37              | 3026.48              |

CORCON data relative to the SORS data shape, Fig. 2. In general, after t = 1 h the CORCON data has lower temperatures, with differences upwards of 150 K, than SORS for both  $T_{MAX}(t)$  and  $T_{AVG}(t)$ .

4. AYER Data

The maximum and average temperatures,  $T_{MAX}(t)$  and  $T_{AVG}(t)$  are reproduced in Table IV from AYER data.<sup>4,5</sup>

The results of the spline representation of the data of Table IV are displayed in Fig. 4.

We note that for this data  $T_{MAX}(t)$  attains and exceeds the graphite sublimation temperature at 17 h.

Comparing the AYER to SORS temperature histories we note that  $T_{MAX}(t)_{AYER} < T_{MAX}(t)_{SORS}$  for 0 < t < 15 h and  $T_{AVG}(t)_{AYER} < T_{AVG}(t)_{SORS}$  for 0 < t < 20 h, with temperature differences of the order of 50-200 K. After 15 h,  $T_{MAX}(t)_{AYER} > T_{MAX}(t)_{SORS}$  until t  $\sim$  20 h when the 2 models are equal.

Comparing the AYER and CORCON temperature histories we note that  $T_{MAX}(t)_{AYER} < T_{MAX}(t)_{CORCON}$  for 0 < t < 10.5 h with a maximum difference of approximately 100 K. For 10.5 < t < 20 h,  $T_{MAX}(t)_{AYER} > T_{MAX}(t)_{CORCON}$  with a maximum difference of almost 200 K occurring at 17 h.  $T_{AVG}(t)$ , on the other hand, for AYER and CORCON data differ by less than 50 K over the range 0 < t < 20 h. AYER is first lower than CORCON (0 < t < 1.8 h), then higher (1.8 < t < 4.5 h), then lower (4.5 < 5 < 15 h), and, finally higher (15 < t < 20 h).

5. Computation of T(x,t) for Models 1, 2, and 3

Using the temperature vs core volume fraction data, by spline interpolation we find T(x) for any x in the range  $0 \le x \le 1$ . The average temperature is given by  $\overline{T} = 1174.4$  K from Eq. (98).

From the spline representations of  $T_{MAX}(t)$  and  $T_{AVG}(t)$  we find these quantities at any time t by spline interpolation.

In order to determine T(x,t) we use a simple scaling law given by

$$T(x,t) = \frac{T_{MAX}(t) - T_{AVG}(t)}{T(0) - \overline{T}} [T(x) - \overline{T}] + T_{AVG}(0) .$$
(99)

# TABLE IV

#### AYER TEMPERATURE DATA

| t(h) | T <sub>MAX</sub> (K) | T <sub>AVG</sub> (K) |
|------|----------------------|----------------------|
| 0.2  | 1199                 | 1167                 |
| 0.4  | 1278                 | 1219                 |
| 0.5  | 1315                 | 1243                 |
| 1.0  | 1461                 | 1338                 |
| 1.5  | 1589                 | 1421                 |
| 2.0  | 1704                 | 1496                 |
| 2.5  | 1810                 | 1566                 |
| 3.0  | 1908                 | 1631                 |
| 3.5  | 2002                 | 1692                 |
| 4.0  | 2091                 | 1749                 |
| 4.5  | 2176                 | 1804                 |
| 5.0  | 2257                 | 1856                 |
| 5.5  | 2335                 | 1906                 |
| 6.0  | 2411                 | 1954                 |
| 6.5  | 2483                 | 1999                 |
| 7.0  | 2554                 | 2044                 |
| 8.0  | 2687                 | 2126                 |
| 9.0  | 2815                 | 2204                 |
| 10.  | 2936                 | 2278                 |
| 11.  | 3053                 | 2347                 |
| 12.  | 3165                 | 2414                 |
| 13.  | 3273                 | 2477                 |
| 14.  | 3376                 | 2538                 |
| 15.  | 3475                 | 2596                 |
| 16.  | 3570                 | 2653                 |
| 17.  | 3663                 | 2707                 |
| 18.  | 3636                 | 2756                 |
| 19.  | 3664                 | 2801                 |
| 20.  | 3665                 | 2840                 |

This form scales the maximum to average difference of the T(x) curve to match the maximum to average difference of a model at time t.

The function T(x,t) and the isotherms are displayed for 0 < x < 1,  $0 \le t \le 20$  h in Fig. 5-10 for the SORS (Model 1), CORCON (Model 2) and AYER (Model 3) data.

6. AYER Fu-Cort Data

Data was available for x = x(T,t) from recent results of the AYER code<sup>4,7</sup> in which the core volume was divided into 112 elements. Reinterpreting this data as the function T(x,t)and supplying additional interpolated points, we constructed the tabular values for T(x,t) given in Table V.

Performing a two-dimensional spline fit we calculate T(x,t) for any (x,t) in the range  $0 \le x \le 1$ , 0 < t < 20 h by spline interpolation.

The T(x,t) and isotherms are displayed for Model 4 in Figs. 11 and 12.

Comparing Model 4 to Models 1-3 for the temperature field T(x,t), Figs. 5,7,9, and 11, we note that Model 4 maintains a larger fraction of the core (x = 1) at a lower temperature than the other models. Models 1-3, on the other hand exhibit a rise and then a decrease in the temperature as a function of time near x = 1. Maintaining any significant fraction of the core at a uniformly low temperature during a LOFC would seem to need further justification. As we shall see later, it results in a considerable reduction in the release to the coolant for t > 9 h.

B. Fission Product Release Rates

The graphic data for fission product release rates as a function of temperature (T) in the  $SORS^2$  and  $GASSAR^{12}$  reports has been fitted to Arrhenius relations of the form

$$r(T) = \alpha e^{-\beta/T}$$
(100)


Fig. 4. Temperature vs time after LOFC, AYER tabular data.



Fig. 5. Temperature model 1 vs time (x) and core volume fraction (y).





Fig. 7. Temperature model 2 vs time (x) and core volume fraction (y).



Fig. 8. Contours of temperature model 2 vs time (x) and core volume fraction (y).







Fig. 10. Contours of temperature model 3 vs time (x) and core volume fraction (y).



Fig. 11. Temperature model 4 vs time (x) and core volume fraction (y).

Fig. 12. Contours of temperature model 4 vs time (x) and core volume fraction (y).

for intact and failed particle coatings. The isotopes have been arranged in the 10 groupings as used by SORS, and listed in Table VI.

In the SORS data, the effects of BISO and TRISO particles have been "added for a conservative estimate."<sup>2</sup> In the GASSAR data, BISO and TRISO release rates are distinguished in some instances.

The fitted parameters for the SORS and GASSAR data are given in Tables VII and VIII, where the parameters are further subdivided as intact or failed. In the case of GASSAR parameters a subscript B (BISO) or T (TRISO) on the group index further distinguishes the release rate parameters.

The release rates using the parameters of Table VI-VIII are displayed graphically in Figs. 13-15. The SORS data is denoted as the Ft. St. Vrain fuel model.

#### TABLE V

TEMPERATURE VS TIME AND CORE FRACTION INDEX I,  $I = \frac{CORE FRACTION}{112} + 1$ (Interpolated Fu-Cort Data)

9h 10h 11h 12h 13h 14h 15h 16h 17h 18h 19h 20h 7h 8h Т lh 2h 3h 4h 5h 6h 1 1455 1694 1875 2073 2236 2387 2526 2657 2182 2901 3016 3126 3232 3334 3431 3525 4616 3624 3630 3634 2 1454 1666 1801 2041 2206 2359 2501 2634 2/60 2881 2996 3140 4211 3314 3402 3485 4553 3590 3613 3633 3 1452 1651 1841 2019 2184 2338 2481 2615 2/43 2863 2979 3048 3192 3289 3278 3456 3519 3565 3600 3631 4 1450 1642 1849 2003 2168 2321 2465 2600 2127 2848 2963 3073 3176 3274 3358 3434 3497 3548 3590 3629 5 1448 1636 1819 1992 2155 2308 2452 2586 2714 2834 2949 3058 3161 3250 3342 3417 3481 3535 3582 3626 6 1446 1632 1811 1983 2145 2297 2440 2574 2701 2822 2936 3045 3147 3242 3327 3403 3468 3525 3575 3623 7 1444 1627 1805 1975 2136 2288 2430 2564 2590 2810 2924 3032 2134 3225 3314 3390 2457 3515 3569 3620 8 1442 1624 1800 1969 2128 2279 2420 2553 2580 2799 2913 3020 3121 3215 3301 3378 3446 3507 3563 3617 9 1440 1620 1725 1962 2121 2271 2411 2544 2069 2788 2901 3000 3109 3203 3289 3366 3436 3499 3558 3615 10 1438 1617 1740 1957 2114 2263 2403 2535 2560 2778 2890 2946 3046 3190 3276 3355 426 3491 3552 3612 11 1436 1613 1740 1951 2108 2256 2495 2526 250 2768 2879 2944 3044 3177 3264 3343 4415 3483 3546 3609 12 1434 1610 1784 1946 2102 2249 2387 2518 2041 2757 2868 2973 3071 3164 3251 3331 3405 3474 3540 3606 13 1432 1607 1774 1941 2096 2242 2380 2509 2632 2747 2857 2950 3059 3151 3238 3318 3393 3464 3534 3603 14 1430 1604 1774 1936 2090 2235 2372 2501 2022 2737 2845 2948 3046 3138 3224 3305 1381 3454 3525 3600 15 1428 1602 1770 1932 2085 2229 2464 2492 2012 2726 2834 2946 3032 3124 3210 3291 4368 3441 3513 3586 16 1427 1599 1701 1927 2079 2222 2357 2483 2003 2715 2822 2923 3019 3110 3196 3277 3354 3428 3500 3571 17 1425 1597 1764 1923 2074 2216 2349 2475 2993 2705 2811 2911 3006 3097 3182 3263 440 3414 3486 3557 18 1423 1594 1760 1918 2068 2209 2342 2467 2984 2695 2800 2899 2994 3084 3169 3249 3326 3400 3472 3543 19 1421 1591 1750 1914 2063 2203 2435 2459 275 2685 2789 2808 2982 3074 3156 3236 4312 3386 3457 3528 20 1419 1588 1754 1910 2058 2197 2328 2451 2567 2676 2779 2877 2970 3054 3143 3223 4299 3372 3444 3514 21 1417 1586 1749 1905 2053 2191 2321 2443 258 2667 2769 2867 2959 3047 3131 3210 3286 3359 3430 3500 22 1415 1583 1740 1901 2048 2186 2315 2436 2550 2658 2760 2856 2948 3030 3119 3198 3274 3346 3417 3487

 $\frac{\omega}{7}$ 

TABLE V(cont)

23 1413 1580 1742 1897 2043 2180 2308 2429 2542 2649 2750 2846 2938 3025 3108 3186 3261 3334 3405 3475 24 1410 1577 1738 1892 2038 2174 2302 2422 2934 2640 2741 2836 2927 3014 3096 3174 3249 3321 3392 3462 25 1408 1574 1735 1888 2033 2168 2295 2414 2526 2632 2732 2847 2917 3004 3084 3162 3237 3309 3380 3450 26 1405 1570 1731 1884 2028 2163 2289 2407 2518 2623 2723 2811 2906 2991 3072 3149 3224 3296 3367 3437 27 1402 1567 1727 1879 2023 2157 2283 2400 2511 2615 2713 2807 2895 2974 3060 3137 3211 3283 3354 3425 28 1400 1564 1744 1875 2018 2152 2277 2394 203 2607 2704 2740 2884 2968 3047 3124 498 3270 3341 3412 29 1398 1561 1720 1871 2013 2146 2271 2387 2496 2598 2695 278 2873 2950 3035 3111 3185 3257 3329 3400 30 1396 1559 1716 1867 2008 2141 2264 2380 2488 2590 2685 2775 2861 2943 3022 3098 3171 3244 3316 3390 31 1394 1556 1714 1862 2003 2135 2258 2373 2480 2581 2675 2765 4849 2931 3008 3084 4157 3229 3302 3375 32 1392 1553 1704 1858 1998 2129 2251 2365 2472 2571 2665 2753 2837 2914 2995 3064 3142 3214 3286 3360 33 1390 1550 1700 1854 1993 2123 2244 2357 2463 2561 2654 2742 2825 2904 2980 3054 2126 3197 3268 3340 34 1388 1547 1704 1849 1987 2116 2237 2349 2453 2551 2643 2740 2812 2890 2965 3037 4108 3179 3249 3320 35 1386 1545 1678 1844 19a1 2109 2229 2340 2444 2541 2632 2717 2748 2875 2949 3020 4090 3160 3230 3300 36 1384 1542 1644 1839 1975 2102 2421 2331 2434 2530 2620 2704 2784 2860 2932 3002 2072 3141 3210 3280 37 1382 1539 1640 1834 1969 2095 2213 2322 2424 2519 2608 2641 2769 2844 2915 2984 3053 3122 3191 3260 38 1380 1536 1689 1829 1963 2088 2205 2313 2414 2508 2596 2617 2754 2827 2897 2966 2034 3102 3171 3240 39 1378 1533 1682 1824 1957 2081 2197 2304 2404 2497 2583 2663 2739 2811 2880 2947 2015 3082 3151 3220 40 1376 1530 1678 1819 1951 2074 2189 2295 2493 2485 2570 2649 2723 2794 2862 2929 6995 3062 3130 3200 41 1374 1527 16/4 1814 1945 2067 2181 2285 2383 2473 2557 2635 2708 2774 2845 2911 2976 3042 3109 3180 42 1372 1524 16/0 1809 1939 2060 2172 2276 2472 2461 2543 2641 2643 2764 2828 2893 4457 3020 3082 3140 43 1371 1521 1660 1804 1933 2053 2164 2266 2461 2449 2531 260/ 2679 274/ 2812 2876 2438 3000 3061 3120 44 1369 1518 1664 1799 1927 2045 2155 2257 2350 2437 2518 2594 2665 2734 2797 2860 4921 2982 3041 3100

80

45 1367 1515 16<sup>58</sup> 1793 1920 2038 2147 2247 2<sup>4</sup>0 2426 2506 2581 26<sup>5</sup>1 2718 2782 2844 4<sup>4</sup>904 2964 3022 3080 ▲6 1365 1512 1654 1788 1913 2030 2138 2237 2329 2414 2494 2568 2638 2705 2768 2829 ¢888 2946 3003 3060 47 1363 1509 164<u>9</u> 1782 1907 2022 2129 2227 2319 2403 2482 2556 2625 2691 2754 2814 4872 2929 2985 3040 48 1361 1505 1645 1777 1900 2014 2120 2217 2408 2392 2470 2543 2612 2678 2739 2797 2856 2911 2966 3020 49 1359 1502 1640 1771 1893 2006 2111 2208 2297 2380 2458 2531 2599 2664 2725 2783 2839 2894 2947 3000 50 1358 1500 1645 1766 1887 1998 2102 2197 2486 2368 2445 2511 2585 2649 2709 2761 4822 2876 2928 2980 51 1356 1497 1612 1760 1880 1991 2093 2187 2275 2356 2432 2504 2571 2634 2693 2750 4004 2857 2909 2960 52 1354 1494 162<u>4</u> 1755 1974 1983 2084 2177 2464 2344 2419 24<u>4</u>7 2555 2617 2676 2732 4786 2838 2889 2940 53 1352 1491 1649 1750 1867 1975 2075 4167 2452 2331 2405 2474 2539 2600 2658 2713 4766 2818 2869 2920 <u>54 1350 1488 1620 1744 1860 1967 2066 2156 2240 2318 2391 2458 2522 2582 2639 2694 2747 2799 2849 2900</u> 55 1348 1484 1615 1739 1853 1959 2055 2145 2228 2305 2376 24<u>4</u>2 2505 25<u>64</u> 2621 2675 278 2779 2830 2880 56 1346 1481 1611 1732 1846 1950 2046 2134 2216 2291 2361 242<u>6</u> 24<u>88</u> 25<u>4</u>1 2603 2657 2709 2760 2810 2860 57 1344 1477 1600 1726 1838 1941 2036 2123 2203 2278 2347 2411 2472 2530 2585 2639 2091 2742 2791 2840 58 1342 1474 1600 1719 1830 1932 2025 2112 2191 2264 2332 2396 2457 2514 2569 2623 2674 2724 2773 2820 59 1340 1470 1595 1713 1822 1922 2015 2100 2178 2251 2319 2382 2442 2500 2554 2607 6658 2708 2755 2800 60 1338 1467 15<sup>4</sup>4 1706 1814 1913 2004 2088 2166 2238 2305 236<sup>4</sup> 242<sup>4</sup> 2486 2540 2593 4644 2693 2741 2787 61 1336 1463 1545 1699 1806 1904 1994 2077 2154 2225 2292 2355 2415 2472 2527 2579 4630 2679 2727 2775 62 1334 1460 1540 1693 1798 1894 1983 2065 2141 2212 2279 2342 2401 2454 2513 2565 4016 2666 2714 2762 63 1332 1456 1575 1687 1790 1886 1473 2054 2129 2200 2265 234<u>4</u> 23<u>4</u>7 244<u>4</u> 2499 2551 4902 2652 2701 2750 64 1330 1453 15/V 1680 17A3 1877 1964 2043 2118 2187 2252 2314 2373 243V 2484 2536 2988 2638 2688 2737 65 1328 1449 1565 1675 1776 1869 1954 2033 2106 2175 2239 2300 2359 2415 2469 2521 4573 2623 2674 2725 66 1326 1446 15<u>61</u> 1<u>669 1769 1861 1945 2023 2095 2163 2226 2286 2344 2399</u> 2453 2506 2557 2609 2661 2712 67 1324 1443 155<u>5</u> 1663 1762 1853 1936 2013 2085 215<u>1 2214 2273</u> 2330 2385 2438 2490 4542 2595 2647 2700

TABLE V (cont)

TABLE V (cont)

68 1322 1439 1551 1657 1755 1845 1928 2004 2075 2141 2202 2261 2317 2370 2423 2475 2527 2580 2634 2687 69 1320 1436 1541 1651 1748 1837 1919 1995 2005 2130 2191 2247 2303 2357 2408 2460 2513 2566 2620 2675 70 1318 1432 1544 1045 1741 1829 1911 1986 2055 2119 2180 2236 2291 2343 2394 2446 4498 2552 2607 2662 71 1316 1429 154/ 1639 1733 1821 1901 1976 2044 2108 2168 2224 2277 2329 2380 2431 2484 2538 2594 2650 72 1314 1425 1532 1632 1726 1812 1892 1965 2033 2096 2155 2211 2264 2315 2365 2416 2469 2524 2580 2637 73 1312 1421 1526 1625 1717 1803 1882 1954 2021 2084 2142 2197 2250 2300 2351 2402 2454 2510 2567 2625 74 1310 1417 1541 1618 1709 1793 1871 1943 2009 2071 2129 2143 2235 2286 2336 2385 4440 2495 2553 2612 75 1308 1414 1515 1011 1701 1783 100 1931 1996 2058 2115 2169 2221 2271 2320 2371 4424 2480 2538 2600 76 1306 1410 1510 1604 1692 1774 1849 1919 1984 2044 2101 2155 2206 2256 2305 2356 4409 2464 2521 2580 77 1304 1406 1504 1597 1684 1764 1839 1908 1972 2032 2088 2141 2192 2241 2291 2341 4393 2447 2503 2560 78 1302 1402 1497 1590 1676 1755 1829 1897 1960 2019 2075 2128 2178 2228 2277 2326 2378 2431 2485 2540 79 1300 1398 1493 1584 1668 1746 1819 1887 1949 2008 2063 2115 2166 2215 2263 2312 2363 2414 2467 2520 80 1296 1394 1488 1577 1661 1738 1810 1877 1939 1997 2052 2104 2154 2202 2250 2299 2348 2398 2449 2500 81 1292 1389 1484 1571 1653 1730 1802 1868 1929 1987 2012 2093 2143 2191 2238 2286 2334 2382 2431 2480 82 1288 1384 14// 1564 1646 1723 1793 1859 1720 19/8 2032 2083 2132 2180 2227 2273 4320 2366 2413 2460 83 1284 1379 14/1 1558 1640 1715 1785 1851 1911 1969 2022 2073 2122 2169 2215 2261 4306 2350 2395 2440 84 1280 1375 1499 1552 1633 1708 1778 1842 1903 1959 2013 2069 2112 2150 2204 2240 2291 2334 2377 2420 85 1276 1370 1490 1546 1626 1701 1770 1834 1894 1950 2003 2054 2101 2147 2192 2235 4477 2318 2359 2400 86 1272 1365 1455 1540 1619 1693 1762 1825 1885 1940 1993 2042 2040 2135 2179 2221 2262 2302 2341 2380 87 1268 1361 1450 1534 1613 1686 1753 1816 1875 1930 1982 2031 2078 2122 2165 2205 2246 2284 2322 2360 88 1264 1356 1444 1528 1606 1678 1745 1807 1465 1919 1970 2014 2064 2108 2150 2191 4229 2267 2303 2340 89 1260 1351 1444 1521 1598 1670 1736 1797 1454 1907 1958 2005 2050 2094 2135 2174 2212 2248 2284 2320 90 1256 1346 1433 1515 1591 1661 1726 1787 1843 1895 1945 1941 2036 2078 2118 2157 2194 2230 2265 2300

40

41

91 1252 1341 1421 1508 1543 1652 1711 1776 1431 1883 1931 1911 2020 2062 2101 2139 2176 2211 2246 2280 92 1248 1336 1424 1501 1575 1644 1/07 1765 1819 1869 1917 1951 2004 2045 2084 2121 2157 2192 2226 2260 93 1244 1331 1415 1494 1547 1634 1696 1753 1806 1855 1902 1945 1987 2027 2066 2103 2138 2173 2207 2240 94 1240 1326 1407 1487 1559 1625 1685 1741 1/92 1840 1885 1948 1969 2007 2047 2084 419 2153 2187 2220 95 1236 1321 1404 1479 1549 1613 1073 1727 1/77 1824 1868 1910 1951 1990 2028 2064 4100 2134 2168 2200 96 1232 1315 1345 1470 1538 1601 1559 1712 1/61 1806 1850 1841 1931 1970 2008 2044 2080 2115 2149 2183 97 1228 1309 130/ 1460 1527 1588 1444 1696 1/43 1788 1831 1872 1911 1950 1987 2024 4060 2096 2131 2166 98 1224 1303 13/9 1449 1514 1574 1029 1679 1/26 1770 1812 1852 1851 1930 1967 2004 4041 2077 2114 2150 99 1220 1296 1307 1437 1501 1559 1013 1662 1/08 1752 1793 1833 1872 1907 1947 1984 4021 2058 2096 2134 100 1216 1289 1357 1425 1487 1544 1596 1645 1690 1733 1774 1813 1852 1887 1926 1963 6001 6039 2077 2116 101 1212 1281 1345 1412 1472 1528 1580 1628 1572 1715 1755 1754 1832 1865 1906 1943 1981 2019 2059 2100 102 1208 1273 134/ 1499 1457 1512 1562 1610 1654 1696 1735 1774 1811 1845 1884 1922 1959 1998 2039 2080 103 1200 1263 1345 1441 1495 1544 1591 1534 1675 1715 1752 1789 1825 1862 1899 1937 1976 2017 2060 104 1189 1251 1311 1470 1425 1477 125 1571 1013 1654 1692 1730 1726 1802 1838 1874 4912 1952 1994 2040 105 1178 1238 129/ 1353 1407 1457 1504 1548 1590 1630 1667 1704 1740 1775 1810 1846 4884 1924 1968 2020 106 1167 1225 1241 135 1387 1435 1480 1523 1564 1602 1639 16/5 1710 1744 1779 1814 1451 1890 1933 1980 107 1156 1211 1294 1415 1343 1410 1453 1494 1543 1570 1606 1641 16/4 1705 1742 1776 1412 1851 1893 1940 108 1145 1195 1243 1291 1336 1379 1420 1459 1497 1532 1567 1600 1633 1665 1698 1731 1767 1805 1848 1895 109 1134 1177 1244 1462 1304 1343 1384 1418 1453 1487 1520 1554 1583 1614 1646 1679 1714 1753 1798 1850 110 1123 1155 1141 1228 1265 1301 1336 1370 1403 1435 1466 1446 1526 1556 1586 1618 1652 1691 1739 1800 111 1110 1127 1155 1189 1221 1254 1285 1317 1447 1376 1405 1444 1462 1491 1520 1550 1582 1620 1667 1730 112 1050 1086 1110 1145 1174 1203 1231 1259 1287 1314 1341 1368 1374 1421 1448 1476 1506 1538 1578 1630 113 1000 1050 10/5 1100 1125 1150 1475 1200 1425 1250 1275 1300 1325 1350 1375 1400 4425 1450 1475 1500

TABLE V (cont)

| ISO   | TOPE GROUPING OF RELEASE RATES |
|-------|--------------------------------|
| Group | Isotopes                       |
| 1     | Sr                             |
| 2     | Cs, Rb                         |
| 3     | Ba, Sm, Eu                     |
| 4     | Ce                             |
| 5     | Хе                             |
| 6     | Kr                             |
| 7     | Zr, Nb, Mo, Te                 |
| 8     | Pm, Nd, Pr, Y, Pd, Sn, La      |
| 9     | Ru, Rh                         |
| 10    | Se, Br, Te, Sb, I              |

.

# TABLE VI

# TABLE VII

**1** 

• •

|       | INTACT                                      |                                      | FAILED                                      |                                      |
|-------|---|--------------------------------------|---|--------------------------------------|
| Group | $\alpha$ (h <sup>-1</sup> )                 | β(Κ)                                 | $\alpha$ (h <sup>-1</sup> )                 | β(Κ)                                 |
| 1     | 9.7733 x $10^{-4}$                          | 8.2621 x 10 <sup>3</sup>             | $1.82889 \times 10^4$                       | 2.2861 x $10^4$                      |
| 2a    | 5.3231 x 10 <sup>9</sup>                    | 5.8360 x 10 <sup>4</sup>             | 5.3231 x 10 <sup>9</sup>                    | 5.8360 x 10 <sup>4</sup>             |
|       | $\left[\frac{1}{T} < 5.64 \text{ x}\right]$ | 10 <sup>-4</sup> (к) <sup>-1</sup> ] | $\left[\frac{1}{T} < 5.64 \text{ x}\right]$ | $10^{-4}$ (K) $^{-1}$ ]              |
| 2b    | 4.6144 x $10^{-2}$                          | $1.3198 \times 10^4$                 | $4.6144 \times 10^{-2}$                     | 1.3198 x 10 <sup>4</sup>             |
|       | $[\frac{1}{T} > 5.64 \text{ x}]$            | 10 <sup>-</sup> 4(K) <sup>-1</sup> ] | $(5.64 \times 10^{-4})$                     | $<\frac{1}{T}<7.59 \times 10^{-4}$ ) |
| 2c    | 9.7733 x $10^{-4}$                          | 8.2621 x 10 <sup>3</sup>             | 9.7733 x $10^{-4}$                          | $8.2621 \times 10^3$                 |
|       |   |                                      | $[\frac{1}{T} > 7.59 \text{ x}]$            | $10^{-4}$ (K) $^{-1}$ ]              |
| 3     | 9.7733 x $10^{-4}$                          | $8.2621 \times 10^3$                 | $8.9524 \times 10^3$                        | 2.2657 x $10^4$                      |
| 4     | 9.7733 x $10^{-4}$                          | 8.2621 x 10 <sup>3</sup>             | $2.2317 \times 10^3$                        | 2.1229 x $10^4$                      |
| 5     | 9.7733 x $10^{-4}$                          | $8.2621 \times 10^3$                 | $8.9524 \times 10^3$                        | $2.2657 \times 10^4$                 |
| 6     | 7.2751 x $10^{-3}$                          | 8.6963 x 10 <sup>3</sup>             | $3.9423 \times 10^4$                        | $2.2435 \times 10^4$                 |

# SORS RELEASE RATE PARAMETERS

| TABLE | VII | (cont) |
|-------|-----|--------|
|-------|-----|--------|

| JURS RELEASE RAIE PARAMETE | SORS | EASE RATE | PARAMETER |
|----------------------------|------|-----------|-----------|
|----------------------------|------|-----------|-----------|

|       | INTACT                               |                                      | FAILE                       | D               |
|-------|--------------------------------------|--------------------------------------|-----------------------------|-----------------|
| Group | $\alpha (h^{-1})$                    | β(Κ)                                 | $\alpha$ (h <sup>-1</sup> ) | β(Κ)            |
| 7a    | $1.7385 \times 10^3$                 | $3.5259 \times 10^4$                 | 2.317 x $10^3$              | 2.1229 x $10^4$ |
|       | $\left[\frac{1}{T} < 5.33 \right]$ x | 10 <sup>-4</sup> (K) <sup>-1</sup> ] |                             |                 |
| 7b    | 9.7733 x $10^{-4}$                   | 8.2621 x 10 <sup>3</sup>             |                             |                 |
|       | $[\frac{1}{T} > 5.33 x]$             | 10 <sup>-4</sup> (K) <sup>-1</sup> ] |                             |                 |
| 8     | 9.7733 x $10^{-4}$                   | 8.2621 x 10 <sup>3</sup>             | $2.2317 \times 10^3$        | 2.1229 x $10^4$ |
| 9a    | $1.10548 \times 10^4$                | 3.4207 x 10 <sup>4</sup>             | $2.2317 \times 10^3$        | 2.1229 x $10^4$ |
|       | $[\frac{1}{T} < 6.26]$               | $(K 10^{-4} (K)^{-1}]$               |                             |                 |
| 9b    | 9.7733 x $10^{-4}$                   | 8.2621 x 10 <sup>3</sup>             |                             |                 |
|       | $[\frac{1}{T} > 6.26]$               | $(10^{-4} (K)^{-1}]$                 |                             |                 |
| 10    | $9.7733 \times 10^{-4}$              | 8.2621 x 10 <sup>3</sup>             | $8.9524 \times 10^3$        | 2.2657 x $10^4$ |

# TABLE VIII

• •

|                         | Intact                  |                      | Failed                      |                          |
|-------------------------|-------------------------|----------------------|-----------------------------|--------------------------|
| Group                   | α(h <sup>-1</sup> )     | β(Κ)                 | $\alpha$ (h <sup>-1</sup> ) | β(Κ)                     |
| 1_*<br>B                | 39.3                    | $1.2 \times 10^4$    | $1.5937 \times 10^2$        | 1.1861 x 10 <sup>4</sup> |
| 1 <sub>T</sub>          | 5.40686                 | 2.5798 x $10^4$      | $1.5937 \times 10^{-2}$     | 1.1861 x 10 <sup>4</sup> |
| <sup>2</sup> в.т        | 5.9769 x $10^2$         | 2.3157 x $10^4$      | 1.6154 x 10 <sup>6</sup>    | 2.6374 x $10^4$          |
| 3 <sub>B</sub>          | $1.7191 \times 10^2$    | $1.7858 \times 10^4$ | $1.3192 \times 10^3$        | $1.7782 \times 10^4$     |
| 3 <sub>T</sub>          | $1.2282 \times 10^{-2}$ | $1.4834 \times 10^4$ | $1.3192 \times 10^3$        | $1.7782 \times 10^4$     |
| 4 <sub>B</sub>          | $1.58225 \times 10^5$   | 2.86525 x $10^4$     | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| 4 <sub>T</sub>          | 5.40686                 | $2.5798 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| -<br>5 <sub>в.т</sub>   | $1.0742 \times 10^{-2}$ | $1.0313 \times 10^4$ | $1.74925 \times 10^3$       | $1.95451 \times 10^4$    |
| 6 <sub>в.т</sub>        | 4.427 x $10^{-2}$       | $1.0482 \times 10^4$ | $1.5004 \times 10^3$        | 1.7662 x $10^4$          |
| -,-<br>7 <sub>в.т</sub> | 5.40686                 | $2.5798 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| 8 <sub>B</sub>          | $4.427 \times 10^{-2}$  | $1.0482 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| 8 <sub>1</sub>          | 5.40686                 | $2.5798 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| -<br>9 <sub>B</sub>     | $4.427 \times 10^{-2}$  | $1.0482 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| -<br>9 <sub>T</sub>     | 5.40686                 | $2.5798 \times 10^4$ | 1.2316 x 10 <sup>6</sup>    | 2.8319 x $10^4$          |
| -<br>10 <sub>B</sub>    | 0.10280                 | $1.0314 \times 10^4$ | $2.1494 \times 10^3$        | 1.8175 x $10^4$          |
| -                       | 0.10280                 | $1.0314 \times 10^4$ | 7.3605                      | $1.3777 \times 10^4$     |

#### GASSAR RELEASE RATE PARAMETERS

**1** •

45



Fig. 13. Fission product release rate vs temperature, SORS data. The upper set of curves gives the release rate for failed particles; the lower set is for intact particles.



rate vs temperature for failed particles, GASSAR.



BISO

\$150

C. Fuel Failure Fraction (Particle Coatings)

The BISO and TRISO particle coatings begin to exhibit failure as a function of temperature (T) and age (t:time of a particular fuel rod in the reactor) of irradiation.

Analytic fits and a functional algorithm were developed from the graphic data displayed in the  $SORS^2$  and  $GASSAR^6$  reports for the failed fraction of particle coatings as a function of temperature and age, f(T,t).

# SORS: f(T,t)

The SORS data is displayed graphically in Figs.5-1, 5-2 of the SORS report (see also Figs. 16 and 17). The failed fraction is approximated as a linear function of temperature in the partially failed region. The boundaries of no coating failures and 100% coating failures are a function of age and type (BISO, TRISO).

Using these assumptions we may write a simple analytic fit of the data to obtain the failed fraction, f(T,t), as a function of the temperature (T) and the age of the fuel (t) for BISO and TRISO fuels.



Fig. 16. Fuel failure diagram for BISO particles, SORS data.





The temperatures for f = 0 (no coating failure) and f = 1 (100% coating failure) at 4 yr and 0.12 yr at the knee of the curves, are given in Table IX. The temperatures for 0 < t < 0.12 yr are taken to be the same for BISO and TRISO fuels.

For  $0 \le t < 0.12$  yr, the failed fraction can be represented as a linear function of temperature by

$$f = A + BT , \qquad (101)$$

where the coefficients A and B for BISO and TRISO are given in Table X.

For 0.12 < t < 4 yr, we fit the f = 0 and f = 1 boundaries by  $\alpha_i e^{\beta_i t}$  (i = 0,1) and perform a linear interpolation between the f = 0 and f = 1 boundaries. This approximation leads us to the form

$$f(T,t) = \frac{T(t) - T_0(t)}{T_1(t) - T_0(t)}$$
 (102)

where

$$T_{i}(t) = \alpha_{i} e^{\beta_{i} t}$$
 (i = 0,1) (103)

and the coefficients  $\alpha_i$  and  $\beta_i$  for BISO and TRISO are given in Table X.

As is mentioned on page 6-3 of the SORS report,<sup>2</sup> linear fuel failure is assumed with 10% failed fuel at 4 yr. This is an amount that is added to the fraction that fails due to temperature; 2.5%, 5%, 7.5%, and 10% failure is added to the 1 yr-,2 yr-,3 yr- and 4-yr-old-fuel respectively.

Figures 16 through 21 were generated using the above equations and data.

| SORS TE | MPERATURES | (K) | FOR AGED                                | FRACTION | FAILURES, | f |
|---------|------------|-----|---|----------|-----------|---|
| Tyj     | pe/f       |     | <u>f</u> = 0                            |          | f = 1     |   |
| BISO:   |            |     |   |          |           |   |
| 0.12    | yr         |     | 1858.15                                 |          | 1998.15   |   |
| 4       | yr         |     | 1360.15                                 | <u></u>  | 1599.15   |   |
| TRISO:  |            |     |   |          |           |   |
| 0.12    | yr         |     | 1858.15                                 |          | 1998.15   |   |
| 4       | yr         |     | 1273.15                                 |          | 1663.15   |   |
|         |            |     | • • · · · · · · · · · · · · · · · · · · |          | /         |   |

TABLE IX

TABLE X SORS AGE-TEMPERATURE FUEL FAILURE PARAMETERS

| Туре  |                                     | $0 \leq t \leq 0.12 \text{ yr}$ |                                     |                            |  |  |  |
|-------|-------------------------------------|---------------------------------|-------------------------------------|----------------------------|--|--|--|
|       | A                                   | <u> </u>                        |                                     |                            |  |  |  |
| BISO  | -13.2725                            | 7.14                            | 286                                 |                            |  |  |  |
| TRISO | -13.2725                            |                                 |                                     |                            |  |  |  |
|       |                                     | 0.12 yr <u>&lt;</u> t           | <u>&lt;</u> 4 yr                    |                            |  |  |  |
| Туре  | 10 <sup>-3</sup> α <sub>0</sub> (K) | $10^{2}\beta_{o}(yr^{-1})$      | 10 <sup>-3</sup> α <sub>1</sub> (K) | $10^{2}\beta_{1}(yr^{-1})$ |  |  |  |
| BISO  | 1.87617                             | 8.04098                         | 2.01197                             | 5.74098                    |  |  |  |
| TRISO | 1.8801                              | 9.74459                         | 2.00953                             | 4.72964                    |  |  |  |



Fig. 18. Fraction of failed particles vs temperature, BISO particles, SORS data. This figure is derived from Fig. 16.



Fig. 19. Fraction of failed particles vs temperature, TRISO particles, SORS data. This figure is derived from Fig. 17.

50

٩



GASSAR: f(T,t)

The graphic data obtained from Fig. 1 and 2 of the GASSAR report are summarized in Tables XI and XII for various aged fuels and particle coating failed fractions.

For the BISO particle coatings, a spline fit to the data was used below a certain failed fraction,  $f_0$ , and temperature T(marked with an asterisk in Table XI). Above  $f_0$ , a linear fit of the form

$$f(t) = A + BT$$
 (104)

was used, where f = 1 if  $T \ge T_1$ . The BISO parameters A, B and the threshold for the linear fit,  $f_0$ , are given in Table XIII.

For the TRISO particle coatings an exponential fit of the form

$$f(t) = \alpha e^{\beta T}$$
(105)

| GASSAR BISO PARTICLE COATING FAILED FRACTIONS AND TEM | PERATURES FOR | VARIOUS AGES |
|---|---------------|--------------|
|---|---------------|--------------|

| Age =   | Age = 1 yr 2 yr |         | 3         | yr      | 4 y       | r       |                    |
|---------|-----------------|---------|-----------|---------|-----------|---------|--------------------|
| f       | T(K)            | f       | T(K)      | f       | T(K)      | f       | T(K)               |
| 0.00179 | T<2073.15       | 0.00377 | T<2073.16 | 0.00526 | T<1690.15 | 0.00718 | T <u>≤</u> 1673.15 |
| 0.282   | 2143.15         | 0.282   | 2143.15   | 0.0059  | 1743.15   | 0.0079  | 1697.15            |
| 1.0     | 2273.15         | 1.0     | 2273.15   | 0.0071  | 1793.15   | 0.010   | 1733.15            |
|         |                 |         |           | 0.0116  | 1873.15   | 0.021   | 1793.15            |
|         |                 |         |           | 0.0185  | 1917.15   | 0.0557  | 1853.15            |
|         |                 |         |           | 0.046   | 1973.15   | 0.10    | 1893.15            |
|         |                 |         |           | 0.057   | 2000.0    | 0.222   | 1973.15            |
|         |                 |         |           | 0.0815* | 2073.15   | 0.4039* | 2073.15            |
|         |                 |         |           | 0.10    | 2083.15   | 0.649   | 2153.15            |
|         |                 |         |           | 0.23    | 2113.15   | 1.0     | 2273.15            |
|         |                 |         |           | 1.0     | 2273.15   |         |                    |

•

•

<sup>\*</sup>Linear fit above this fraction and temperature, spline fit below.

.

•

|--|

. .

1

...

# GASSAR TRISO PARTICLE COATING FAILED FRACTIONS AND TEMPERATURES FOR VARIOUS AGES

| Age =   | l yr    | 2       | yr      | 3       | yr      | 4       | yr      |
|---------|---------|---------|---------|---------|---------|---------|---------|
| f       | T(K)    | f       | T(K)    | f       | T(K)    | f       | T(K)    |
| 0.00157 | 1941.15 | 0.00385 | 1473.15 | 0.00601 | 1473.15 | 0.00677 | 1473.15 |
| 1.0     | 2273.15 | 0.00566 | 1902.15 | 0.00942 | 1888.85 | 0.0109  | 1873.15 |
|         |         | 1.0     | 2273.15 | 1.0     | 2273.15 | 1.0     | 2273.15 |

# TABLE XIII

### GASSAR BISO FAILED FRACTION PARAMETERS

| Age (yr) | fo      | A        | $10^{3}B(K)^{-1}$ |
|----------|---------|----------|-------------------|
| 1        | 0.00179 | -10.3454 | 4.99105           |
| 2        | 0.00377 | -10.3229 | 4.98115           |
| 3        | 0.0815  | - 9.4394 | 4.5925            |
| 4        | 0.4039  | - 5.7751 | 2.9805            |

was used for f  $\leq$  f<sub>o</sub>, which corresponds for TRISO to the first row of Table XII. A linear fit of the form

$$f(T) = A + BT$$
(106)

was used above  $f_0$ , where f = 1 if  $T \ge T_1$ . The TRISO parameters and their temperature ranges are given in Table XIV.

The data described by these analytic fits are displayed for BISO and TRISO in Figs. 22-25.

#### D. Aged Fuel Failure Fraction (Particle Coatings)

Different segments of the HTGR core have been subjected to different irradiation times, or aging, due to the replacement of 1/4 of the fuel rods each year with new fuel rods. <u>SORS</u>: For the SORS data, if this replacement process does not occur, we say the fuel is <u>not</u> aged, and the fraction of failed particle coatings is given by

$$\bar{f} = f(T,t)$$
, (107)

where t is the age in years and Eq. (107) is evaluated using Eqs.(102) and (103) of Section C with the parameters of Table X.

On the other hand, if the fuel replacement process occurs, we say the fuel <u>is aged</u>, and the fraction of failed particle coatings is given by

$$\overline{f} = \frac{1}{4} \sum_{i=1}^{4} f_{i}^{s} [\theta(t - i + 1) - \theta(t - i)], \qquad (108)$$

where t is the age in years, i = [t] + 1, and [ ] means "least integer", with

$$f_{i}^{s} = \begin{cases} 4f_{1} & i = 1 & 0 \leq t \leq 1 \\ f_{1} + 3f_{2} & i = 2 & 1 \leq t \leq 2 \\ f_{1} + f_{2} + 2f_{3} & i = 3 & 2 \leq t \leq 3 \\ f_{1} + f_{2} + f_{3} + f_{4} & i = 4 & 3 \leq t \leq 4 \end{cases}$$
(109)

54

| Age (yr) | ΔΤ(Κ)    | 10 <sup>3</sup> α | $10^{3}\beta(K)^{-1}$ | ΔТ  | A      | 10 <sup>2</sup> β(K) <sup>-1</sup> |
|----------|----------|-------------------|-----------------------|---|--------|------------------------------------|
| 1        | <1941.15 | 1.57              |                       | 1941.15 <t<2273.15< td=""><td>5.8361</td><td>0.300732</td></t<2273.15<> | 5.8361 | 0.300732                           |
| 2        | <1894.15 | 0.99966           | 0.915323              | 1894.15 <t<2273.15< td=""><td>4.9638</td><td>0.262359</td></t<2273.15<> | 4.9638 | 0.262359                           |
| 3        | <1888.15 | 1.2240            | 1.08109               | 1888.15 <t<2273.15< td=""><td>4.8593</td><td>0.257762</td></t<2273.15<> | 4.8593 | 0.257762                           |
| 4        | <1873.15 | 1.17176           | 1.19064               | 1873.15 <t<2273.15< td=""><td>4.6209</td><td>0.24728</td></t<2273.15<>  | 4.6209 | 0.24728                            |

,

# GASSAR TRISO FAILED FRACTION PARAMETERS

TABLE XIV

•

r

•

3

# 55

----



and

$$f_i = f[T, t \mod(4)] = f(T, i-1 + x),$$
 (110)

where  $x \equiv t - [t]$ , using the parameters of Table X. <u>GASSAR</u>: For the GASSAR data, if the fuel is not aged, then a linear interpolation is performed between the two nearest ages, or

$$\overline{f} = \sum_{i=1}^{4} [(1-x)f_{i-1}^{G} + xf_{i}^{G}][\theta(t-i+1) - \theta(t-1)], \qquad (111)$$

where  $f_0^G \equiv 0$ , i = [t] + 1, x = t - [t], and  $f_i^G$  is given by

$$f_{i}^{G} = f(T,t) = f(T, i-1 + x),$$
 (112)

using Eqs. (104-106) and Tables XIII and XIV of Sec. C.

On the other hand, if the fuel is aged, then the particle coating failed fuel fraction is given by

$$\overline{f} = \frac{1}{4} \sum_{i=1}^{4} f_{i}^{\circ} [\theta(t - i + 1) - \theta(t - 1)], \qquad (113)$$

where

$$\hat{f}_{i}^{G} = \begin{cases} 4 x f_{1}^{G} & i = 1 & 0 \le t \le 1 \\ 3 f_{1}^{G} - 2 x f_{1}^{G} + 3 x f_{2}^{G} & i = 2 & 1 \le t \le 2 \\ f_{1}^{G} + (2 - x) f_{2}^{G} + 2 x f_{3}^{G} & i = 3 & 2 \le t \le 3 \\ f_{1}^{G} + f_{2}^{G} + f_{3}^{G} + x f_{4}^{G} & i = 4 & 3 \le t \le 4 \end{cases}$$

$$(114)$$

with

$$f_{i}^{G} = f(T,t) = f(T, i-1 + x),$$
 (115)

using Eqs. (104-106) and Tables XIII and XIV of Sec. C.

The failed fraction in BISO, TRISO, and TOTAL = 0.6 BISO + 0.4 TRISO for the SORS and GASSAR models are displayed in Figs. 26-37 for aged and not aged fuel. (LAGE = T and F respectively)

We note that the SORS (Ft. St. Vrain) model exhibits an exponential rise in the failed fraction between refuelings compared to the linear rise of the GASSAR model in the same circumstance. The temperatures of Fig. 1 were used and were held constant in time.

The maximum and minimum failed fraction for the SORS data are (0.08, 0.04). The maximum and minimum for the GASSAR data are (0.004, 0.0025). Thus, a factor of (20,16) decrease in the maximum and minimum, in going from SORS to GASSAR data is obtained.



Fig. 26. Failed fraction vs age of the fuel in years, BISO particles, SORS data, aged fuel.



Fig. 27. Failed fraction vs age of the fuel in years, TRISO particles, SORS data, aged fuel.



Fig. 28. Failed fraction vs age of the fuel in years, averaged total for aged fuel, SORS data.



Fig. 29. Failed fraction vs age of the fuel in years, BISO particles, SORS data, fuel not aged.



Fig. 30. Failed fraction vs age of the fuel in years, TRISO particles, SORS data, fuel not aged.



Fig. 31. Failed fraction vs age of the fuel in years, averaged total for fuel not aged, SORS data.



Fig. 32. Failed fraction vs age of the fuel in years, BISO particles, GASSAR data, aged fuel.



Fig. 33. Failed fraction vs age of the fuel in years, TRISO particles, GASSAR data, aged fuel.



Fig. 34. Failed fraction vs age of the fuel in years, averaged total for aged fuel, GASSAR data.



Fig. 35. Failed fraction vs age of the fuel in years, BISO particles, GASSAR data, fuel not aged.



Fig. 36. Failed fraction vs age of the fuel in years, TRISO particles, GASSAR data, fuel not aged.

Fig. 37. Failed fraction vs age of the fuel in years, averaged total for fuel not aged, GASSAR data.

#### IV. COMPARISONS

A comparison for  $^{131}$ I was made for the Ft. St. Vrain fuel model (MFUEL = 1) with an average age of 2.5 yr (AGE = 2.5), fuel not aged (LAGE = F). A BISO-TRISO mixture (0.6, 0.4) was used (FRAC = 0.6). Six partitions of the core volume IC = 1, 5, 10, 25, 100, 200 and five partitions of the 20 h time period IT = 20, 40, 100, 300, 500 were used. A typical result is displayed in Figs. 38 and 39 and compared with the uniform temperature model of Ref. 1 for the fraction in the coolant and the cumulative release. Four temperature models SORS, CORCON, AYER, and AYER Fu-Cort (ITEMP = 1, 2, 3, 4) and the four equation models, Simplified Model-Renormalized, Constant Release-Renormalized, Linear Felease-Renormalized, and Intact-Failed Self-Consistent fuel transition (NEQ = 1, 2, 3, 4) were used.

A typical terminal run output under the NOS system is displayed in Fig. 40.





Fig. 38. LARC-1 and uniform temperature model results, fraction in coolant.



I-131 ISO=10 MFUEL=1 AGE= 2.5 LAGE=F FRAC= .6 YIELD= .031 NTOT= 100 IVFMAX=100 JOB=R4LCP 555 DATE=09/20/76 NEQ=2 CONSTANT RELEASE RATE. CONSTANT FAILURE

Fig. 39. LARC-1 and uniform temperature model results, cumulative release.

? END END TEXT EDITING. SEDIT.LARC1. /REWINDILGO SREWIND.LGD. /REPLACE · LARC1 FUNINE FLARES CTIME 015.277 SEC. FUN LASL20 1.60 JOBNAME - AJUI210 DATE = 76/08/30. TIME =10.33.34 ISOTOPE NAME -? I-131 DECAY CONSTANT (CHR) ? 3.53∈-3 RELEASE GROUP -? 10 YIELD (FRACTION) -? .031 AGE IN YEARS -? 2.3 FUEL TYPE (FT. ST. VRAIN =1, GASSAR =2) = ? 1 FUEL AGED (T) OR NOT AGED (F)? ? F FRACTION OF BISD IN LOADING -? 0.0 NOBLE GAS? (T DR F) 7 F DECAY CONSTANT = 3.580E-03 GROUP =10 I-131 7IELD - 3.100E-02 NZERD = 7.792E+07AGE - 2.30 LAGE -F FRAC -.60 NEQ 44 - דנדא 100 TEMPERATURE HODEL USED - 1 MFUEL =1 ISOTOPE -I-131 IVFMAX = 100 INTERVAL TIME AMOUNT FRACTION AMOUNT AMOUNT IN CUMULATED NUMBER REMAINING IN COOLANT IN COOLANT CONTAINMENT (HR) RELEASE (CURIES) (CURIES) BLDG (CURIES) (CURIES) 1.00 3 7.76E+07 8.67E+02 1.11E-03 6.92E+02 .01 .43 10 2.00 7.73E+07 4.885+04 6.262-04 3.932+04 3.00 7.63E+07 7.70E+03 3°33E-03 5.582+05 3.95 15 20 4.00 7.302+07 3.772+06 4.832-02 2.332+06 65.62 1.372-01 6.392+07 23 5.00 1.07E+07 5.722+06 229.13 6.00 3.41E+07 2.222+07 2.342-01 30 1.01E+07 339.24 7.00 33 3.932+07 3.65E+07 4.688-01 1.36E+07 1061.39 8.00 2.572+07 40 5.00E+07 6.42E-01 1.44E+07 1656.69 43 9.00 1.31E+07 6.04E+07 7.73E-01 1.26E+07 2226.51 30 10.00 6.71E+07 8.61E-01 8.132+06 9.312+06 2689.03 55 11.00 4.032+06 7.092+07 9.10E-01 6.42E+06 3019.60 60 12.00 1.34E+06 7.282+07 9.35E-01 3.972+06 3233.48 2.262+06 63 13.00 7.722+05 7.36E+07 9.432-01 3360.77 70 14.00 2.992+03 7.38E+07 9.48E-01 1.21E+06 3431.21 6.07E+03 3467.79 75 15.00 1.062+03 7.382+07 9.47E-01 80 16.00 3.402+04 7.362+07 9.44E-01 2.902+03 3485.74 7.33E+07 17.00 9.81E+03 3494.13 9.41E-01 1.322+03 82 30 18.00 2.31E+03 7.31E+07 9.33E-01 3.732+04 3497.88 7.28E+07 9.332-01 32 2.462+04 3499.51 19.00 3.71E+02 20.00 1.132+02 7.262+07 9.312-01 1.02E+04 3300.19 100 DOES ANOTHER CASE FOLLOW? ? NJ EXIT

Fig. 40. Typical terminal run output for LARC-1 under NOS system.

The most sensitive test of these 320 calculations was the comparison of the fraction in the coolant and the cumulative release at 2 h time. These results are given in Appendix E. The main result is that at 2 h the maximum variation between (IT, IC) of (100, 100) and (500, 200) for the <sup>131</sup>I fraction release in the coolant is  $\sim$  20% for any temperature model whereas the various temperature models differ by as much as a factor of 3.7. Similarly for the cumulative release the maximum variation is  $\sim$  19% for any temperature model, whereas the various temperature models differ by as for any temperature model temperature model.

The  $^{131}$ I fraction in the coolant and cumulative release as a function of time and model number (NEQ) are given in Tables XV - XXII for the four temperature models with IT = IC = 100. We note that better than two-digit agreement for the fraction in the coolant between the various equation models occurs after 4 h for all temperature models, Tables XV - XVIII.

Taking model 4, the Intact-Failed Self-Consistent Fuel model, as a standard, we compare the <sup>131</sup>I cumulative release in Tables XXIII-XXVI. Again we note that the maximum difference occurs at  $^{\circ}$  2 h where as much as a 17% error can occur at the 0.4 Ci level. However, comparing Tables XIX - XXVI we can estimate an approximate upper bound on the error in the cumulative release, displayed in Fig. 41. A good rule of thumb is that the error made by the renormalized models compared to the Intact-Failed Self-Consistent model is " less than 5% at 50 Ci, and less than 1% at 300 Ci."

A similar set of comparisons was made for  $^{127m}$ Te, and is summarized in Tables XXVII - XXIX for the fraction in the coolant, the cumulative release and the comparison to model 4. We note that the cumulative release at 20 h has only reached 25 Ci, as compared to 3500 for  $^{131}$ I. The maximum error, 12%, occurs at 6 h as compared to 2 h for  $^{131}$ I. The approximate upper bound for  $^{131}$ I bounds the  $^{127m}$ Te results.

64

#### TABLE XV

131 i fraction in the coolant itemp = 1, it = 100, ic = 100

٠

| . NEQ |          |          |          |
|-------|----------|----------|----------|
| T(II) | 1,2      | 3        | 4        |
| 2     | 0.000522 | 0.000522 | 0.000626 |
| 4     | 0.0475   | 0.0475   | 0.0483   |
| 6     | 0.284    | 0.284    | 0.284    |
| 8     | 0.641    | 0.641    | 0.642    |
| 10    | 0.861    | 0.861    | 0.861    |
| 12    | 0.935    | 0.935    | 0.935    |
| 14    | 0.948    | 0.948    | 0.948    |
| 16    | 0.944    | 0.944    | 0.944    |
| 18    | 0.938    | 0.938    | 0.938    |
| 20    | 0.931    | 0.931    | 0.931    |

#### TABLE XVI

131 I FRACTION IN COOLANT AT 2 h ITEMP = 2, IT = 100, IC = 100

| NEQ  |          |          |          |
|------|----------|----------|----------|
| т(н) | 1,2      | 3        | 4        |
| 2    | 0.000157 | 0.000157 | 0.000175 |
| 4    | 0.0129   | 0.0129   | 0.0135   |
| 6    | 0.134    | 0.134    | 0.135    |
| 8    | 0.401    | 0.401    | 0.402    |
| 10   | 0.670    | 0.670    | 0.670    |
| 12   | 0.842    | 0.842    | 0.842    |
| 14   | 0.917    | 0.917    | 0.917    |
| 16   | 0.936    | 0.936    | 0.936    |
| 18   | 0.936    | 0.936    | 0.936    |
| 20   | 0.931    | 0.931    | 0.931    |

#### TABLE XVI

131 I FRACTION IN COOLANT ITEMP = 3, IT = 100, IC = 100

| NEO  |                |          |          |
|------|----------------|----------|----------|
| T(H) | 1.2            | 3        | 4        |
| 2    | 0.000144       | 0.000144 | 0.000169 |
| 4    | 0.0158         | 0.0158   | 0.0165   |
| 6    | 0.113          | 0.113    | 0.114    |
| 8    | 0.325          | 0.325    | 0.326    |
| 10   | 0.586          | 0.586    | 0.587    |
| 12   | 0.791          | 0.791    | 0.791    |
| 14   | 0.895          | 0.895    | 0.895    |
| 16   | 0 <b>.9</b> 29 | 0.929    | 0.929    |
| 18   | 0.934          | 0.934    | 0.934    |
| 20   | 0.931          | 0.931    | 0.931    |

#### TABLE XVIII

# 131 FRACTION IN COOLANT ITEMP = 4, IT = 100, IC = 100

| NEQ  |          |          |          |
|------|----------|----------|----------|
| т(н) | 1,2      | 3        | 4        |
| 2    | 0.000220 | 0.000220 | 0.000269 |
| 4    | 0.0203   | 0.0206   | 0.0211   |
| 6    | 0.139    | 0.139    | 0.139    |
| 8    | 0.362    | 0.362    | 0.362    |
| 10   | 0.540    | 0.540    | 0.540    |
| 12   | 0.646    | 0.646    | 0.646    |
| 14   | 0.717    | 0.717    | 0.717    |
| 16   | 0.767    | 0.767    | 0.767    |
| 18   | 0.803    | 0.803    | 0.802    |
| 20   | 0.827    | 0.827    | 0.827    |

# TABLE XIX

| 131           |                  |
|---------------|------------------|
| I CUMULATIVE  | RELEASE (CURIES) |
| ITEMP = 1, IT | = 100, IC = 100  |

| NEQ  | ]        |          |          |          |
|------|----------|----------|----------|----------|
| T(H) | 1        | 2        | 3        | 4        |
| 2    | 0.362    | 0.362    | 0.353    | 0.429    |
| 4    | 63.620   | 63.646   | 63.299   | 65.617   |
| 6    | 556.424  | 556.781  | 555.819  | 559.238  |
| 8    | 1654.131 | 1655.048 | 1654.214 | 1656.690 |
| 10   | 2687.453 | 2688.273 | 2687.888 | 2689.032 |
| 12   | 3232.777 | 3233.196 | 3233.047 | 3233.480 |
| 14   | 3430.953 | 3431.101 | 3431.045 | 3431.212 |
| 16   | 3485.639 | 3485.678 | 3485.651 | 3485.742 |
| 18   | 3497.822 | 3497.831 | 3497.810 | 3497.883 |
| 20   | 3500.136 | 3500.137 | 3500.118 | 3500.188 |

| INDUL AA | TA | BLE | XX |
|----------|----|-----|----|
|----------|----|-----|----|

131 CUMULATIVE RELEASE (CURIES) ITEMP = 2, IT = 100, IC = 100

| NEQ         |          |          | <u> </u> | <del>, , , , , , , , , , , , , , , , , , , </del> |
|-------------|----------|----------|----------|---|
| <u>T(H)</u> | 1        | 2        | 3        | 4   |
| 2           | 0.164    | 0.164    | 0.162    | 0.177   |
| 4           | 15.101   | 15.105   | 14.994   | 16.071  |
| 6           | 235.211  | 235.330  | 234.763  | 237.816   |
| 8           | 942.483  | 942.944  | 942.250  | 945.159   |
| 10          | 1909.057 | 1909.699 | 1909.208 | 1911.122  |
| 12          | 2710.293 | 2710.852 | 2710.570 | 2711.583  |
| 14          | 3181.464 | 3181.803 | 3181.674 | 3182.123  |
| 16          | 3386.173 | 3386.317 | 3386.296 | 3386.450  |
| 18          | 3455.200 | 3455.246 | 3455.221 | 3455.327  |
| 20          | 3474.843 | 3474.855 | 3474.837 | 3474.919  |

# TABLE XXI

| NEQ  |          |          |          | · · · · · · · · · · · · · · · · · · · |
|------|----------|----------|----------|---------------------------------------|
| T(H) | 1        | 2        | 3        | 4                                     |
| 2    | 0.129    | 0.129    | 0.127    | 0.142                                 |
| 4    | 19.972   | 19.976   | 19.871   | 21.152                                |
| 6    | 212.131  | 212.199  | 211.822  | 214.730                               |
| 8    | 764.819  | 765.116  | 764.545  | 767.487                               |
| 10   | 1620.123 | 1620.675 | 1620.123 | 1622.351                              |
| 12   | 2468.057 | 2468.659 | 2468.291 | 2469.601                              |
| 14   | 3043.649 | 3044.072 | 3043.891 | 3044.513                              |
| 16   | 3323.847 | 3324.050 | 3323.975 | 3324.247                              |
| 18   | 3429.105 | 3429.180 | 3429.143 | 3429.285                              |
| 20   | 3463.127 | 3463.152 | 3463.130 | 3463.227                              |

#### 131 I CUMULATIVE RELEASE (CURIES) ITEMP = 3, IT = 100, IC = 100

# TABLE XXII

### 131 I CUMULATIVE RELEASE (CURIES) ITEMP = 4, IT = 100, IC = 100

| NEQ  |          |          |          |                |
|------|----------|----------|----------|----------------|
| T(H) | 1        | 2        | 3        | 4 <sup>.</sup> |
| 2    | 0.186    | 0.186    | 0.183    | 0.214          |
| 4    | 27.313   | 27.320   | 27.172   | 28.390         |
| 6    | 262.656  | 262.801  | 262.290  | 264.627        |
| 8    | 888.430  | 889.010  | 888.353  | 890.765        |
| 10   | 1610.957 | 1611.575 | 1611.152 | 1612.910       |
| 12   | 2126.310 | 2126.664 | 2126.440 | 2127.661       |
| 14   | 2469.188 | 2469.388 | 2469.256 | 2470.152       |
| 16   | 2711.513 | 2711.641 | 2711.552 | 2712.238       |
| 18   | 2888.546 | 2888.635 | 2888.569 | 2889.110       |
| 20   | 3020.609 | 3020.671 | 3020.616 | 3021.063       |

#### TABLE XXIII

 $\frac{131}{1:} |R_{i}/R_{4} - 1| \times 10^{2}$ PERCENTAGE DIFFERENCE IN MODELS COMPARED TO MODEL 4 ITEMP = 1, IT = 100, IC = 100

| NEQ |        |        | ·· <b>·</b> |
|-----|--------|--------|-------------|
| T   | 1      | 2      | 3           |
| 2   | 15.62  | 15.62  | 17.72       |
| 4   | 3.04   | 3.00   | 3.53        |
| 6   | 0.50   | 0.44   | 0.61        |
| 8   | 0.15   | 0.10   | 0.15        |
| 10  | 0.06   | 0.03   | 0.04        |
| 12  | 0.02   | 0.009  | 0.013       |
| 14  | 0.008  | 0.003  | 0.005       |
| 16  | 0.003  | 0.002  | 0.003       |
| 18  | 0.002  | 0.0015 | 0.002       |
| 20  | 0.0015 | 0.0015 | 0.002       |

#### TABLE XXIV

 $\frac{13I}{1:} [R_i/R_4 - 1] \times 10^2$ PERCENTAGE DIFFERENCE IN MODELS COMPARED TO MODEL 4
ITEMP = 2, IT = 100, IC = 100

| NEQ |       |       |       |
|-----|-------|-------|-------|
| Т   | 1     | 2     | 3     |
| 2   | 7.34  | 7.34  | 8.47  |
| 4   | 6.04  | 6.01  | 6.70  |
| 6   | 1.10  | 1.05  | 1.28  |
| 8   | 0.28  | 0.23  | 0.31  |
| 10  | 0.11  | 0.07  | 0.10  |
| 12  | 0.05  | 0.03  | 0.04  |
| 14  | 0.02  | 0.01  | 0.01  |
| 16  | 0.008 | 0.004 | 0.005 |
| 18  | 0.004 | 0.002 | 0.003 |
| 20  | 0.002 | 0.002 | 0.002 |

TABLE XXVI

 $\begin{array}{rl} 131 \\ \text{I:} & |\texttt{R}_{1}/\texttt{R}_{4} + 1| \ge 10^{2} \\ \text{PERCENTAGE DIFFERENCE IN NODELS COMPARED TO MODEL 4} \\ \text{ITEMP = 4, IT = 100, IC = 100} \end{array}$ 

# TABLE XXV

<sup>131</sup>i:  $|R_i/R_4 - 1| \ge 10^2$ PERCENTAGE DIFFERENCE IN NODELS COMPARED TO MODEL 4 ITEMP = 3, IT = 100, IC = 100

| <b>a</b> |       |       |       |
|----------|-------|-------|-------|
| NEQ      |       |       |       |
| <u>T</u> | 1     | 2     | 3     |
| 2        | 13.08 | 13.08 | 14.49 |
| 4        | 3.79  | 3.77  | 4.29  |
| 6        | 0.74  | 0.69  | 0.88  |
| 8        | 0.26  | 0.20  | 0.27  |
| 10       | 0.12  | 0.08  | 0.11  |
| 12       | 0.06  | 0.05  | 0.06  |
| 14       | 0.04  | 0.03  | 0.04  |
| 16       | 0.03  | 0.02  | 0.03  |
| 18       | 0.020 | 0.016 | 0.019 |
| 20       | 0.015 | 0.013 | 0.015 |

| NEQ |       |       |       |
|-----|-------|-------|-------|
| Т   | 1     | 2     | 3     |
| 2   | 9.15  | 9.15  | 10.56 |
| 4   | 5.58  | 5.56  | 6.06  |
| 6   | 1.21  | 1.18  | 1.35  |
| 8   | 0.35  | 0.31  | 0.38  |
| 10  | 0.14  | 0.10  | 0.14  |
| 12  | 0.06  | 0.04  | 0.05  |
| 14  | 0.03  | 0.01  | 0.02  |
| 16  | 0.01  | 0.006 | 0.008 |
| 18  | 0.005 | 0.003 | 0.004 |
| 20  | 0.003 | 0.002 | 0.003 |



Fig. 41. Approximate upper bound to error in cumulative release in 131 I calculations using IT = IC = 100 for all temperature models.

# TABLE XXVII

127m Te FRACTION IN COOLANT ITEMP = 4, IT = 100, IC = 100

| T(H) | 1,2      | 3        | 4        |
|------|----------|----------|----------|
| 2    | 0.000128 | 0.000128 | 0.000128 |
| 4    | 0.00114  | 0.00114  | 0.00126  |
| 6    | 0.0435   | 0.0435   | 0.0484   |
| 8    | 0.205    | 0.205    | 0.210    |
| 10   | 0.324    | 0.324    | 0.327    |
| 12   | 0.405    | 0.405    | 0.408    |
| 14   | 0.475    | 0.475    | 0.477    |
| 16   | 0.539    | 0.539    | 0.541    |
| 18   | 0.594    | 0.594    | 0.595    |
| 20   | 0.642    | 0.642    | 0.644    |
# TABLE XXVIII <sup>127m</sup>Te CUMULATIVE RELEASE (Ci) ITEMP = 4, IT = 100, IC = 100

| T(H) | 1      | 2      | 3      | 4      |
|------|--------|--------|--------|--------|
| 2    | 0.002  | 0.002  | 0.002  | 0.002  |
| 4    | 0.019  | 0.019  | 0.019  | 0.020  |
| 6    | 0.627  | 0.629  | 0.627  | 0.713  |
| 8    | 5.063  | 5.071  | 5.067  | 5.269  |
| 10   | 10.573 | 10.571 | 10.577 | 10.733 |
| 12   | 14.597 | 14.601 | 14.600 | 14.717 |
| 14   | 17.746 | 17.749 | 17.748 | 17.847 |
| 16   | 20.517 | 20.519 | 20.519 | 20.605 |
| 18   | 22.970 | 22.971 | 22.971 | 23.039 |
| 20   | 25.102 | 25.103 | 25.102 | 25.160 |

## TABLE XXIX $127m_{Te:} |R_1/R_4 - 1| \times 10^2$ PERCENTAGE DIFFERENCE IN MODELS COMPARED TO MODEL 4 ITEMP = 4, IT = 100, IC = 100

| T (H) | 11    | 2     | 3     |
|-------|-------|-------|-------|
| 2     | 0.0   | 0.0   | 0.0   |
| 4     | 5.00  | 5.00  | 5.00  |
| 6     | 12.06 | 12.06 | 12.06 |
| 8     | 3.91  | 3.76  | 3.83  |
| 10    | 1.49  | 1.43  | 1.45  |
| 12    | 0.82  | 0.79  | 0.79  |
| 14    | 0.57  | 0.55  | 0.55  |
| 16    | 0.43  | 0.42  | 0.42  |
| 18    | 0.30  | 0.30  | 0.30  |
| 20    | 0.23  | 0.23  | 0.23  |

Results for three representative isotopes,  $^{131}$ I,  $^{135}$ Xe, and  $^{138}$ Xe, are displayed in Figs. 42 through 45. On each figure four temperature models are displayed. The SORS (ITEMP = 1) model gives the largest release and the AYER-Fu Cort (ITEMP = 4) model the smallest.

The sensitivity of the accumulated release to fuel modeling where the fuel is the Ft. St. Vrain (FSV) or GASSAR model is illustrated in Figs. 42 and 43, respectively, where there is a 50% reduction at 9 h in using the GASSAR model.

The sensitivity of the temperature models and the effects of larger  $\lambda$ 's is illustrated in Figs. 44 and 45 for  $^{135}$ Xe and  $^{138}$ Xe, respectively. For  $^{135}$ Xe the different temperature models predict a 30% difference in fraction released in the coolant with a 4-h time spread in the maximum. The  $^{135}$ Xe decay constant causes the decaying tail after the peak release.

The double peak exhibited by <sup>137</sup>Xe in Fig. 45 was investigated in detail and is explained as follows: the first peak is formed because of release from intact particles. Decay causes it to fall because most of the amount available for release is depleted by decay. During the fall, the rise in temperature of the SORS model is sufficient to cause a large increase in the failed fraction before decay again causes the second peak to fall off. In the CORCON and AYER temperature models. The temperature-time behavior is such that decay overrides the increased failure and a leveling off of the second peak is expected.

### V. CONCLUSIONS

We have developed and compared four analytical models of fission product release from an HTGR core during the LOFC accident. We have also developed a numerical data base for release constants, temperature modeling, fission product release rates, coated fuel particle failure fraction and aged coated fuel particle failure fraction. Analytic fits and graphic displays for these data were given for the Ft. St. Vrain and GASSAR models.



Fig. 42. Calculated time-dependent release of <sup>131</sup>I from the reactor core using the Ft. St. Vrain fuel failure model and using four different core temperature models.



Fig. 43. Calculated time-dependent release of <sup>131</sup>I from the reactor core using the GASSAR fuel failure model and using four different core temperature models.



Fig. 44. Calculated time-dependent release of <sup>135</sup>Xe from a large HTGR using four different core temperature models.



Fig. 45. Calculated time-dependent release of <sup>138</sup>Xe from a large HTGR using four different core temperature models.

The assumptions of the simplified model<sup>1</sup> have been systematically removed. However, the LARC-1 program neglects precursors, diffusion, and absorption and evaporation of the metallics. These topics will be treated in subsequent reports.

Comparison of the various analytic models indicates that the use of a renormalized constant release model is sufficiently accurate to warrant the extension of this method to more complex theoretical modelings.

Comparisons of the various temperature and release models indicate that these are the most sensitive LARC-1 parameters in that order. The need for detailed accurate temperature calculations and physically realistic release models, that are validated by experiment, must be emphasized.

#### REFERENCES

- 1. J. E. Foley, "<sup>131</sup>I Release from an HTGR During the LOFC Accident," Los Alamos Scientific Laboratory report LA-5893-MS (March 1975).
- 2. M. H. Schwartz, D. B. Sedgley, and M. M. Mendonca, "SORS: Computer Programs for Analyzing Fission Product Release from HTGR Cores During Transient Temperature Excursions," General Atomic Company report GA-Al2462 (April 1974).
- 3. K. E. Schwartztrauber and F. A. Silady, "CORCON: A Program for Analysis of HTGR Core Heatup Transients," General Atomic Company report GA-Al2868 (July 1974).
- 4. R. G. Lawton, "The AYER Heat Conduction Computer Program," Los Alamos Scientific Laboratory report LA-5613-MS (May 1974).
- 5. J. H. Fu and G. E. Cort, "Fuel Failure Fraction and Iodine Release Calculation from GASSAR July 18, 1975 Models," Los Alamos Scientific Laboratory internal document (December 1975).
- 6. GASSAR-6, General Atomic Standard Safety Analysis report, GA-A13200, Vol. II, Chap. 4, Fig. 4.4-8 (July 1975).

- J. H. Fu and G. E. Cort, "The Fraction Fuel Volume Above Certain Temperature Levels During an LOFC Accident," Los Alamos Scientific Laboratory internal document (March 1976).
- J. L. Walsh, J. H. Ahlberg, and E. N. Nilson, "Best Approximation Properties of the Spline Fit," J. Math. and Mechanics, II No. 2, 225 (1962); J. H. Ahlberg, E. N. Nilson, and J. L. Walsh, <u>The Theory of Splines and Their Applications</u>, (Academic Press, Inc., New York 1967), p. 296.
- 9. T. L. Jordan and B. Fagen, Programs El02, El03, "Spline Interpolation and Function Evaluation," Los Alamos Scientific Laboratory Computing Division Program Library (April 1969).
- 10. T. L. Jordan, "Smoothing and Multivariant Interpolation with Splines," Los Alamos Scientific Laboratory report LA-3137 (June 1964).
- 11. T. L. Jordan, Program E104, "Two-Dimensional Bi-Cubic Spline Interpolation - Coefficient Calculation," Los Alamos Scientific Laboratory Computer Division Program Library (December 1967).
- 12. GASSAR-6, General Atomic Standard Safety Analysis report, GA-A13200, Vol. I, Chapt. 2, Appendix 2A, Amendment 3 (July 1975).

#### APPENDIX A

EVALUATION OF THE  $M_{k}^{}(\tau)\,\text{, and }\hat{P}_{k}^{}(\tau)$  FUNCTIONS

The 
$$M_k(\tau)$$
,  $P_k(\tau)$ , and  $\hat{P}_k(\tau)$  functions are defined by  $-\Lambda_{\tau}\tau$ 

$$M_{o}(\Lambda_{1},\tau) = e^{-\Lambda_{1}\tau}$$
 (A-1)

$$M_{k}(\Lambda_{1},\alpha,\beta,\tau) = e^{-\Lambda_{1}\tau} P_{k-1}(-\alpha,\beta,\tau), \quad 1 \le k \le 3$$
(A-2)

$$M_{4}(\gamma,\beta,\tau) = e^{-\gamma\tau-\beta\tau^{2}}, \qquad (A-3)$$

$$M_{5}(\gamma,\beta,\tau) = \tau e^{-\gamma\tau-\beta\tau^{2}}, \qquad (A-4)$$

$$P_{k}(\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ s^{k} \ e^{-\gamma s - \beta s^{2}}, \text{ and}$$
(A-5)

$$\hat{P}_{k}(\tau) = \int_{0}^{\tau} ds \ M_{k}(s).$$
 (A-6)

First, we investigate the function  $P_k\left(\gamma,\beta,\tau\right)$  given by Eq.(A-5) as

$$P_{k}(\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ s^{k} \ e^{-\gamma s - \beta s^{2}}$$
$$= \left(-\frac{\partial}{\partial \gamma}\right)^{k} P_{0}(\gamma,\beta,\tau) .$$
(A-7)

Thus, Eq.(A-5) need be integrated only for k = 0 as the other forms may be found by differentiation. For  $\beta \neq 0$ , we find

$$P_{O}(\gamma,\beta,\tau) = \int_{O}^{\tau} ds \ e^{-\gamma s - \beta s^{2}}$$
$$= \frac{1}{2} \sqrt{\frac{\pi}{\beta}} \ e^{\gamma^{2}/4\beta} \left[ erf(\sqrt{\beta}\tau + \frac{\gamma}{2\sqrt{\beta}}) - erf(\frac{\gamma}{2\sqrt{\beta}}) \right]. \quad (A-8)$$

For  $\beta = 0$ , Eq. (A-8) becomes

$$P_{o}(\gamma, 0, \tau) = \frac{1}{\gamma} (1 - e^{-\gamma \tau})$$
 (A-9)

and for  $\beta = \gamma = 0$ , we have

$$P_{O}(0,0,\tau) = \tau$$
 (A-10)

Using Eq. (A-7) we find for  $P_1(\gamma,\beta,\tau)$  and its limiting forms

$$P_{1}(\gamma,\beta,\tau) = -\frac{\gamma}{2\beta} P_{0}(\gamma,\beta,\tau) + \frac{1}{2\beta} (1 - e^{-\gamma\tau - \beta\tau^{2}}), \qquad (A-11)$$

$$P_{1}(\gamma, 0, \tau) = \frac{1}{\gamma^{2}} [1 - (1 + \gamma \tau) e^{-\gamma \tau}], \qquad (A-12)$$

and

$$P_1(0,0,\tau) = \frac{\tau^2}{2}$$
 (A-13)

Similarly, for  $P_2(\gamma, \beta, \tau)$  we have

$$P_{2}(\gamma,\beta,\tau) = \frac{1}{4\beta^{2}} \left[ (\gamma^{2}+2\beta)P_{0}(\gamma,\beta,\tau) - \gamma(1-e^{-\gamma\tau-\beta\tau^{2}}) + (\gamma-2\beta\tau) e^{-\gamma\tau-\beta\tau^{2}} \right], \qquad (A.14)$$

$$P_{2}(\gamma,0,\tau) = \frac{1}{\gamma^{3}} [2 - (2+2\gamma\tau+\gamma^{2}\tau^{2}) e^{-\gamma\tau}] , \qquad (A-15)$$

and

$$P_2(0,0,\tau) = \frac{\tau^3}{3}$$
 (A-16)

Using the results of Eqs.(A-7) - (A-16), we may determine the  $M_k(\tau)$  functions as given by Eqs.(A-1) - (A-4). Specifically, for  $\beta \neq 0$ 

$$M_{1}(\Lambda_{1},\alpha,\beta,\tau) = e^{-\Lambda_{1}\tau} P_{0}(-\alpha,\beta,\tau), \qquad (A-17)$$

$$M_{2}(\Lambda_{1},\alpha,\beta,\tau) = \frac{e^{-\Omega_{1}\tau}}{2\beta} [\alpha P_{0}(-\alpha,\beta,\tau) + 1 - e^{\alpha\tau-\beta\tau^{2}}], \quad (A-18)$$

and

$$M_{3}(\Lambda_{1},\alpha,\beta,\tau) = \frac{e^{-\Lambda_{1}\tau}}{4\beta^{2}} [(\alpha^{2}+2\beta)P_{0}(-\alpha,\beta,\tau) + \alpha(1 - e^{\alpha\tau-\beta\tau^{2}}) - (\alpha-2\beta\tau)e^{\alpha\tau-\beta\tau^{2}}] \cdot (A-19)$$

For  $\beta = 0$  and  $\beta = \alpha = 0$ , the  $M_k(\tau)$  functions for  $1 \le k \le 3$  are found from Eq. (A-2) and the limiting forms of  $P_k(\gamma, \beta, \tau)$ .

Next we address the evaluation of  $\hat{P}_k(\tau)$ . For k = 0, 4, and 5 integration of Eqs (A-1),(A-3), and (A-4) yields

$$\hat{P}_{o}(\Lambda_{1},\tau) = \frac{1}{\Lambda_{1}} (1 - e^{-\Lambda_{1}\tau}) ,$$
 (A-20)

$$\hat{P}_{4}(\gamma,\beta,\tau) = P_{0}(\gamma,\beta,\tau) , \qquad (A-21)$$

and

$$\hat{P}_{5}(\gamma,\beta,\tau) = P_{1}(\gamma,\beta,\tau) , \qquad (A-22)$$

where we have used Eq. (A-7). For  $1 \le k \le 3$ , using Eqs.(A-6) and (A-2),

$$\hat{P}_{k}(\Lambda,\gamma,\beta,\tau) = \left(-\frac{\partial}{\partial\gamma}\right)^{k} \hat{P}_{1}(\Lambda,\gamma,\beta,\tau), \qquad (A-23)$$

where

$$\hat{P}_{1}(\Lambda,\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda s} \ P_{0}(\gamma,\beta,s)$$
$$= \frac{1}{\Lambda} \ [P_{0}(\Lambda+\gamma,\beta,\tau) - e^{-\Lambda\tau}P_{0}(\gamma,\beta,\tau)], \qquad (A-24)$$

which can be proved by direct integration using Eq. (A-8). Differentiating Eq. (A-24), according to Eq. (A-23), we find

$$\hat{P}_{2}(\Lambda,\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda s} \ P_{1}(\gamma,\beta,s)$$

$$= + \frac{(\Lambda+\gamma)}{2\beta\Lambda} \ P_{0}(\Lambda+\gamma,\beta,\tau) - \frac{\gamma}{2\beta\Lambda} \ e^{-\Lambda\tau} \ P_{0}(\gamma,\beta,\tau)$$

$$+ \frac{1}{2\beta\Lambda} \ (1 - e^{-\Lambda\tau})$$
(A-25)

and

$$\hat{P}_{3}(\Lambda,\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda s} \ P_{2}(\gamma,\beta,s)$$

$$= \frac{1}{4\beta^{2}} \{ -\frac{[2\beta + (\gamma \ \Lambda)^{2}]}{\Lambda} \ P_{0}(\Lambda+\gamma,\beta,\tau) + (1 - e^{-\beta\tau^{2} - (\Lambda+\gamma)\tau}) + \frac{(-2\beta+\gamma^{2})}{\Lambda} \ e^{-\Lambda\tau} \ P_{0}(\gamma,\beta,\tau) + (1 - e^{-\beta\tau^{2} - (\Lambda+\gamma)\tau}) + \frac{\gamma}{\Lambda} \ (1 - e^{-\Lambda\tau}) \}$$
(A-26)

Substituting  $-\alpha \rightarrow \gamma$  and  $\Lambda_1 \rightarrow \Lambda$  in Eqs(A-24) - (A-26), we have the results

$$\hat{P}_{1}(\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{\Lambda_{1}} \left[P_{0}(\Lambda_{1} - \alpha,\beta,\tau) - e^{-\Lambda_{1}\tau} P_{0}(-\alpha,\beta,\tau)\right], \quad (A-27)$$

$$\hat{P}_{2}(\Lambda_{1},\alpha,\beta,\tau) = + \frac{1}{2\beta\Lambda_{1}} [(\Lambda_{1}-\alpha)P_{0}(\Lambda_{1}-\alpha,\beta,\tau) + \alpha e^{-\Lambda_{1}\tau} P_{0}(-\alpha,\beta,\tau) - 1 + e^{-\Lambda_{1}\tau}], \qquad (A-28)$$

and

$$\hat{P}_{3}(\Lambda_{1},\alpha,\beta,\tau) = \frac{1}{4\beta^{2}} \{ -\frac{\left[\frac{2\beta + (\Lambda_{1}-\alpha)^{2}\right]}{\Lambda_{1}} - P_{0}(\Lambda_{1}-\alpha,\beta,\tau) + \frac{(-2\beta + \alpha^{2})}{\Lambda_{1}} - e^{-\Lambda_{1}\tau} P_{0}(-\alpha,\beta,\tau) + \frac{(-2\beta + \alpha^{2})}{\Lambda_{1}} - e^{-\beta\tau^{2} - (\Lambda_{1}-\alpha)\tau} + \frac{\alpha}{\Lambda_{1}} (1 - e^{-\Lambda_{1}\tau}) \}$$

$$+ (1 - e^{-\beta\tau^{2} - (\Lambda_{1}-\alpha)\tau}) + \frac{\alpha}{\Lambda_{1}} (1 - e^{-\Lambda_{1}\tau}) \} (A-29)$$

For the case  $\beta = 0$ ,  $\hat{P}_k(\Lambda, \alpha, 0, \tau)$  and  $\hat{P}_k(\Lambda, 0, 0, \tau)$  are clearly integrable and convergent for k = 2,3 using the limiting forms for  $P_k(\gamma, \beta, \tau)$ . However, since for k = 2,3 these  $\hat{P}_k(\Lambda, \alpha, 0, \tau)$  and  $\hat{P}_k(\Lambda, 0, 0, \tau)$  are multiplied by  $\beta \propto b/2$  in the model solution, they are not needed. On the other hand  $\hat{P}_0(\tau)$ ,  $\hat{P}_1(\tau)$ ,  $\hat{P}_4(\tau)$ , and  $\hat{P}_5(\tau)$ are needed since their coefficients in the model solution are (or can be)nonvanishing even if  $\beta = 0$ .

For  $\beta = 0$ ,  $\hat{P}_{0}(\Lambda_{1}, \tau)$  is still given by Eq. (A-20). For  $\hat{P}_{1}(\Lambda, \alpha, 0, \tau)$  we may use

$$\hat{P}_{1}(\Lambda_{1},\alpha,0,\tau) = \frac{1}{\Lambda_{1}} \left[ P_{0}(\Lambda_{1}-\alpha,0,\tau) - e^{-\Lambda_{1}\tau} P_{0}(-\alpha,0,\tau) \right]$$
(A-30)

where Eqs.(A-12) and (A-13) are applicable for  $P_{O}^{}(\gamma,0,\tau)$  . Similarly,

$$\hat{P}_{4}(\gamma,0,\tau) = P_{0}(\gamma,0,\tau) = \frac{1}{\gamma} (1-e^{-\gamma\tau})$$
 (A-31)

$$\hat{P}_{5}(\gamma,0,\tau) = P_{1}(\gamma,0,\tau) = \frac{1}{\gamma^{2}} [1 - (1+\gamma\tau)e^{-\gamma\tau}]. \quad (A-32)$$

#### APPENDIX B

EVALUATION OF THE  $Q_k(\tau)$  AND  $V_k(\tau)$  FUNCTIONS

The functions  $Q_k(\tau)$  and  $V_k(\tau)$  are defined by

$$Q_{k}(\tau) = \int_{0}^{\tau} ds \ e^{\Lambda^{*}s} \ M_{k}(s)$$
(B-1)

and

$$V_{k}(\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} Q_{k}(s) , \qquad (B-2)$$

where the  $M_k(\tau)$  functions are given explicitly in Appendix A. We shall need these functions for the parameters  $\Lambda^*$ ,  $\Lambda_1$ ,  $\alpha$ ,  $\beta$ , and  $\gamma$ non-zero and zero. However, knowing the limiting forms of the  $P_k(\gamma,\beta,\tau)$  functions, using the fact that some functions  $[Q_2(\tau), Q_3(\tau), Q_5(\tau), V_2(\tau), V_3(\tau), and V_5(\tau)]$  have finite  $\beta = 0$  limits and are multiplied by  $\beta$ , and that these same functions are expressible in terms of  $Q_0(\tau)$ ,  $Q_1(\tau)$ ,  $Q_4(\tau)$ ,  $V_0(\tau)$ ,  $V_1(\tau)$ , and  $V_4(\tau)$  leads to considerable simplification in that limiting forms are needed only for the latter functions. Evaluation of  $Q_k(\tau)$  $Q_0(\tau)$ : For  $\Lambda_1 \neq \Lambda^*$  using Eqs.(B-1) and (A-1), we have

$$Q_{O}(\Lambda^{*},\Lambda_{1},\tau) = \int_{O}^{\tau} ds \ e^{\Lambda^{*}s} \ e^{-\Lambda_{1}s} = \frac{1}{\Lambda_{1}-\Lambda^{*}} [1-e^{-(\Lambda_{1}-\Lambda^{*})\tau}]$$
 (B-3)

and for  $\Lambda_1 = \Lambda^*$ , Eq. (B-3) becomes

$$Q_{O}(\Lambda^{*},\Lambda^{*},\tau) = \tau.$$
 (B-4)

 $Q_1(\tau)$ : For  $\Lambda_1 \neq \Lambda^*$ , using Eqs.(B-1), (A-17) and (A-27) we have

$$Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \int_{0}^{\tau} ds e^{\Lambda^{*}s} M_{1}(\Lambda_{1},\alpha,\beta,s)$$

$$= \int_{\Omega}^{1} ds e^{\Lambda^* s} e^{-\Lambda_1 s} P_{\Omega}(-\alpha,\beta,s)$$

$$= \frac{1}{\Lambda_{1}^{-\Lambda^{*}}} \begin{bmatrix} P_{O}(\Lambda_{1}^{-\Lambda^{*}-\alpha,\beta,\tau}) & -e \end{bmatrix} \begin{bmatrix} -(\Lambda_{1}^{-\Lambda^{*}})\tau \\ P_{O}(-\alpha,\beta,\tau) \end{bmatrix} (B-5)$$

For 
$$\Lambda_{1} = \Lambda^{*}$$
, we have from Eq. (B-5)  
 $Q_{1}(\Lambda^{*}, \Lambda^{*}, \alpha, \beta, \tau) = \int_{0}^{\tau} ds P_{0}(-\alpha, \beta, s)$ , (B-6)

where

$$P_{O}(\gamma,\beta,\tau) = \frac{1}{2}\sqrt{\frac{\pi}{\beta}} e^{\gamma^{2}/4\beta} \left[ erf(\sqrt{\beta}\tau + \frac{\gamma}{2\sqrt{\beta}}) - erf(\frac{\gamma}{2\sqrt{\beta}}) \right]$$
(B-7)

and

$$\int_{0}^{\tau} ds P_{0}(\gamma,\beta,s) = \frac{1}{2\beta} [(\gamma+2\beta\tau)P_{0}(\gamma,\beta,\tau) - 1 + e^{-\gamma\tau-\beta\tau^{2}}]. \quad (B-8)$$

Thus,

$$Q_{1}(\Lambda^{*},\Lambda^{*},\alpha,\beta,\tau) = \frac{1}{2\beta} \left[ (-\alpha + 2\beta\tau) P_{0}(-\alpha,\beta,\tau) - 1 + e^{\alpha\tau - \beta\tau^{2}} \right]. \quad (B-9)$$

Now for  $\Lambda_1 = \Lambda^*$ , and  $\beta = 0$ , using Eq. (A-9) in Eq. (B-6) we find

$$Q_1(\Lambda^*,\Lambda^*,\alpha,0,\tau) = \int_{0}^{\tau} ds P_0(-\alpha, 0,s) = \frac{1}{\alpha^2} [e^{\alpha\tau} - (1+\alpha\tau)].$$
 (B-10)

Finally, if  $\Lambda_1 = \Lambda^*$ , and  $\alpha = \beta = 0$ , we have

τ

$$Q_{1}(\Lambda^{*},\Lambda^{*},0,0,\tau) = \frac{\tau^{2}}{2},$$
 (B-11)

which follows from the limit of Eq. (B-10) as  $\alpha \neq 0$  or from using Eq. (A-10) for  $P_0(0,0,\tau)$  in Eq. (B-10). The limiting forms for Eq. (B-5) for  $\alpha = 0$  and  $\beta \neq 0$  follow from Eq. (A-8), namely

$$P_{O}(0,\beta,\tau) = \frac{1}{2}\sqrt{\frac{\pi}{\beta}} \quad erf(\sqrt{\beta\tau}). \qquad (B-12)$$

 $\underbrace{Q_2(\tau):}_{(A-24), \text{ we find}} \text{ For } \Lambda_1 \neq \Lambda^* \text{ and } \beta \neq 0 \text{ , using Eqs.(B-1), (A-8), (A-18) and}$ 

$$Q_2(\Lambda^*,\Lambda_1,\alpha,\beta,\tau) = \int_0^\tau ds e^{\Lambda^*s} M_2(\Lambda_1,\alpha,\beta,s)$$

$$= \frac{1}{2\beta(\Lambda_{1}-\Lambda^{*})} \left[ (\Lambda_{1}-\Lambda^{*}-\alpha)P_{0}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau) + \alpha e^{-(\Lambda_{1}-\Lambda^{*})\tau} \right]$$

$$\times P_{0}(-\alpha,\beta,\tau) - [1-e^{-(\Lambda_{1}-\Lambda^{*})\tau}] .$$
(B-13)

Further limiting forms are not needed explicitly. For the cases

(a) 
$$\Lambda_{1} = \Lambda^{*}, \ \beta \neq 0,$$
  
(b)  $\Lambda_{1} = \Lambda^{*}, \ \beta = 0, \ \alpha \neq \Lambda_{1} - \Lambda^{*},$   
(c)  $\Lambda_{1} = \Lambda^{*}, \ \beta = 0, \ \alpha = \Lambda_{1} - \Lambda^{*},$   
(d)  $\Lambda_{1} = \Lambda^{*}, \ \beta = 0, \ \alpha \neq 0,$   
(e)  $\Lambda_{1} = \Lambda^{*}, \ \beta = 0, \ \alpha = 0,$ 

the integral for  $Q_2(\Lambda^*, \Lambda_1, \alpha, \beta, \tau)$  is finite. In addition for  $\beta = 0, Q_2(\tau)$  is independent of  $\beta$ . Since  $B_2$  has a coefficient involving a factor  $\beta$ , the  $\beta = 0$  contribution from  $Q_2(\tau)$  vanishes. Re-expressing  $Q_2(\tau)$  as

$$Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{Q_{0}(\Lambda^{*},\Lambda_{1},\tau) - Q_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$
(B-14)

eliminates the necessity for the  $\Lambda_1 = \Lambda^*$  limit since it is automatically accounted for by the limiting forms of  $Q_0(\tau)$ ,  $Q_1(\tau)$ , and  $Q_4(\tau)$ . In Eq. (B-14) we have used the identity  $\gamma = \Lambda_1 - \alpha$  from the definitions given in the text.

$$Q_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \int_{0}^{\tau} ds \ e^{\Lambda^{*}s} \ M_{3}(\Lambda_{1},\alpha,\beta,s)$$

$$= \frac{1}{4\beta^{2}} \left\{ \frac{[2\beta + (\Lambda_{1} - \Lambda^{*} - \alpha)^{2}]}{\Lambda_{1} - \Lambda^{*}} \ P_{0}(\Lambda_{1} - \Lambda^{*} - \alpha,\beta,\tau) \right\}$$

$$- \frac{2\beta + \alpha^{2}}{\Lambda_{1} - \Lambda^{*}} \ e^{-(\Lambda_{1} - \Lambda^{*})\tau} \ P_{0}(-\alpha,\beta,\tau)$$

$$- [1 - e^{-\beta\tau^{2} - (\Lambda_{1} - \Lambda^{*} - \alpha)\tau}]$$

$$+ \frac{\alpha}{\Lambda_{1} - \Lambda^{*}} [1 - e^{-(\Lambda_{1} - \Lambda^{*})\tau}] \left\}. \qquad (B-15)$$

Further limiting cases are not needed explicitly, just as for the  $Q_2(\tau)$  function. The coefficient  $B_3$  has a coefficient  $\beta$ , and all the limiting forms involving  $\beta = 0$  for  $Q_3(\tau)$  are finite and do not involve  $\beta$ . Thus, the  $\beta = 0$  contribution from  $Q_3(\tau)$ vanishes.

Re-expressing  $Q_3(\tau)$  in Eq. (B-15) as

$$Q_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) - Q_{5}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$

(B-16)

eliminates the necessity for the  $\Lambda_1 = \Lambda^*$  limit since it is automatically accounted for by the limiting forms of  $Q_1(\tau)$ ,  $Q_2(\tau)$ , and  $Q_5(\tau)$ .

 $Q_4(\tau)$ : Using Eqs. (B-1), (A-3), and (A-7) we have

$$Q_{4}(\Lambda^{*},\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{\Lambda^{*}s} \ M_{4}(\gamma,\beta,s) = P_{0}(\gamma-\Lambda^{*},\beta,\tau). \tag{B-17}$$

The limiting forms are given in Appendix A.

$$Q_5(\tau)$$
: Using Eqs. (B-1), (A-4) and (A-7) we have

$$Q_{5}(\Lambda^{*},\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{\Lambda^{*}s} \ M_{5}(\gamma,\beta,s) = P_{1}(\gamma-\Lambda^{*},\beta,\tau). \tag{B-18}$$

For  $\beta \neq 0$ , from Appendix A we have

$$Q_{5}(\Lambda^{*},\gamma,\beta,\tau) = \frac{1}{2\beta} \left[ -(\gamma-\Lambda^{*})P_{0}(\gamma-\Lambda^{*},\beta,\tau) + 1 - e^{-(\gamma-\Lambda^{*})\tau-\beta\tau^{2}} \right]. \quad (B-19)$$

Using Eq. (A-12) for  $\beta = 0$ ,  $\gamma \neq \Lambda^*$  find

$$Q_{5}(\Lambda^{*},\gamma,0,\tau) = \frac{1}{(\gamma-\Lambda^{*})^{2}} \{1 - [1 + (\gamma-\Lambda^{*})\tau] e^{-(\gamma-\Lambda^{*})\tau} \}.$$
(B-20)

For  $\beta = 0$  and  $\gamma = \Lambda^*$ , Eq. (B-20) limits to

$$Q_5(\Lambda^*,\Lambda^*,0,\tau) = \frac{\tau^2}{2}$$
 (B-21)

Since  $B_5$  has  $\beta$  as a factor, the  $\beta = 0$  limits will not contribute. Evaluation of  $V_k(\tau)$ :

$$\frac{V_{O}(\tau):}{V_{O}(\Lambda^{*},\Lambda_{1},\tau)} = \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} Q_{O}(\Lambda^{*},\Lambda_{1},s)$$

$$= \frac{1}{\Lambda_{1} - \Lambda^{*}} \left[ \frac{1}{\Lambda^{*}} (1 - e^{-\Lambda^{*} \tau}) - \frac{1}{\Lambda_{1}} (1 - e^{-\Lambda_{1} \tau}) \right].$$
 (B-22)

For  $\Lambda_1 = \Lambda^*$ , using Eq. (B-4) in Eq. (B-22) we find

$$V_{o}(\Lambda^{*},\Lambda^{*},\tau) = \frac{1}{\Lambda^{*2}} [1 - (1 + \Lambda^{*}\tau) e^{-\Lambda^{*}\tau}].$$
 (B-23)

 $V_1(\tau)$ : For  $\Lambda_1 \neq \Lambda^*$ , using Eqs. (B-2), (B-5), and (A-24) we find

$$V_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \int_{0}^{\tau} ds e^{-\Lambda^{*}s} Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,s)$$

$$= \frac{1}{\Lambda_{1} \Lambda^{*}} P_{0}(\Lambda_{1} - \alpha, \beta, \tau)$$

$$- \frac{1}{\Lambda_{1} - \Lambda^{*}} \left[ \frac{e^{-\Lambda^{*} \tau}}{\Lambda^{*}} P_{0}(\Lambda_{1} - \Lambda^{*} - \alpha, \beta, \tau) - \frac{e^{-\Lambda_{1} \tau}}{\Lambda_{1}} P_{0}(-\alpha, \beta, \tau) \right] . \qquad (B-24)$$

One could use the identity

•

•

$$\int_{0}^{\tau} ds \ s \ e^{-\Lambda s} \ P_{0}(\gamma,\beta,s) = - \frac{\partial}{\partial \Lambda} \left[ \hat{P}_{1}(\Lambda,\gamma,\beta,\tau) \right]$$

$$= \frac{2\beta - \Lambda(\Lambda + \gamma)}{2\beta \Lambda^{2}} \ P_{0}(\Lambda + \gamma,\beta,\tau) \ - \frac{1 + \Lambda \tau}{\Lambda^{2}} \ e^{-\Lambda \tau} P_{0}(\gamma,\beta,\tau)$$

$$+ \frac{1}{2\beta \Lambda} \left[ 1 - e^{-\beta \tau^{2} - (\gamma + \Lambda) \tau} \right] , \qquad (B-25)$$

•

to solve explicitly for  $V_1(\Lambda^*, \Lambda^*, \alpha, \beta, \tau)$ . On the other hand, one can rewrite Eq. (B-24) as

$$V_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{V_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) - e^{-\Lambda^{*}\tau}Q_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{\Lambda_{1}}$$
(B-26)

and incorporate the limiting forms from  $\textbf{Q}_1\left(\tau\right)$  and  $\textbf{V}_4\left(\tau\right)$  .

 $\frac{V_2(\tau):}{(A-24), \text{ we find}} \quad \text{For } \Lambda_1 \neq \Lambda^* \text{ and } \beta \neq 0, \text{ using Eqs. (B-2), (B-13), and}$ 

$$V_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} Q_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,s)$$
$$= \frac{\Lambda_{1}-\Lambda^{*}-\alpha}{2\beta(\Lambda_{1}-\Lambda^{*})} \frac{1}{\Lambda^{*}} \left[P_{0}(\Lambda_{1}-\alpha,\beta,\tau)-e^{-\Lambda^{*}\tau}P_{0}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau)\right]$$

$$+ \frac{\alpha}{2\beta(\Lambda_{1}-\Lambda^{*})} \frac{1}{\Lambda_{1}-\Lambda^{*}} \left[P_{O}(\Lambda_{1}-\Lambda^{*}-\alpha,\beta,\tau)-e^{(\Lambda_{1}-\Lambda)\tau} x\right]$$
$$- \frac{1}{2\beta(\Lambda_{1}-\Lambda^{*})} \left[\frac{1}{\Lambda^{*}} (1-e^{-\Lambda^{*}\tau}) - \frac{1}{\Lambda_{1}} (1-e^{-\Lambda_{1}\tau})\right]. \quad (B-27)$$

Further limiting forms are not needed explicitly. For the cases given in connection with  $Q_2(\tau)$ , all the  $V_2(\tau)$  integrals are also finite. In addition in the  $\beta = 0$  limit they are finite and independent of  $\beta$ . Since  $B_2$  has a factor  $\beta$ , the contribution  $B_2V_2(\tau)$  is zero.

We may re-express  $V_2(\tau)$  as

$$V_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{V_{0}(\Lambda^{*},\Lambda_{1},\tau) - V_{4}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha V_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$

,

which eliminates the necessity for using an explicit  $\Lambda_1 = \Lambda^*$  limit except through the limiting forms for  $V_O(\tau)$ ,  $V_1(\tau)$ , and  $V_4(\tau)$ .

 $\underbrace{V_3(\tau):}_{\text{we find}} \quad \text{For } \Lambda_1 \neq \Lambda^* \text{ and } \beta \neq 0, \text{ using Eqs. (B-2), (B-15) and (A-24),}$ 

$$\begin{aligned} V_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) &= \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} \ Q_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,s) \\ &= \frac{1}{4\beta^{2}} \left\{ \frac{\left[ 2\beta + (\Lambda_{1} - \Lambda^{*} - \alpha)^{2} \right]}{\Lambda^{*}(\Lambda_{1} - \Lambda^{*})} - \frac{2\beta + \alpha^{2}}{\Lambda_{1}(\Lambda_{1} - \Lambda^{*})} + 1 \right\} P_{0}(\Lambda_{1} - \alpha,\beta,\tau) \\ &+ \frac{1}{4\beta^{2}} \frac{2\beta + \alpha^{2}}{\Lambda_{1}(\Lambda_{1} - \Lambda^{*})} e^{-\Lambda_{1}\tau} P_{0}(-\alpha,\beta,\tau) \\ &- \frac{1}{4\beta^{2}} \frac{2\beta + (\Lambda_{1} - \Lambda^{*} - \alpha^{2})}{\Lambda^{*}(\Lambda_{1} - \Lambda^{*})} e^{-\Lambda^{*}\tau} P_{0}(\Lambda_{1} - \Lambda^{*} - \alpha,\beta,\tau) \end{aligned}$$

$$-\frac{1}{4\beta^2} \frac{1}{\Lambda^*} (1-e^{-\Lambda^* \tau})$$

+ 
$$\frac{1}{4\beta^2}$$
  $\frac{\alpha}{\Lambda_1 - \Lambda^*} \left[\frac{1}{\Lambda^*} \left(1 - e^{-\Lambda^* \tau}\right) - \frac{1}{\Lambda_1} \left(1 - e^{-\Lambda_1 \tau}\right)\right]$  (B-29)

Further limiting forms are not needed explicitly, just as for the  $V_2(\tau)$  function. The coefficient  $B_3$  has a factor  $\beta$ , and all the limiting forms involving  $\beta = 0$  for  $V_3(\tau)$  are finite and do not involve  $\beta$ . Thus, the  $B_3V_3(\tau)$  contribution vanishes for  $\beta = 0$ .

Re-expressing  $V_3(\tau)$  we have

$$V_{3}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) = \frac{V_{1}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau) - V_{5}(\Lambda^{*},\Lambda_{1}-\alpha,\beta,\tau) + \alpha V_{2}(\Lambda^{*},\Lambda_{1},\alpha,\beta,\tau)}{2\beta}$$

(B-30)

which eliminates the necessity for using explicit limiting forms for  $\Lambda_1 = \Lambda^*$  except in  $V_1(\tau)$ ,  $V_2(\tau)$  and  $V_5(\tau)$ . Of course,  $V_2(\tau)$ , as given by Eq. (B-28) is expressible in terms of  $V_0(\tau)$ ,  $V_1(\tau)$ , and  $V_4(\tau)$ .

 $V_4(\tau)$ : Using Eqs. (B-2), (B-17), and (A-24), we find

$$V_4(\Lambda^*,\gamma,\beta,\tau) = \int ds e^{-\Lambda^*s} Q_4(\Lambda^*,\gamma,\beta,s)$$

$$= \frac{1}{\Lambda^{*}} \left[ P_{O}(\gamma, \beta, \tau) - e^{-\Lambda^{*}\tau} P_{O}(\gamma - \Lambda^{*}, \beta, \tau) \right]$$
(B-31)

The limiting forms for  $V_4(\tau)$  are accounted for by the forms given for the  $P_0(\gamma,\beta,\tau)$  function in Appendix A.

 $V_5(\tau)$ : For  $\beta \neq 0$ , using Eqs. (B-2), (B-18), and (A-24), we find

$$V_{5}(\Lambda^{*},\gamma,\beta,\tau) = \int_{0}^{\tau} ds \ e^{-\Lambda^{*}s} \ Q_{5}(\Lambda^{*},\gamma,\beta,s)$$
$$= -\frac{\gamma}{2\beta\Lambda^{*}} P_{0}(\gamma,\beta,\tau) + \frac{\gamma-\Lambda^{*}}{2\beta\Lambda^{*}} e^{-\Lambda^{*}\tau} P_{0}(\gamma-\Lambda^{*},\beta,\tau)$$
$$+ \frac{1}{2\beta\Lambda^{*}} (1-e^{-\Lambda^{*}\tau}) \qquad (B-32)$$

The limiting cases for  $\beta = 0$  yield finite integrals for  $V_5(\tau)$ . Since  $B_5$  has a factor  $\beta$ , the  $\beta = 0$  limit contribution from  $V_5(\tau)$  vanishes. The necessity for writing the other limiting cases for  $V_5(\tau)$  is removed by re-expressing Eq. (B-32) for  $\beta \neq 0$  as

$$v_{5}(\Lambda^{*},\gamma,\beta,\tau) = \frac{\frac{1}{\Lambda^{*}}(1-e^{-\Lambda^{*}\tau})-\gamma v_{4}(\Lambda^{*},\gamma,\beta,\tau) - e^{-\Lambda^{*}\tau} Q_{4}(\Lambda^{*},\gamma,\beta,\tau)}{2\beta}$$

(B-33)

and using the limiting forms for  $V^{}_4(\tau)$  and  $Q^{}_4(\tau)$  .

## APPENDIX C CODE LISTING FOR LARC-1

•

|   | COPYSE  | 3 FILES               | FROM                       |                        |               | LASL           | Identificat          | ion:   | LP-0721    |
|---|---------|-----------------------|----------------------------|------------------------|---------------|----------------|----------------------|--------|------------|
|   |         |                       |                            |                        |               |                |                      |        |            |
|   | PROG    | RAM LARCI             |                            | UT.FIIM.FS             | FT12=FT1M     | ,              |                      | I APC1 | 2          |
|   | PARA    | METER (N50            | 0=500)                     | • (N501=N50            | 0+1)          | ,              |                      | 1 4801 | 3          |
|   | REAL    | NPRIME +L+            | 11+N2+                     | N3.N4.NZER             | NZERO+LA      | MRDA           |                      | I ARC1 | á          |
|   | DIMF    | NSTON NPRI            | 1E (N50                    | 0) . L(N500            | ), T(N501     | . RPRIME'N     | 500), psilmin500)    | LAPC1  | 5          |
|   | 1. v.   | N580) . FF (1         | 1501),                     | 7N (N500) .            | ZR (N500)     | 7A (N500)      | ZF (N5001 - ZN1 (N   | LARC1  | 6          |
|   | 2500)   | • 7N2 (N500)          | ) • ZN3                    | (N500) + ZN            | 14 (N50n) + ; | 7R1 (N500) . : | R2 (NSAAL - 7R3IN    | LARC1  | 7          |
|   | 35001   | • 784 (N500)          | • ZA1                      | (N500), ZA             | 2(N50n) + ;   | 7A3(N500).     | 784 (N5001, 7F1 (N   | LARC1  | 8          |
|   | 4500)   | • 7F2 (N500)          | • ZF3                      | (N500), ZF             | 4(N500) + '   | TARLE (NSON+4  | 4) . TAPI'X (N500'.4 | LARC1  | 9          |
|   | 5)      | NC-ON TITL            | -1/7.                      |                        |               |                |                      | LARC1  | 10         |
|   |         | NSTON ITTE            | <u>.</u> 1(7)9<br>/6). N   | TTILE(6)<br>Set (5)    | • IIILES(A    | +), X[IM(2)    | • YLI4(21            | LARCI  | 11         |
|   | COMM    | UN ZE INFWZ           | V A 2 X T                  | 351 (3)<br>F. TYSAVE.T | X2. TY2       |                |                      | LARCI  | 12         |
|   | LOGT    | CAL LAGE +B           |                            | BGAS                   | NE 11 12      |                |                      |        | 14         |
|   | REAL    | NI DLO ,NZO           | D+N30                      | LD.N40LD               |               |                |                      | 1 ARC1 | 15         |
|   | COMM    | ON /LA/ LAG           | E.AGE                      | .WFUEL ISO             | +HISO         |                |                      | I APC1 | 16         |
|   | COMM    | ON /TMODEL            | MODE                       | L                      |               |                |                      | LARC1  | 17         |
| C | MODE    | L = 1 S(              | DRS DA                     | TA FROM TH             | AX+ TAVE      | GRAPHS         |                      | LARC1  | 18         |
| C | MODF    |                       | PRCON                      | TARULAR DA             | Тд            |                |                      | LARC1  | 19         |
| C | MODF    |                       | , <del>-</del> CO          | RT TABULAR             | DATA          |                |                      | LARC1  | 20         |
|   |         | 1521/1939             | 10,25,                     | 100,2007               |               |                |                      | LARCI  | 21         |
|   |         | NSCI/20940<br>≈4      | J + 1 U U +                | 30093007               |               |                |                      | LARCI  | . 22       |
|   | NNUN    | = 5                   |                            |                        |               |                |                      |        | 24         |
|   | NEQ-    | 4                     |                            |                        |               |                |                      | 1 ARC1 | 25         |
| С | NE:0    | INDICATES N           | инісн                      | EQUATION S             | ET TO USE     |                |                      | LARCI  | 26         |
| С | NEQ     | - î S                 | MPLE                       | EQ FIRST H             | ALF. OLD      | EQ SECOND H    | ALF                  | LARC1  | 27         |
| c | NEQ     | = 2 S                 | IMPLE                      | ЕО ВОТН НА             | LVES          |                |                      | LAPC1  | 28         |
| C | NEQ     | = 3, L.               |                            | RELEASE BO             | TH HALVES     |                |                      | LAPC1  | 59         |
| C |         | - Α L.<br>Ξο 149 ΕΩ// |                            | FAILURE 80             | TH HALVES     |                |                      | LARC1  | 30         |
|   |         | GETQ (41 K.           | 18N a. 10                  | RNAME 1                |               |                |                      |        | 31         |
|   | CALL    | DATE1 (DA             | TE 1                       | UNAME?                 |               |                |                      |        | 32         |
|   | Z=FQ    | AC=0(0.0)             | -,                         |                        |               |                |                      |        | 34         |
|   | 1TEM    | P=4                   |                            |                        |               |                |                      | LARC1  | 35         |
|   | ITEv    | P=1                   |                            |                        |               |                |                      | LARC1  | 36         |
|   | IF (    | ITEMP .EQ.4           | Z=SP                       | LTNE(0.0+0             | •0)           |                |                      | LARC1  | 37         |
|   | 10 CONT |                       |                            |                        |               |                |                      | LARC1  | 38         |
|   | 15      | 150-17 1) /           | 10 TO                      | A. [ 50, YIEL          |               | L. LAGE FRA    | C.NUBGAS             | LAPCI  | 39         |
|   |         | U=M2ER#YIF            | 0 10                       | <00                    |               |                |                      | LARCI  | 40         |
| С | UNIT    | S OF NZERO            | ARE C                      | I (CUPTES)             |               |                |                      | LARC1  | 42         |
|   | PRIN    | T 220 NAM             | E.LAMB                     | DA.ISO, YIE            | LD.NZERO      |                |                      | LARC1  | 43         |
|   | PRIN    | 7 230+ AGE            | LAGE,                      | FRAC                   |               |                |                      | LARC1  | 44         |
|   | 1F (    | NORGAS) PR            | [NT 24                     | 0                      |               |                |                      | LARC1  | 45         |
|   | VSET    |                       |                            |                        |               |                |                      | LARC1  | 46         |
| r |         | SULED DELE            | 1 = () • ()<br>• S E D • • |                        |               |                |                      | LARC1  | 47         |
| č |         | A PERCENT             | UHGAN                      | 3 91 PERU<br>10        | באו בנייבו    | VIALE D PER    | CENT PARTTCULATE     | LARCI  | 48         |
| č | FOR     | THESE MATE            | RIAIS                      | THE CLEAND             | P SYSTEM      | FTI TEB esèt   | CIENCIES ADD         | LARGI  | . 49<br>Eo |
| č | .90     |                       | .70 R                      | ESPECTIVEL             | Y.            | FIGIGA REFI    |                      |        | 50         |
| С | THE     | FORE EACH             | RELEA                      | SF IS RED              | CED BY        |                |                      | LARCI  | 52         |
| С |         | (.90).91              | • (.05                     | ).99 + (.0             | 4).70 = .     | 8965           |                      | LARC1  | 53         |
| C | RELF    | ASED FRACT            | 10N 15                     | THEREFORE              | .1035         |                |                      | LARC1  | 54         |
| С | L A M C | AUA IS THE            | ADIOA                      | CTIVE DECA             | T CONSTAN     | T IN HNITE     | OF PER HOUR          | LARC1  | 55         |
|   |         |                       |                            |                        |               |                |                      | LARC1  | 56         |
|   | PRTA    | T 210 . NED           |                            |                        |               |                |                      | LARCI  | 57         |
|   | 1PR1    | +=+1TUT/20            |                            |                        |               |                |                      | I ARCI | 59         |
|   | PAIN    | 1 -50, NTO            | T                          |                        |               |                |                      | LARCI  | 60         |
| С | NTOT    | IC THE TO.            | TAL NU                     | MRER OF IN             | TERVALS       |                |                      | LARC1  | 61         |

|   |    |   | LARC1               | 62  |
|---|----|---|---------------------|-----|
|   |    | NTOT1=NTOT+1  | LARC1               | 63  |
|   |    | 00 20 T=1*N1011   | LARC1               | 64  |
|   | 20 | T(I]=(T-1)+DT   | LARC1               | 65  |
|   |    | DO 170 NH=1+ITEMP   | LARC1               | 66  |
|   |    | MODTLENR  | LARC1               | 67  |
|   |    | PRINT 260, MODEL,MFUEL,NAME   | LARC1               | 68  |
|   |    | $1F$ (NR_EQ.4) GO TO 40   | LARC1               | 69  |
| С |    | CALCULATE SECONO DERIVATIVES FOR SPLINE   | LARC1               | 70  |
|   |    | Z=TI(Axn(0,0)   | LARC1               | 71  |
|   |    | $2 = TAVE_{0}(0.0)$   | LARC1               | 72  |
| • |    |   | LARC1               | 73  |
| C |    | I (I) ARE THE TIMES OF THE INTERVAL BOUNDARIES (IN HOURS)                       | LARC1               | 74  |
|   |    | TDE( 1 = TFMP(0,0) - 1174.4   | LARC1               | 75  |
|   |    |   | LARCI               | 76  |
|   | ~~ | IIMFET(1)   | LARCI               | 77  |
|   | 30 | PETTETHALTIMETETAVE(TIME))/IDELI  | LARCI               | 78  |
|   | 40 |   | 1.ARC1              | /9  |
|   |    | $\Delta [1 M (1) + 1 (1)]$  | LARC1               | 80  |
|   |    |   | LARCI               | 81  |
|   |    |   | LARCI               | 02  |
|   |    |   | LARCI               | 0.5 |
|   |    |   | LARCI               | 95  |
|   |    |   |                     | 84  |
|   |    |   | LARCI               | 87  |
|   |    |   |                     | 88  |
|   |    |   | LARCI               | 89  |
|   |    | ZR4(1)-0.0  | LARC1               | 90  |
|   |    | ZA1(I)=0,0  |                     | 91  |
|   |    | ZA2(I1=0•0  | LAPC1               | 92  |
|   |    | 2A3; I1=0•0   | LARC1               | 93  |
|   |    |   | LARC1               | 94  |
|   |    | ZF1(1)=0.0  | LARC1               | 95  |
|   |    | $2F2(1) = 0 \cdot 0$  | LARC1               | 96  |
|   |    | 2F3(1)=0.0  | LARC1               | 97  |
| ~ |    |   | LARC1               | 98  |
| C |    | 1 REFERS TO FAILED BISO   | 1_A <sup>H</sup> C1 | 99  |
| č |    | 2 REFERS TO INITAL RESO   | LARCI               | 100 |
| ž |    | S REFERS TO INTACT BISD   | LARCI               | 101 |
| ř |    | A RELEAS TO INTACT TRISO  |                     | 102 |
| ř |    | HUI UTAG AT THE END OF THE ITHE INTERVAL (1, - AT TAGE T(1))                    |                     | 103 |
| C |    | NORTHEATING A THE END OF THE THE THE THEFTAL CLEF. AT THME TITAL.               |                     | 104 |
|   |    |   | LARCI               | 106 |
|   |    | RSU4(1)=0.0   | 1 ARC1              | 107 |
|   |    | L(1) = 0.01/24  | 1 ARC1              | 108 |
|   |    | V(I)=VSFT   | I ARC1              | 109 |
| С |    | L IS THE CONTAINMENT BUILDING LEAK RATE ASSUMED TO BE ADDIVDAY                  | LARC1               | 110 |
| С |    | FOR THE FIRST 24 HOURS AND .0005/DAY THEREAFTER.                                | LARC1               | 111 |
| С |    | VSET=.q965  | LARC1               | 112 |
| С |    | VSET ASSUMED TO BE .9 BY FOLEY.   | LARC1               | 113 |
|   | 50 | CONTINUE  | LARC1               | 114 |
|   |    | PRINT 270, IVFMAX   | 1_ARC1              | 115 |
|   |    | PER=1./IVFMAX   | LAPC1               | 116 |
|   |    | DO 140 IVF=1.IVFMAX   | LA <sup>R</sup> C1  | 117 |
|   |    | BIN=PEP*(IVF=0.5)   | LARC1               | 118 |
| ~ |    | IF (NR.NL.*) TEMETEMP(BIN)  | LARC1               | 119 |
| C |    | INTER AN INTERACE IEMPERATURE OF UNE PERCENT OF THE TOTAL                       | LARC1               | 120 |
| C |    | UURF [NVENIURT<br>TE AND NE AN TE-EEANNHATEM 3376 ANA-AVEN-3355                 | LARCI               | 121 |
|   |    | 1F (NR NC +4) (EIFF(1)*(TEM=11/4+4)*TAVE(T(1))<br>TE (NR E() /) TE=SR(/A - NTN) | LARCI               | 122 |
|   |    | 17 (78,004) 12=37L(0.+81N)<br>FR=5RAAR/75N                                      | LARCI               | 123 |
|   |    |   | 1 676.7             | 164 |

|        |    | FT≖F <sup>R</sup> ACT(TE)  | I ARC1  | 125 |
|--------|----|--|---------|-----|
| С      |    | FRACE = FRACTION OF BISO PARTICLES WITH FAILED COATINGS            | LARC1   | 126 |
| С      |    | FRACT = FRACTION OF TRISO PARTICLES WITH FAILED COATINGS           | LARC1   | 127 |
| С      |    | FRAC = 0.6 = FRACTION OF BISO FUEL IN THE LOADING                  | LARC1   | 128 |
|        | •  | BIS∩≖.Ť.   | LARC1   | 120 |
|        |    | Rl=p/(fE)  | LARC1   | 130 |
|        |    | R3=p1(†E)  | I ARC1  | 131 |
|        |    | BISO=_FALSE.   | 1 ARC1  | 132 |
|        |    |  | LARC1   | 133 |
|        |    | R4=RI(†E)  | LARC1   | 134 |
|        |    | N1=NZEPO*PER*FRAC*FR   | LARC1   | 135 |
|        |    | N2=N4EpO*PER*(1.0-FRAC)*FT   | LARC1   | 136 |
|        |    | N3=N4FD0*PER*FRAC*(1.n=FB)   | 1.ARC1  | 137 |
|        |    | $N4 = N \leq PO^{*}PER^{*}(1,0-FRAC)^{*}(1,0-FT)$                  | LARC1   | 138 |
|        |    | A 1 = n • 0  | LARC1   | 139 |
|        |    | A2=0+0   | LARC1   | 140 |
|        |    | A3=0.0   | LARC1   | 141 |
| _      |    |  | LARC1   | 147 |
| č      |    | NI TO THE AMOUNT OF THE ITH COMPONENT REMAINING IN THE CORF        | LARC1   | 143 |
| C<br>a |    | RRI IS THE AMOUNT OF THE ITH COMPONENT RELEASED TO THE CONLANT     | LARC1   | 144 |
| C      |    | AT 15 THE AMOUNT OF THE ITH COMPONENT IN THE CODIANT               | LARC1   | 145 |
| C      |    | ALL THESE REFER TO THE GIVEN TIME STEP AND CORE PRACTION.          | LARC1   | 146 |
|        |    |  | LARC1   | 147 |
|        |    |  | LARC1   | 149 |
|        |    |  | 1-ARC1  | 149 |
|        |    |  | LARC1   | 150 |
|        |    |  | 1. ARC1 | 151 |
|        |    |  | LARC1   | 152 |
|        |    | DT = T (I + I) = T (I)   | LARC1   | 153 |
|        |    |  | LARC1   | 154 |
|        |    |  | LARCI   | 155 |
| r      |    | ILMFTI(1+1)<br>TENDEREFATURE AT COUNDARY TIMES                     | LARC1   | 156 |
| C      |    | TE /NO NE AL TEMPOSE (TALLATINES)                                  | LARCI   | 157 |
|        |    | 1 (NR, KC + + ) (CH D-FF ((+1)*(CH-11/4++)+TAVE ((TME)))           | LARCI   | 158 |
|        |    |  | LARC1   | 159 |
|        |    |  | LARCI   | 160 |
|        |    |  |         | 101 |
|        |    |  | LARCI   | 102 |
|        |    |  |         | 103 |
|        |    | K401 D=p4  |         | 104 |
|        |    | BISO = TRUE  |         | 164 |
|        |    | R1=pf(TEMPB)   |         | 167 |
|        |    | R3=RI(TEMPB)   | LARC-   | 160 |
|        |    | BISN= FALSE.   | LARC1   | 160 |
|        |    | R2=RF (TEMP8)  | t ARC1  | 170 |
|        |    | R4=pI(TEMPB)   | I ARC1  | 171 |
| С      |    | R(I1 IS THE AVERAGE RELEASE CONSTANT OF THE ISOTOPE DURING THE ITH | LARC1   | 172 |
| С      |    | INTFRVAL.  | LARC1   | 173 |
|        |    | N101 D = N1  | I ARC1  | 174 |
|        |    | NSOL DEVIS   | I ARC1  | 175 |
|        |    |  | LARC1   | 176 |
|        |    | N401 D=N4  | LARC1   | 177 |
|        |    | DECAY=1AMBDA+V(I)+L(I)   | LARC1   | 170 |
|        |    | GO TU (60,70,80,90), NEQ   | 1 ARC1  | 179 |
|        | 60 | CONTINUE   | LARC1   | 180 |
|        |    | CALL CALCI (N1,N3,R1,R3,LAMBDA,DT,FB,N1,N3,RR1,RR3,R10LD,R30LD)    | LARC1   | 181 |
|        |    | CALL CALCI (N2+N4+R2+R4+LAMBDA+DT+FT+N2+N4+RR2+RP4+R20LD+R40LD)    | LARCI   | 182 |
|        |    | CALL FTN (PN1+RP1+RR1+LAMBDA+DECAY+DT+L(T))                        | LARC1   | 183 |
|        |    | CALL FIN (PN2+RP2+RR2+LAMADA+DECAY+DT+L(T))                        | LARC1   | 184 |
|        |    | CALL FTN (PN3+PP3+PR3+LAMBDA+DECAY+DT+L(T))                        | LARC1   | 185 |
|        |    | CALL FIN (PN4+RP4+RR4+LAMBDA+DECAY+DT+L(T))                        | LARC1   | 186 |
|        |    | G0 τ <sup>0</sup> j00  | LARC1   | 187 |

|        | 70  | CONTINIJE  | LARC1              | 188  |
|--------|-----|--|--------------------|------|
|        |     | CALL CALCI (N1+N3+R1+R3+LAMBOA+DT+FB+N1+N3+RR1+RP3+R10LD+P30LD)                      | LARC1              | 189  |
|        |     | CALL CALCI (N2+N4+R2+R4+LAMBDA+DT+FT+N2+N4+RR2+RP4+R20LD+P401D)                      | LARC1              | 190  |
|        |     | CALL FINI (PN1, RP1, LAMBDA, DECAY, DT, L(I), N10LD, P1, R10LD)                      | LARC1              | 191  |
|        |     | CALL FINI (PN2+RP2+LAMBDA+DECAY+DT+L(I)+N20LD+P2-R20LD)                              | LARC1              | 192  |
|        |     | CALL FINI (PN3+RP3+LAMBDA+DECAY+OT+L(1)+N30LD+R3+R30LD)                              | LARCI              | 193  |
|        |     | Ca = 0   | LARCI              | 194  |
|        |     |  | LARCI              | 195  |
|        | 80  | CALL CALCO (NICNO RICORD AND AND AND AND AND AND AND AND AND AN                      | LARCI              | 195  |
|        |     | CALL CALC2 (N19N39R19M39LAMD0A9D19F19N19N39R19R39R10LD, $R^{23}$                     |                    | 197  |
|        |     | CALL ETN2 (PN), RP1, LAM90A, DECAY, OTAL (1), AND DAGE $(0, 0)$                      |                    | 190  |
|        |     | CALL FINE (PN2 $(PN2 + RP2 + I A RDA + DECAY + 0 T + I (I) + N 20 (D + P2 + R20 I))$ | LARCI              | 200  |
|        |     | CALL FINZ (PN3+RP3+LAMBDA+DECAY+DT+L(L)+N30(D+P3-R30(D)                              | 1 ARC1             | 201  |
|        |     | CALL FINZ (PN4+RP4+LAMBOA+DECAY+DT+L(I)+N40LD+P4-R40L0)                              | I ARC1             | 202  |
|        |     | GO TU joo  | LARC1              | 203  |
|        | 90  | CONTINUE   | LARC1              | 204  |
|        |     | CALL CALCE (N1+N3+R1+P3+LAMBDA+DT+F8+FB0  D+N1+N3+RF1+RR3+RIOLD+R30                  | LARC1              | 205  |
|        |     | 1L0)   | LARCI              | 206  |
|        |     | CALL CALC3 (N2,N4,R2,R4,LAMBDA,DT,FT.FTOI D,N2,N4,RR2,RR4,R201,D,R40                 | LARC1              | 207  |
|        |     | 1LD)   | LARC1              | 208  |
|        |     | CALL FIN3 (PN1,PN3,RP1,RP3,LAMBDA,DECAY,DT,L(I),N10LD,N301,D.P1,R10                  | LARC1              | 209  |
|        |     | 1LD.P3.P30L0.F8.F80LD)   | LARC1              | 210  |
|        |     | CAL1. FTN3 (PN2+PN4+RP2+RP4+LAMBDA+DECAY+DT+L(I)+N201.D+N401 0+R2+R20                | LARC1              | 211  |
|        | _   | 1L0,R4,p40L0,FT,FT0LD)   | LARC1              | 212  |
|        | 100 |  | LARC1              | 213  |
|        |     | ELD=EXP(-LAMBDA+DT)  | LARC1              | 214  |
|        |     |  | LARC1              | 215  |
|        |     |  | LARC1              | 216  |
|        |     |  | LA"C1              | 217  |
| ~      |     | AGEAGE/UHRRG<br>This is the total angulat of the tota conductive privatation to the  | LARC1              | 218  |
| د<br>د |     | CORE AT THE FOUND OF THE ITH COMPONENT REMAINING IN THE                              | LARCI              | 219  |
| ř      |     | ZRIJI IS THE TOTAL ANOLINE OF THE ITH CONDONENT DELEASED TO THE                      |                    | 220  |
| č      |     | CODIANT DURING THE ITH INTERVAL  |                    | 222  |
| č      |     | ZAI J IS THE AMOUNT OF THE ITH COMPONENT IN THE COOL ANT AT THE                      | 1 ARC1             | 223  |
| Ċ      |     | END OF THE JTH INTERVAL  | LARC1              | 224  |
| Ĉ      |     | ZFI(J) IS THE FRACTION OF THE ITH COMPONENT IN THE COOLANT AT THE                    | LARC1              | 225  |
| с      |     | END OF THE JTH INTERVAL  | LARC1              | 226  |
|        |     | PN=PN1+PN2+PN3+PN4   | LARC1              | 227  |
|        |     | RP=qP1 +RP2 +RP3 + RP4   | LARC1              | 22 g |
|        |     | NPRTMF(1) = NPR1ME(I) + PN   | LARC1              | 229  |
|        |     | $RPHTME(\mathbf{I}) = PPHIME(\mathbf{I}) + RP$                                       | LA <sup>R</sup> C1 | 230  |
|        |     |  | LARC1              | 231  |
|        |     | HSUIA()=RSUM(I)+SUM  | LARCI              | 237  |
|        |     | 2N1 (1 = 2N1 (1) + N1  | LARCI              | 233  |
|        |     | 2N2(4) = 2N2(1) + N2   | LARCI              | 2.34 |
|        |     | 2N3(1)=2N3(1)*N3   | LARCI              | 235  |
|        |     | 2N4 (11 ± 2N4 (1) *N4<br>7D1 (1 = 24) / (1 ± 20)                                     | LARCI              | 236  |
|        |     |  |                    | 237  |
|        |     | 4R2(+134R2(1)+RR4<br>7D3(1)-7D3(1)+RR4   | LARCI              | 2.38 |
|        |     | 276/1/12/2/01/14/PD4   |                    | 234  |
|        |     | 2 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 =  | LARCI              | 241  |
|        |     | $Z_{A2}(1) = Z_{A2}(1) + A^{2}$  | 1 ARC1             | 242  |
|        |     | $Z_{A3}(I) = Z_{A3}(I) + A3$   | I ARC1             | 243  |
|        |     | ZA4(I) = 7A4(I) + A4   |                    | 244  |
|        |     | ZF1(I1=ZF1(I)+A1/NZER0   | LARC1              | 245  |
|        |     | ZF2(1) = 2F2(1) + A2/NZERO   | LARC1              | 246  |
|        |     | ZF3(1)=7F3(1)+A3/NZER0   | LARC1              | 247  |
|        |     | ZF4(I1=ZF4(I)+A4/NZER0   | LARC1              | 248  |
|        | 110 | CONTINUE   | LARC1              | 249  |
|        | 120 | CONTINUE   | LARC1              | 250  |

•

DO 130 I=1,NTDT 251 LARC1 ZN(T) = 7N1(I) + ZN2(I) + ZN3(I) + ZN4(I)252 LARC1 ZR(I) = 7R1(I) + ZR2(I) + ZR3(I) + ZR4(I)LARC1 253 ZA(T) = 7A1(T) + ZA2(T) + ZA3(T) + ZA4(T)254 LARC1 ZF(T)=7F1(I)+ZF2(I)+ZF3(I)+ZF4(I) 255 LARC1 TABLE (T + NR) = ZF(I)256 LARC1 TABIX(T+NR)=RSUM(I) LARC1 257 130 CONTINUE LARC1 258 PRINT 310 LARC1 259 PRINT 320+ (I+T(I+1)+ZR(I)+ZR(I)+ZA(I)+ZF(I)+I=TPRTF+NTOT+TPRTF) LARC1 260 IF (NR.NE.ITEMP) GO TO 160 LARC1 261 IOPEI 262 LARC1 LINFAR\_LINEAR PLOT X, Y AXES С LAPC1 263 NCHAR=>7 LARC1 264 CHARACTER WILL BE С LARC1 265 ICON=1 LARC1 266 LARCI С POINTS WILL BE CONNECTED 267 YL14(11=100. LARC1 26R YL1M(21=0. 259 LARC1 DO 140 II=1+NTGT DO 140 JJ=1+NR LARC1 270 LARC1 271 YLIM(1)=AMIN1(YLIM(1),TABLE(II+JJ)) LAPC1 272 YLIW(21=AMAXI(YLIM(2),TABLE(II,JJ)) LARC1 273 140 CONTINUE LARC1 274 CALL SPLOT (IOP+2+XLIM+YLIM+48+0) LARC1 275 ENCODE (67,280,TITLE1)NAME, ISO,MFUEL, AGE, LAGE, FRAG, YIELD 276 LARC1 ENCODE (60,290,T1TLE2)NTOT,IVFMAX,JOBNAME,DATE LARC1 277 ENCODE (35+240+TITLE3) LARC1 278 DO 150 IP=1+NR LARC1 270 CALL PLOT (NTDT, T(2), 1, TABLE(1, IR), 1, NCHAR, ICON) LARC1 280 ENCODE (5+350+TSAVE) IR 281 LARC1 CALI WLCH (IXSAVE-15.TYSAVE.5.TSAVE.1) 1.ARC1 282 150 CONTINUE LARC1 283 CALL WLCV (50+800+20+20HFRACTION IN COOLANT +1) LARC1 284 CALL WICH (300,940,36,36HTIME AFTER UNSET OF ACCIDENT (HOURS),1) LARC1 285 CALL WLCH (100,965,67,TITLE1,1) LARC1 286 CALL WLCH (100,990,60,TITLF2,)) LARC1 287 IF (NED.EQ.1) CALL WICH (100.5.64.64HNED#1 CONSTANT RELFASE RATE, LARCI 288 1 CONSTANT FAILURE, AVERAGED RELEASE,1). IF (NED.EQ.2) CALL WICH (100.5.46.464NED=2 CONSTANT RELEASE RATE. LARCI 289 290 1 CONSTANT FAILURE .1) 291 LARC1 IF (NEA.EQ.3) CALL WICH (100,5,44,44HNEQ#3 | INFAR RELEASE PATE, C LARCI 292 10NSTANT FAILURE + I) LARC1 293 IF (NER.EQ.4) CALL WLCH (100,5,44,44HNER=4 CONSTANT RELFASE RATE. LARCI 294 1 LINEAD FAILURE .1) 295 LARC1 CALL ANV (1) 1. ARC1 296 160 CONTINHE LARC1 297 PRINT 340 PRINT 330+ (I+T(I+1)+NPRIME(I)+RPRIME(I)+RSUM(I)+I#IPRTF+NTOT+IPPT LARCI LARCI 298 299 1F) 30 n IF (NR.NE.ITEMP) GO TO 190 LARC1 301 YLIM(1) = 100. LARC1 302 YLIM(21=0. LARC1 303 00 ) 70 II=1+NTOT LARC1 304 DO )70 JJ=1+ITEMP LARC1 305 YL1M(1) = AMIN1(YLIM(1), TABLX(II+JJ)) 1 ARC1 306 YLIM(21=AMAX1(YLIM(2),TABLX(II+JJ)) LARC1 307 170 CONTINUE LARC1 30 A CALL SPLDT (IOP,2,XLIM,YL(M,48+0) LARC1 309 00 1<sup>8</sup>0 IS=1+1TEMP CALL PLOT (NTOT,T(2)+1,TABLX(1+IS)+1,NCHAR+ICON) I ARC1 310 LARC1 311 ENCODE (5+350+TSAVE) IS LARC1 312 CALI WICH (IXSAVE-15+TYSAVE+5+TSAVE+1) LARC1 313

|   | 180 CONTINUE  | LARC1  | 314 |
|---|---|--------|-----|
|   | CALL WICY (50+800+26+26HCUMULATED RELEASE (CURTES)-1)                       | LARC1  | 315 |
|   | IF (NEO.EQ.1) CALL WICH (100.5.64.64HNEO.1 CONSTANT RELEASE RATE.           | LARC1  | 316 |
|   | 1 CONSTANT FAILURE. AVERAGED BELEASE.1)                                     | LARC1  | 317 |
|   | IF (NED.EQ.2) CALL WICH (100.5.46.46HNED=2 CONSTANT RELEASE RATE.           | LARC1  | 318 |
|   | 1 CONSTANT FAILURE, 1)  | 1 ARC1 | 319 |
|   | IF (NEO.EQ.3) CALL WICH (190.5.44.44HNEO.3) ITNEAR RELEASE PATE. C          | LARC1  | 320 |
|   | lonstant FAILURE 1)   | LARC1  | 321 |
|   | IF (NED.ER.4) CALL WECH (100.5.44.44HNED=4 CONSTANT RELEASE RATE.           | LARC1  | 322 |
|   | 1 LINEAD FAILURE +1)  | LARCI  | 323 |
|   | CALL WICH (300,940,36,36HTIME AFTER ONSET OF ACCIDENT (HOURS).1)            | LARC1  | 324 |
|   | CALI WICH (100,965,67.TITLF1.1)   | LARC1  | 325 |
|   | CALL WICH (100,940,60,TITLE2,1)   | I ARC1 | 326 |
|   | IF (NURGAS) CALL WLCH (100.1023.35.TITLF3.1)                                | LARC1  | 327 |
|   | CALL ADV (1)  | 1 ARC1 | 328 |
|   | 190 CONTINUE  | LARC1  | 320 |
|   | GO τ <sup>U</sup> 10  | LARC1  | 330 |
|   | 200 CALI ExIT   | LARC1  | 331 |
| С |   | LARC1  | 332 |
|   | 210 FOKMAT (* NEG =*+I1)  | LARC1  | 333 |
|   | 220 FORMAT (1X+A10+5X+16HDECAY CONSTANT =+E10.3+5X.740ROUP =+72.5X+744      | LARC1  | 334 |
|   | 1IELD =. EI0.3.5X.7HNZER0 =. F10.3)   | ARC1   | 335 |
|   | 230 FORMAT (6H AGE = + F6.2.5X + 6HLAGE = + L1 + 5X + 6HFRAC = + F6.2)      | LARC1  | 336 |
|   | 240 FORWAT (* NOULE GASCLEANUP RATE ZERO *)                                 | LARC1  | 337 |
|   | 250  FORMAT (# NTOT =#,151  | LARC1  | 33R |
|   | 260 FORMAT (* TEMPERATURE MODEL USED =* I2 SX .* MEUEL =* I] SX .* TSOTOPE  | LARC1  | 339 |
|   | $1 = * \cdot ^{A} 1 \dot{0}$  | LARC1  | 340 |
|   | 270 FORHAT (* IVFMAX =*,15)   | LARC1  | 341 |
|   | 280 FORMAT. (A10+*1S0=*+I2+2X+*HFUFL=*+I1+2X+*AGE=*+F4+1+2X+*1ARF=*+L1+     | LARC1  | 342 |
|   | 12x•+FRAC=+•F4•1•2x•+YIELD=+•F5•2)  | LARC1  | 343 |
|   | 290 FORMAT (#NTD!=#,14,2X,#IVFMAX=#,13:10X+#,108=#+A1n,2X,#DATF=#,A8)       | LAPC1  | 344 |
|   | 300 FORMAT (A10+E10-3+I10+E10-3+FA+2+I1+L1+F10-3+9x+1)                      | LARC1  | 345 |
|   | 310 FORMAT (* INTERVAL NO. TIME AMOUNT PELFASED AMOUNT R                    | LARC1  | 346 |
|   | IEMATING AMOUNT IN COOLANT FRACTION IN COOLANT #//)                         | LARC1  | 347 |
|   | 320 FORMAT (110,0PF12,2-104F21,2)   | LARC1  | 348 |
|   | 330 FORMAJ (110+F12-2+1PE25-5+0P2F25-5)                                     | LAPC1  | 349 |
|   | 340 FORMAL (VI3H INTERVAL NO.554,4411ME,54,23HAMT IN CONTAINMENT BLDA.      | LARC1  | 351 |
|   | 113X + 2HAMT RELEASED + 8X + 1 (HOUMILATED REHEASE + //)                    | LARC1  | 371 |
|   | 350 FORMAL (11,4X)  | LARC1  | 352 |
|   |   | LAPC1  | 353 |
|   |   | LARC1  | 354 |
|   |   | LARC1  | 355 |
|   |   | LARCI  | 356 |
|   | $\begin{array}{c} 1 \\ 0 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 0$ | LAPCI  | 357 |
|   |   | LARCI  | 378 |
|   | $R_{1} = (1, 1, 0)$ (0 10 20 $R_{1} = (1, 1, 0)$                            | LARCI  | 350 |
|   | PETURN  |        | 360 |
|   | 20 81=29, 34FXP(=12000, /T)   |        | 361 |
|   |   |        | 362 |
|   | 30 RI=597 69#FXP(-23157./T)   |        | 364 |
|   | RETURN  | LARCI  | 365 |
|   | 40 IF (BISD) 60 TO 50   | 1 APC1 | 364 |
|   | RI = 012824EXP(-14834.7)  |        | 367 |
|   | RETURN  | LARC1  | 368 |
|   | 50 HI=171_91*EXP(-17858_/T)   | I ARC1 | 260 |
|   | RETURN  | LARC1  | 370 |
|   | 60 IF ( <sup>1</sup> 150) GO TO 70  | t ARC1 | 371 |
|   | RI=5+4A686+EXP(-25798_/T)   | I ARC1 | 372 |
|   | RETURN  | I ARC1 | 373 |
|   | 70 RI=)•5#225E5*EXP(=28652•5/T)   | LARCI  | 374 |
|   | RETURN  | LARC1  | 375 |
|   | 80 HI=_UIN742*EXP(-10313./T)  | LARC1  | 376 |
|   |   |        |     |

|     | RETHRN   | 1.ARC1 | 377             |
|-----|--|--------|-----------------|
| 90  | RI=_04427*EXP(=10482./T)                             | LARC1  | 37A             |
|     | RETHRN   | LARC1  | 379             |
| 100 | RI===+40686*EXP(-2579A./T)                           | LARC1  | 38n             |
|     | RETURN   | LARC1  | 381             |
| 110 | IF (8190) GO TO 120                                  | LARC1  | 382             |
|     | RI=5.40686*EXP(-25798./T)                            | LARC1  | 38.3            |
|     | RETURN   | LARC1  | 384             |
| 120 | RI=_04427*EXP(-10482./T)                             | LARC1  | 385             |
|     | RETURN   | LARC1  | 385             |
| 130 | IF (BISO) GO TO 140                                  | L-ARC1 | 387             |
|     | RI=5.40686*EXP(-25798./T)                            | LARC1  | 388             |
|     | RETURN   | LARCI  | 389             |
| 140 | RI=_04427*EXP(-10482./T)                             | LARC1  | 390             |
|     | RETIRN   | LARC1  | 391             |
| 150 | RI=_10280*EXP(=10314./T)                             | LARC1  | 392             |
|     | RETURN   | LARC1  | 393             |
| 160 | GO TU (170+180+210+220+230+240+250+270+240+300), TSO | 1.ARC1 | 394             |
| 170 | RI29.7733L=4*LXP(=8262.1/T)                          | LARCI  | 395             |
|     | RETURN   | LARCI  | 396             |
| 180 | IF (1./1.GT.5.64E=4) GO TO 190                       | LARC1  | 397             |
|     | RI=5•3>3IE9*EXP(=58360•/T)                           | LARC1  | 398             |
|     | RETHRN   | LARCI  | 399             |
| 190 | IF (1./T.GT.7.59E-4) GO TO 200                       | 1_ARC1 | 400             |
|     | RI = V4x144 + EXP(-13198 / T)                        | LARC1  | 401             |
| _   | RETURN   | LARCI  | 402             |
| 200 | RI=9•7733E-4*EXP(-8262.1/T)                          | LARCI  | 403             |
|     |  | LARCI  | <b>404</b>      |
| 210 | R1=9•7733E=4*EXP(=8262•1/1)                          | LARCI  | 405             |
|     |  | LARCI  | 405             |
| 220 | 1=7.733C+44CXP(=0202.1/1)                            |        | 407             |
| 224 |  |        | 80 <del>0</del> |
| 230 | RIE114//33644-676/650501/1)                          |        | 404             |
| 340 | RETURN<br>RT-7-3-51F-30FYD/-9494 3/TV                |        | 411             |
| 240 | NI=/*//JIC=J*CXF(=0070+3/1)                          |        | 411             |
| 250 | TE (1) (T-GT-5-338-4) CO TO 340                      |        | 412             |
| 270 | $P_1 = 1/30$ 585 $P_1 = 35350$ $P_1 = 1$             |        |                 |
|     |  |        |                 |
| 260 | RI=0+7733F+4#FXP(+8969-1/T)                          |        | 414             |
| 200 | RETURN   |        | 417             |
| 270 | RI=0.7733F=4#FXP(=8262 1/T)                          |        | 410             |
| 210 | RETURN   |        | 410             |
| 280 | 1E (1 )T.GT 6-26E-41 60 TO 290                       |        | 420             |
| 2   | HT=1+1+548F4*EXP(=34207-/T)                          | LARC1  | 421             |
|     | RETURN   | 1 APC1 | 422             |
| 290 | RI=9.7733E=4*EXP(=8262 1/T)                          | 1 ARC1 | 423             |
| 270 |  | 1 APC1 | 424             |
| 300 | RI=9.7733E-4*EXP(-8262.1/T)                          | LARC1  | 425             |
| 500 | RETURN   | LARC1  | 426             |
|     | FND  | t ARC1 | \$27            |
|     | FUNCITON RE (T)                                      |        | 429             |
|     | LOGICAL LAGE BISO                                    | t ARC1 | 429             |
|     | COMMUN /LA/ LAGE + AGE + MEHEL + ISO + BISO          | 1 ARC1 | 430             |
|     | IF (MFHEL.EQ.1) GO TO 120                            | LARC1  | 431             |
|     | GO TU (10,20,30,40,50,60,70,80,90,100), 150          | LARC1  | 432             |
| 10  | RF=159.37*EXP(-11861./T)                             | LARC1  | 433             |
|     | RETIMN   | LARC1  | 434             |
| 50  | RF=) • 6154E64EXP (-26374./T)                        | LARC1  | 435             |
| -   | RETURN   | LARC1  | 436             |
| 30  | RF=)319+2*EXP(-17782+/T)                             | LARC1  | 437             |
|     | RETURN   | LARC1  | 43Å             |
| 40  | HF=1.2316E6#EXP(~28319./T)                           | LARC1  | 439             |

.

•

|     | PE TURN  |         |     |
|-----|--|---------|-----|
|     |  | LARCI   | 440 |
| 50  | RF=1/49+25*EXP(=19545+1/T)   | LARC1   | 441 |
|     |  | LAPC1   | 442 |
| 60  | RF=130()+4*EXP(=1/662*/T)  | LARC1   | 443 |
|     | RETI/N   | LARC1   | 444 |
| 70  | RF=1+2316E6*EXP(-28319,/T)   | LARC1   | 445 |
| • • |  | LARC1   | 446 |
| 80  | RF=1+2316E6*EXF(-28319,/T)   | LARC1   | 447 |
|     | RETURN   | LAPC1   | 448 |
| 90  | RF=1•2316E6*EXP(-28319•/T)   | LARC1   | 449 |
|     |  | LARC1   | 450 |
| 100 | IF (BISO) GO TO 110  | 1. ARC1 | 451 |
|     | RF=7•3405*EXP(-13777•/T)   | LARC1   | 452 |
|     | RETURN   | LARC1   | 453 |
| 110 | RF=2149.44*EXP(-18175./T)  | LARC1   | 454 |
|     | RETIRN   | LARC1   | 455 |
| 120 | G0 TD (130+140+170+180+190+200+210+220+230+240)+ 150                 | LARC1   | 456 |
| 130 | RF=1.8289E4#EXP(-22861./T)   | I ARCI  | 457 |
|     | RETURN   | LARC1   | 458 |
| 140 | IF (1,/T.GT.5.64E-4) CO TO 150                                       | I ARC1  | 459 |
|     | HF=5+3231E9*EXP(-58360./T)   | LARC1   | 460 |
|     | RETIKN   | I ARC1  | 461 |
| 150 | IF (1°/1.4.1.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.                      | LARC1   | 462 |
|     | RF=_0461444EXP(-13198_/T)  | I ARC1  | 463 |
|     | RETURN   | I ARC1  | 464 |
| 160 | HF=9+7733E-4*EXP(-8262-1/T)  | LARC1   | 464 |
|     | RETURN   | LANCI   | 464 |
| 170 | RF-8952-44FXP(-22657 / T)  | LARCI   | 467 |
|     | RETURN   | LADOL   | 407 |
| 190 | NE 100N<br>NF=0237,7#FXP(=21220,7T)                                  |         | 408 |
| 100 |  | LARCI   | 47  |
| 190 |  | LARCI   |     |
| 1,0 |  | LANCI   | 47  |
| 200 |  |         | 4/2 |
| 200 | RETURN   | LARCI   | 47  |
| 210 | BE-2231 78EXP (-21229 /T)  | LARCI   | 476 |
|     | RETURN   | LARCI   | 474 |
| 220 | RF=-23%, 7#FXP(=21220, /T)   | LARCI   | 47- |
| 220 | RETURN   | LARCI   | 470 |
| 230 | RF=2231-7#EXP(-21229-21)   | LARCI   | 470 |
|     | RETURN   | LANCI   | 413 |
| 240 | RF=89544FXP(-22657-/T)   |         | 400 |
| 240 | NETINA   | LARCI   | 401 |
|     |  | LARCI   | 40/ |
|     | FUNCTION FRACED (T)  |         | 402 |
|     |  | LARCI   | 404 |
|     |  | LARCI   | 407 |
|     |  | LARCI   | 405 |
|     |  |         | 45/ |
|     |  | LARCI   | 40. |
|     | $D_{1} = (3) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0$                 | LARCI   | 400 |
| 2   | U) TY (R)<br>DATA EDA(2/-0)5264-00504-00714-01164-0105-046-057-084-4 | LARC1   | 490 |
|     |  | LARCI   | 471 |
| 1   | 13 1-7 / / / / / / / / / / / / / / / / / / /                         | LARCI   | 490 |
|     | DATA FRACA/ 00718, 0070, 01, 021, 0557, 10, 525, (-20)               | LARCI   | 49  |
|     | DATA 1/1672-154/60/174-01/1/0/19/021/021/021/0270-05                 | LARCI   | 494 |
| ,   |  | LANUI   | 490 |
|     | SOLANE BUILNDARY CONDITIONS FTO                                      | LAPC1   | 496 |
|     | STETTE BOONDART CUNDITIONS ETC.                                      | LARC1   | 497 |
|     |  | LARC1   | 496 |
|     |  | LARCI   | 499 |
|     | 107 (* ) = 2   | LARC1   | 500 |
|     |  | LARC1   | 501 |
|     | 114 = M  | LARC1   | 502 |

с

|          | CALL SPLID1 (N3+T3+FRAC3+W3+IOP+IJ+A+B+C)<br>CALL SPLID1 (N4+T4+FRAC4+W4+IOP+IJ+A+B+C)<br>RETURN  |
|----------|---|
|          | ENTRY FRACB   |
|          | IAGE=AGE<br>IAGE <sup>I</sup> =IAGE+1   |
|          | F1=0.0  |
|          | F2=n•0<br>F3=n•n  |
|          | F4=n+0  |
|          | F23± <sup>V</sup> ,0<br>X=Act=TAGE  |
|          | IF (Å.NE. 0.0) GO TO 10   |
|          | IF (AGF.EQ.0.0) GO TO 10  |
|          | IAGF1=IAGE  |
| 10       | IAGE=IAGE-1   |
| 10       | IF (MFHEL.EQ.1) GO TO 160   |
|          | F1=1+0  |
|          | F2=1•0<br>F3=1•0  |
|          | F4=1.0  |
|          | $IF (1_{0}GE_{0}2273_{0}15) GO TO 50$ $IF (1_{0}GE_{0}2073_{0}15) GO TO 40$   |
|          | F1=,00179   |
|          | $FZ=_{0}0377$<br>IF ( $T_{0}$ , $T$ |
|          | CALL SOLIDE (N4+T4+FRAC4+W4+IJ+T+TAB)   |
|          | IF ( <sup>T</sup> •1 T•1690•15) GO TO 30  |
|          | CALL SPL1D2 (N3+T3+FRAC3+W3+IJ+T+TAB)   |
|          | GO TU GO  |
| 20<br>30 | F4=,00718<br>F3=,00=26  |
|          | GO TU 50  |
| 40       | CONTINIE<br>Fiz-In 3454+4-991055-20T  |
|          | F2=_I0_3229+4_98115E=3+T  |
|          | F3=_9,439441+4,592500E_3*T<br>F4=_2,775124+2,98050E_3*T   |
| 50       | CONTINUE  |
|          | F23=0.5*(F2+F3)<br>IF (+NOT+LAGE) GO TO 100   |
|          | IF (1AGE. UT. 3) GO TO 90   |
| 60       | GO TO (60,70,80,90), TAGE1<br>FRACB=AGE*F1  |
| _        | GO TU 150   |
| 70       | FRAC8=1+25*(3+*F1+2+*X*F1+3+*X*F2)<br>GO TU 150   |
| 80       | FRACH=1.25+(F1+(2X)+F2+2.+X+F3)   |
| 90       | GO TO 150<br>FRACB=0.25*(F1+F2+F3+x*F4)   |
|          | GO TU 150   |
| 100      | GO = TO (110+120+130+140) + [AGE1]  |
| 110      | FRACB=AGE#F1  |
| 120      | FKACG=F1+X*(F2=F1)  |
| 13-      | GO TO 150   |
| 120      | GD TO 150   |

| 1 ARC1         | 503        |
|----------------|------------|
| LARC1          | 504        |
| LARC1          | 505        |
| LARC1          | 506        |
| LARC1          | 507        |
|                | 506        |
|                | 500        |
| LARC-          | 510        |
| LARC1          | 511        |
| LARC1          | 512        |
| LARCI          | 513        |
| I ARC1         | 514        |
| LARC1          | 515        |
| LARC1          | 516        |
| 1 ARC1         | 517        |
| LARC1          | 518        |
|                | 510        |
|                | 520        |
|                | 521        |
|                | 522        |
| LARC1          | 523        |
|                | 524        |
|                | 525        |
|                | 526        |
|                | 527        |
| LARCI          | 520        |
|                | 520        |
| LARC1          | 530        |
| LARCI          | 531        |
| LARC1          | 532        |
| LARC1          | 533        |
| LARCI          | 534        |
| t ARC1         | 535        |
|                | 534        |
|                | 537        |
| LARCI          | 530        |
|                | 530        |
| LARC1          | 540        |
|                | 541        |
| I APC1         | 542        |
| LARCI          | 543        |
|                | 543        |
|                | 545        |
|                | 546        |
| LARCI          | 540        |
| LARCI          | 547        |
|                | 540        |
| LARC1          | 550        |
| 1 APC1         | 550        |
| LARCI          | 551        |
|                | 557        |
| I ARC1         | 554        |
| LARCI          | 555        |
| 1 4901         | 554        |
| LARC1          | 557        |
| LARC1          | 550        |
| LARC1          | 550        |
| LARC1          | 559        |
| LANCI<br>LARCI | 500        |
| LARCI          | 501        |
|                | 567        |
|                | 503        |
| LANCI          | 094<br>56e |
| LARCI          | 207        |

|   | 140 | FHACU=F3+(AGE=3,)*(F4=F3)  |
|---|-----|--|
|   | 150 | RETURN   |
| С |     | SORS FIEL AGE MODELRISO  |
|   | 160 | IF (LAGE) GO TO 200  |
|   |     | FRACE=1.0  |
|   |     | IF (AGF.GT.0.221 GO TO 180   |
|   |     | IF (1,67,1998,15) GO TO 190  |
|   |     | $\frac{11}{10} \left( \frac{1}{10} \right) = \frac{1000}{100} \left( \frac{100}{100} \right) = \frac{1000}{100} \left( \frac{1000}{100} \right) = \frac{1000}{100}$ |
|   |     | RA(0 = 10 + 27 - 20 + 14 - 20 + 1 + 20 + 10 + 1  |
|   | 170 | FRACHER  |
|   |     | GO TU 190  |
| С |     | BISD CONSTANTS   |
|   | 180 | TONF=2011,97*EXP(0574098*AGE)  |
|   |     | 15 (1. cf. TONE) GO TO 190   |
|   |     | TZEPU=1876.17#EXP(0804098#AGE)   |
|   |     | IF (T.   E. TZERO) GO TO 170   |
|   |     | FRACE=(T=TZERO)/(TONE=TZERO)   |
|   | 190 | FRACE=FRACE++025*AGE   |
|   |     | RETURN   |
|   | 200 | Finner (   |
|   | 200 | F2=1.0   |
|   |     | F3=1+0   |
|   |     | F4=1 • 0   |
|   |     | AGEI=X   |
|   |     | AGE2=1.+X  |
|   |     | AGE3=2.+X  |
|   |     | AGE4=3.+X  |
|   |     | IF (A.GI.U.12) GU 10 220<br>IF (T.AT.1998 15) 60 70 230  |
|   |     | $\frac{1}{16} \left( \frac{1}{16} + \frac{1}{16}$   |
|   |     | F1=-13 2725+7.14286F-3+T   |
|   |     | GO TU 230  |
|   | 210 | F1=n+0   |
|   |     | GO. TO 230   |
|   | 250 | TONF1=>11.97*EXP(0574098*AGE1)   |
|   |     | IF (1. GT. TONE1) GO TO 290  |
|   |     | IZENO121878.174EAP(=.08040984AGE1)   |
|   |     | IF ('_)F (ZE'OI) (0 (0 ZIU<br>E1 = (T==ZEPOI) / (T(NEI==ZEPOI)   |
|   | 230 | TONE2=0011-970FXP(+-05740980AGE2)  |
|   | 230 | 1F (1.cT.TONE2) GU TO 290  |
|   |     | TZEPU2=1876,17*EXP(-,0804098*AGE2)   |
|   |     | IF (T . E . TZEROZ) GO TO 240  |
|   |     | F <sup>2</sup> =(I-T2ERO <sup>2</sup> )/(TONE <sup>2</sup> -TZERO <sup>2</sup> )   |
|   |     | GO TU 250  |
|   | 240 | $F_{2=0}$  |
|   | 230 | TONE 322011.97"EXP(4.0574094"AGE3)   |
|   |     | T7F903_1876_17#FXP/0804098#AGF31   |
|   |     | IF $(1 - 1) = 172ERO3$ GO TO 260   |
|   |     | F3=(1-T/ERO3)/(TUNE3-TZERO3)   |
|   |     | GO TO 2/0  |
|   | 260 | F3=n•0   |
|   | 270 | TONF4=2011.97*EXP(0574098*AGE4)  |
|   |     | 1F (1.GT.TONE4) GO TO 290  |
|   |     | $I \neq D = 1076 \bullet 1795 \times P = 0804098 \text{ AGE4}$   |
|   |     | 15 (10) [CONCAL (CONCAL) 2000  |
|   |     | GO TÚ 590  |
|   |     |  |
|   | 280 | F4=0.0   |

| I ARC1  | 566                 |
|---------|---------------------|
|         | 567                 |
| LVACI   | 507                 |
| I ARC1  | 568                 |
| 1 1001  | 540                 |
| LARCI   | 504                 |
| LARC1   | 570                 |
| 1.001   | 571                 |
| LARCA   | 571                 |
| LARC1   | 572                 |
| LAPC1   | 573                 |
| LANCI   | 5.7                 |
| LARCI   | D ( 4               |
| LARC1   | 575                 |
| 1.001   | = 1 /               |
| LAKCI   | 219                 |
| I ARC1  | 577                 |
| 1 1001  | 570                 |
| LARCI   | 218                 |
| LARC1   | 579                 |
| LARC1   | 580                 |
| LANCI   |                     |
| LARC1   | 581                 |
| LARC1   | 582                 |
| LANCI   | 5.07                |
| LARCI   | 283                 |
| LARC1   | 584                 |
|         | 505                 |
| LARCI   | 28-                 |
| LARC1   | 586                 |
|         |                     |
| LARCI   | 557                 |
| LARC1   | 588                 |
|         |                     |
| LARCI   | 222                 |
| LARC1   | 590                 |
| LADOL   | 501                 |
| LARCI   | 591                 |
| 1 ARC1  | 592                 |
| 1.4001  | 597                 |
| LVACT   |                     |
| LARC1   | 594                 |
| i ARC1  | 59=                 |
| LARCE   |                     |
| LVHCI   | 246                 |
| LARC1   | 597                 |
| 1.001   | 500                 |
| LARUI   | 376                 |
| I, ARC1 | 599                 |
| LAPC1   | 607                 |
| LANCI   | 201                 |
| LARCI   | 6.1                 |
| LARC1   | 602                 |
| 1.001   |                     |
| [ VHCI  | 6.0.5               |
| LARC1   | 604                 |
| L.Pol   | 607                 |
| LANCI   | 00-                 |
| LARC1   | 60/                 |
| EARC1   | 607                 |
| LACOL   | 6.0.                |
| LAKCI   | 001                 |
| LARC1   | 600                 |
| 1.001   | <b>6</b> 1 <i>1</i> |
| LANCI   | 011                 |
| LARC1   | 611                 |
| I ARC1  | 614                 |
| LANCI   |                     |
| LARCI   | 61                  |
| LARCI   | 614                 |
|         | 611                 |
| LARCI   | 01-                 |
| LARC1   | 616                 |
| I APC1  | 61.                 |
|         | 2.1                 |
| LAKCI   | - 611               |
| LARC1   | 619                 |
| 1 4001  | 4.04                |
| LANCI   | 040                 |
| LARC1   | 621                 |
| I APC1  | 62                  |
| LANUA   | 047                 |
| LARC1   | 62;                 |
| 1 ARC1  | 624                 |
| LHOUI   | 2.2                 |
| LVHC1   | 625                 |
| LARC1   | 621                 |
|         |                     |
| 1 AHCI  | 62                  |
| LARC1   | 621                 |
|         |                     |

| 141    | GO TO (300;310;320;330), IAGE1                                       | LARC1          | 620        |
|--------|--|----------------|------------|
| 300    | F1=F1+_025*AGE1  |                | 630        |
|        | FRACH=F1   |                | 631        |
|        | GO TD 340  |                | 631        |
| 310    | F1=F1+_025*AGE1  |                | 430        |
|        | F2=F4+ 025*AGF2  |                | 63,1       |
|        | FRACH=0.25*(F1+3.0F2)  |                | 634        |
|        | GO TU 240  | LARUI          | C.50       |
| 320    | F1=F1+.025*AGE1  |                | 03h<br>437 |
| - •. • | F2=F2+ 025#AGF2  |                | 631        |
|        | F3=F3+ 025#AGE3  |                | 634        |
|        | FRACH=0.25*(F1+F2+2.*F3)   |                | 6/0        |
|        | GO TO 340  |                | 641        |
| 330    | F1=F1+ 025+AGE1  |                | 643        |
|        | F2=F2+ 025*AGE2  |                | 643        |
|        | F3=F3+ 125*AGE3  | LANCI<br>LARCI | 644        |
|        | F4=F4+ n25+AGE4  |                | 645        |
|        | FRACH=n+25#(F1+F2+F3+F4)   | LANCI<br>LARCI | 644        |
| 340    | FRACH=AMIN1 (FRACH+1.0)  |                | 647        |
|        | RETURN   | t APC1         | 640        |
|        | END  |                | 640        |
|        | FUNCTION FRACT (T)   | 1 APC1         | 650        |
|        | LOGTCAL LAGE + BISO  | LARCI<br>LARCI | 651        |
|        | COMMUN /LA/ LAGE.AGE.MFUEL.ISO.BISO                                  |                | 652        |
|        | COMMUN /F/ F1+F2+F3+F4   |                | 652        |
|        | IAGE=AGE   | LARGI          | 654        |
|        | IAGF1=TAGE+1   | LARC1          | 655        |
|        | F1=0.0   | t ARC1         | 656        |
|        | F2=0.0   | LARCI          | 657        |
|        | F3=0.0   | LARC1          | 65.        |
|        | F4=0.0   | LARC1          | 659        |
|        | F23=0, h   | LARC1          | 660        |
|        | X=AGE-TAGE   | LARC1          | 661        |
|        | IF $(\Lambda_{\bullet} \times E_{\bullet}^{\circ} \circ 0)$ GO TO 10 | LARC1          | 662        |
|        | IF (AGF.EQ.0.0) GO TO 10   | LARC1          | 663        |
|        | x=1,0.   | LARC1          | 664        |
|        | IAGFI=TAGE   | LARC1          | 665        |
| _      | IAGF IAGE -1   | LARC1          | 666        |
| 10     | CONTINIE   | LARC1          | 667        |
|        | IF (MFIEL . EQ. 1) GO TO 170   | 1. ARC1        | 668        |
|        |  | LARC1          | 669        |
|        | r2=1•0   | LARC1          | 670        |
|        | r 3=1+0  | LARC1          | 671        |
|        |  | LARC1          | 67?        |
|        | IF (1.GE. (2273.15) GO TO 60   | LARCI          | 673        |
|        | IF (1.6E.1941.15) GO TO 40   | 1_ARC1         | 674        |
|        |  | LARC1          | 675        |
|        | IF ('• ck • 1902 • 15) GO TO 30                                      | LARC1          | 675        |
|        | THIS IS A CHANGE IN CALCULATION OF FE IN FRACT                       | LARC1          | 677        |
|        | 7 Z=4+94005L=44EXP(9,15,323t=44)                                     | LARC1          | 678        |
|        | 17 (1.61 + 1888 + 85) GO TO 40                                       | LARC1          | 679        |
|        | TE ( 1072 ) CL 00 TO TO  | LARC1          | 680        |
|        | ↓F ('•RC•18/3•15) GO TO 50<br>F4=1+1=1745-385×0/1 1=0/45 3r=1        | LARC1          | 681        |
|        | 「マー」+1/1/0C=3*EXF(1,19064た=3#T)<br>GO T() / D                        | LARC1          | 682        |
| -      | 50 - 5 KU<br>F1m-5 - 03614 - 2007225-287                             | LARC1          | 683        |
| 20     | F2- 5 14221 2680050 244  | LARC1          | 684        |
| 20     | FR   | LARC1          | 685        |
|        | FA==4 /2004 247285-24+   | LARC1          | 686        |
| 60     |  | LARC1          | 687        |
|        | F23=0.ce(F2+F3)  | LARCI          | 683        |
|        | IF (+NOTALAGE) GO TO 110   | 1.ARC1         | 689        |
|        | IF (1AcE.GT.3) GO TO 100   | LARCI          | 690        |
|        | - · · · · · · · · · · · · · · · · · · ·                              | I ARCI         | 971        |

۰.

•

С

|   |       | GO T <sup>U</sup> (70880,90,100); IAGE1  | LARC1  | 692 |
|---|-------|--|--------|-----|
|   | 70    | FRACT=AGE+F1   | I ARC1 | 693 |
|   |       | GO TO TO   | LARCI  | 694 |
|   | 80    | FRACT=j+25*(3+*F1-2+*x*F1+3+*x*F2)   | LARC1  | 695 |
|   |       | GO TO 160  | LARC1  | 696 |
|   | 90    | FRArT=ñ.25#(F1+(2.=x)#F2+2.#x#F3)  | LARC1  | 697 |
|   |       | GO τ <sup>0</sup> į60  | LARC1  | 698 |
|   | 100   | FRACT=6+25#(F1+F2+F3+x#F4)   | LARC1  | 699 |
|   |       | GO T <sup>O</sup> 160  | LARC1  | 700 |
|   | 110   | IF (1AGE.GT.3) GO TO 150   | LARC1  | 701 |
|   |       | GO + O (120+130+140+150) + IAGE1   | LARC1  | 702 |
|   | 120   | FRACT=AGL#F1   | LARC1  | 703 |
|   |       |  | LARCI  | 704 |
|   | 130   | FRACI=F1+X*(F2-F1)   | LARCI  | 705 |
|   | . 4 . |  |        | 705 |
|   | 140   |  |        | 709 |
|   | 15.   | $G_{0} = 10$ 10 100 $F_{0} = 10$ (AGF=2)   | LARC1  | 709 |
|   | 160   |  | I ARC1 | 710 |
| С |       | SORS FUEL AGE MODEL TRISO  | LARC1  | 711 |
|   | 170   | 1F (LAGE) GO TO 210  | LARC1  | 712 |
|   |       | FRACT=1.0  | LARC1  | 713 |
|   |       | IF ( <sup>A</sup> GF.GT.0.12) GO TO 190  | LARC1  | 714 |
|   |       | IF ( <u>1.61.1998.15</u> ) GO TO 200   | LARC1  | 715 |
|   |       | IF (T. T. 1858.15) GO TO 180   | LARCI  | 716 |
|   |       | FRAC1=_13.2725+7.14286E-3*T  | LARC1  | 717 |
|   |       |  | LARC1  | 718 |
|   | 190   |  | LARCI  | 719 |
|   | 190   | GU TO VOV  |        | 721 |
|   | 1 90  |  |        | 723 |
|   |       |  |        | 723 |
|   |       | IF (T. E. TZERO) GO TO 180   | t ARC1 | 724 |
|   |       | FRACT=(T-TZER01/(TONE-TZER0)   | LARCI  | 725 |
|   | 200   | FRACT=FRACT+.025*AGE   | LARC1  | 726 |
|   |       | FRACT=AMIN1 (FRACT+1+01  | LARC1  | 727 |
|   |       | RETURN   | LARC1  | 728 |
|   | 210   | F1=1•0   | LARC1  | 729 |
|   |       | F2=1•0   | LARC1  | 730 |
|   |       | F3=)•0   | LARCI  | 731 |
|   |       |  | LARCI  | 732 |
|   |       |  |        | 733 |
|   |       |  |        | 735 |
|   |       | AGE = 3 + X  | t ARC1 | 736 |
|   |       | IF (X.GT.0.12) GD TO 230   | LARC1  | 737 |
|   |       | IF (T. GT. 1998.15) GO TO 240  | LARC1  | 73g |
|   |       | IF ( <sup>T</sup> .1858.15) GO TO 220  | LARC1  | 739 |
|   |       | F1=-13.2725+7.14286E=3#T   | LARC1  | 740 |
|   |       | GO T <sup>O</sup> 240  | LARC1  | 741 |
|   | 220   |  | LARC1  | 742 |
|   |       |  | LARC1  | 743 |
|   | 230   | $10 \text{ MF} = 2(0.9 \cdot 5.3 \cdot 2.4 \cdot (= 0.0472964^{\circ} \text{ AGE } 1)$ | LARCI  | 744 |
|   |       | 1F ('.cT.TONE1) GO TO 300<br>TZEDU 1980 18570 - 007445084651)                          | LARCI  | 745 |
|   |       | 1257712100001772AF(4007749377A051)<br>15 /T /F.T7FR011 60 TA 320                       |        | 747 |
|   |       | F 1-1C+12CM1/ 00 10 220<br>F1-1T+76P01)//TONF1-776P01)                                 |        | 747 |
|   | 240   | TONE2-0009-53%EXP/- 0472964#AGE2)  |        | 740 |
|   | 240   | IF (T. CT. TONE2) GO TO 300  | t ARC1 | 750 |
|   |       | TZERU2=1880.1*EXP(0974459*AGE2)  | LARC1  | 751 |
|   |       | IF (T.   E. TZEHO2) GO TO 250  | LARC1  | 752 |
|   |       | F2=(T-+/ER02)/(TONE2-T7ER02)   | 1 ARC1 | 753 |
|   |       | GO TO 260  | LARC1  | 754 |

•

|   | •    |   |        |      |
|---|------|---|--------|------|
|   | 250  |   | LARCI  | 755  |
|   | 260  | TONF3=2009.53*EXP(0472964*AGE3)                                       | I ARC1 | 756  |
|   |      | IF $(T_{0}, GT_{0}, TONE3)$ GO TO 300                                 | LARC1  | 757  |
|   |      | T7FR03 - 1880 - 19FXP( - 007445900F3)                                 | LARCI  | 750  |
|   |      |   | LARCI  | 7.58 |
|   |      |   | LARCI  | 759  |
|   |      | (0 - 0 - 00   | LARCI  | 760  |
|   | _    |   | LARC1  | 761  |
|   | 270  | F3=n•0  | LARC1  | 762  |
|   | 280  | TONF4=2099.53*EXP(0472964*AGE4)                                       | LARC1  | 763  |
|   |      | IF $(1 + GT + TONE4)$ GU TO 300                                       | LARC1  | 764  |
|   |      | $TZEPU4 \pm 1880 \cdot 1 + EXP(0974459 + AGE4)$                       | LARC1  | 765  |
|   |      | IF (1) E TZERUA) GO TO 290  | LANCI  | 767  |
|   |      | $F_{4=1}$ (Terreference) / (T(INE( $a - \tau 2EP(a))$ )               |        | 700  |
|   |      |   | LARCI  | 107  |
|   | 200  |   | LARCI  | /08  |
|   | 290  |   | LVHC1  | 769  |
|   | 300  | IF (1AGE+GT-3) GO TO 340  | LARC1  | 770  |
|   |      | GO TU (310,320,330,340), IAGE1  | LARC1  | 771  |
|   | 310  | F1=FI+_025*AGE1   | LARC1  | 772  |
|   |      | FRACT=F1  | 1 ARC1 | 773  |
|   |      | 60 TO 350   | LARC1  | 774  |
|   | 320  | F1=F1+ 025#AGF1   |        | 776  |
|   | •••• |   | LARCI  | 774  |
|   |      |   | LARCI  | 110  |
|   |      |   | LARCI  | 777  |
|   |      |   | LARC1  | 77A  |
|   | 330  | F1=F1+.025*AGE1   | LARC1  | 779  |
|   |      | F?#F2+_025+AGE2   | LARC1  | 780  |
|   |      | F3=F3+_025#AGE3   | LARC1  | 781  |
|   |      | FRACT=++25+(F1+F2+2++F3)  | I APC1 | 78.3 |
|   |      | GO TU 350   |        | 792  |
|   | 340  | F1-F1, 025+AGF1   | LANCI  | 705  |
|   | 340  |   | LARCI  | 704  |
|   |      |   | LARCI  | 785  |
|   |      |   | LARCI  | 786  |
|   |      |   | LARC1  | 787  |
|   |      | FRACI=0.25*(F1+F2+F3+F4)  | LARC1  | 788  |
|   | 350  | FRACI=AMIN1 (FRACT+1+0)   | LARC1  | 789  |
|   |      | 4 E T HRN   | LARC1  | 790  |
|   |      | END   | I ARCI | 791  |
|   |      | SUGDUITINE PLOT (N+X+MX+Y+MY+TCHAR+ICON)                              | LARC1  | 795  |
|   |      | DIMENSTON X(1) . Y(1)   | LANCI  | 792  |
|   |      | COMMON /C.IFO7/ TXL TXP.TVT.TVP.VI /YP.VT VP                          |        | 773  |
|   |      | COMMIN / INFW / TYSAVE +YSAVE   | LARCI  | 794  |
| c |      | THIS SUPERVISED AND AND AND AND AND AND AND AND AND AN                | 1.ARC1 | 795  |
| č |      | THIS STREAM INE IS MONTFIED BY THE INCLUSTON OF I JNEW                | LARCI  | (96  |
| C |      | LUNFA TO INCLUDED SO THAT TXSAVE, IYSAVE MAY BE USED FOR TITLES       | LARC1  | 797  |
|   |      | INTEGER HLANK +PLIDOT   | LARC1  | 798  |
|   |      | DATA BIANK PLIDOT/608,528/  | LARC1  | 799  |
|   |      |   | LARC1  | 800  |
|   |      | IYSAVF=Y(1)   | 1 APC1 | 801  |
|   |      | $YNG=U - c^{\phi}Y(N)$  |        | 801  |
|   |      | IF (N-E0-2) YN6==2 0  |        | 502  |
|   |      | I (Nervel) (NG-2.0)   | LARCI  | 803  |
|   |      |   | 1.ARC1 | 804  |
|   |      |   | LARC1  | 805  |
|   |      |   | LARC1  | 806  |
|   |      | IF (FY_NE.0) FY=(IYR-IYT)/FY  | LARC1  | 807  |
|   |      | K=1   | LAPC1  | 808  |
|   |      | M=N=1   | I ARC1 | 809  |
|   |      | I = 0   | LARC1  | 810  |
|   |      | J=0   | 1 4001 | 011  |
|   |      |   |        | 011  |
|   |      |   | LARCI  | 012  |
|   |      | TE ( TANAD EO DI ANKA AD ( / TOULD ED DI TODEL AND ANT ADA ( TOULD E) | LARCI  | 813  |
|   | • •  | TV3 MT.0(MAN.EM.DELANN/.004(LCHAN.EQ.PL.UDT).AND.(MPJCON.NF.0))) K#0  | LARCI  | 814  |
|   | 10   | +XC=***(NV (MAXU(1XL+1F1X((X(1+1)=XL)*FX)+TXL)+TXR)                   | LARC1  | 815  |
|   |      | 172="IND(MAX0(1Y1+IFIX((Y(.)+1)-YT)"FY)!IYT)+YYA)                     | LARC1  | 816  |
|   |      | IF (N=NE=U) CALL PLT (IXG=IYC=ICHAR)                                  | I ARC1 | 817  |

•

|   | IF (L'NE.O) CALL DRV (IX1,IY1,IX2,IY2)  | LARC1    | 81 A        |
|---|---|----------|-------------|
|   | IF (M., E.O) GO TO 30   | LARCÍ    | 819         |
|   | IF $(Y(j+1),GT,YNG)$ GO TO 20   | LARC1    | 820         |
|   | IXSAVETIX5  | LARC1    | 821         |
|   | IYSA <sup>V</sup> F=IY2   | LARC1    | 822         |
|   | 20 CONTINUE   | LARC1    | 823         |
|   | M=M_1   | LARCL    | 824         |
|   | I = I + M x   | I ARC1   | 824         |
|   | YM+ C=C   | LARCI    | 824         |
|   | L=JC <sup>ON</sup>  | LARCI    | 827         |
|   | IX1=lX2   | LARCI    | 826         |
|   | IY1=1Y2   | I ARC1   | 820         |
|   | GO TU 10  | LARC1    | 830         |
|   | 30 KETUKN   | I ADC1   | 831         |
|   | ENI   | LADCI    | 934         |
|   | FUNCTION TEMPO (VF)   | 1 APC1   | 834         |
|   | DIMENSION IOP (2) + TAB (3)   | I ARC1   | 834         |
|   | UIMENSTON X(14) . TEMPE(14) . W(14) . A(14) . B(14) . C(14)   |          | 836         |
|   | COMMUN /SPEC/ TEMPF.X   | LAPC1    | 934         |
|   | DATA X/001.03333.06666.1.2.2.3.4.5.6.7.8.9.1.4  |          | 837         |
|   | DATA TEMPE/1699 82.1588.71.1479 26.1402 59.1347 59 1255 37 1205 37  |          | 838         |
|   | 1+1173+41+4147+04+1127-59+1104+26+1079+08+1044+26+922+04/   | I ARCI   | 830         |
| с | SPLINE BOUNDARY CONDITIONS FIC.   | 1 1001   | 84/         |
|   | IJ=1  | LADCI    | 841         |
|   | 100(1)-5  | LANCI    | 041         |
|   | $IOP(^2) = 5$   | LARCI    | 847         |
|   | N1=14   | LARC1    | 844         |
|   |   | LANCI    | 940         |
|   | RETURN.   |          | 04          |
|   | ENTRY   | LARCI    | 84-         |
|   | CALL SPL102 (N1+X+TEMPF+W+IJ+VF+TAL,  | 1 ARC1   | 844         |
|   |   | I ARC1   | 840         |
|   | HE TURN   | LARC1    | 850         |
|   | END   | LARC1    | 851         |
|   | FUNCTION TMAXO (T)  | I ARC1   | 85          |
|   | DIMENSION IOP(2) + TAB(3)   | LARC1    | 85          |
|   | DIMFNSTON TT(29), TMAXF(29), W(29), A(29), B(29), C(29)   | LARC1    | 854         |
|   | COMMUN /TMODEL/ MODEL   | LARC1    | 855         |
|   | COMMUN /SPECM/ NT+TT+TMAXF  | LARC1    | 854         |
| С | 1415 COMMON CONTAINS DIMENSIONS IN MAIN PROGRAM   | I, ARC1  | 857         |
| С | SORS DATA   | LARC1    | 856         |
|   | $\text{DIMENSION T1(11)} \bullet \text{TMAX1(11)}$  | LARCI    | 854         |
|   | UATA T1/0+1-3-2-3+3+5+5+6+92+9+42+12+3+17+3+26-5+40+/   | LARCI    | 86 (        |
|   | DATA TMAX1/122/.59,1644.26.1922.04,2199.82,24/7.59,2755.37,3033.14  | LARC1    | 861         |
|   | 1,3310,03,3588,71,3922,04,3922,04/  | LARC1    | 86;         |
| С | CORCON TABULAR DATA   | LARC1    | 86;         |
|   | DIMENSTON T2(10) + TMAX2(10)  | LARC1    | 864         |
|   | DATA 12/0,,0083,2167,1.45,5.25,10.25,15,25,20,25,25,25,36,25/   | LARC1    | 865         |
|   | UATA THAX2/1192.59,1192.59,1280.37,1018.15,2379.26,2969.82,3358.71  | LARC1    | 864         |
| ~ | 1+3630-37+3665-37+3665-37/  | LARC1    | 861         |
| C | FU - CORT DATA  | LARC1    | 866         |
|   | DIMENSION T3(29) + T(AX3(29)  | 1 ARC1   | 860         |
|   | DATA T3/ 21-41-51 1-011-512-017-513-013-514-014-5-5-015-5-6-6-6-5-7   | LARC1    | 87 (        |
|   | <sup>1</sup> • <sup>3</sup> • <sup>9</sup> • <sup>1</sup> 0• <sup>1</sup> 1• <sup>1</sup> 2• <sup>1</sup> 3• <sup>1</sup> 4• <sup>1</sup> 5• <sup>1</sup> 6• <sup>1</sup> 7• <sup>1</sup> 8• <sup>1</sup> 9• <sup>2</sup> 0• <sup>1</sup> | LARC1    | 871         |
|   | DATA 1443/1199.12/8.1315.1461.1589.1704.1810.1908.2002.2  | LARC1    | 872         |
|   | 1071.*21/0+225/+2335.*2411+2483.+2554.+2687.+2915.+2936.+3053.+3  | LARC1    | 873         |
| ~ | - 102 + 12/ 3 + 33/ 0 + 34/ 3 + 32/ 0 + 3663 + 3636 + 3664 + 3665 /   | LARC1    | 874         |
| C | SPLITE BOUNDANT CONDITIONS ETC.   | LARC1    | 87-         |
|   |   | LARC1    | 87 <i>6</i> |
|   | 10P(1)=5  | LARC1    | 877         |
|   |   | 1.ARC1   | 876         |
|   |   | 1. ARC 1 | 879         |
|   | 10 N/211  | 1.ARC1   | 880         |
|   |    | NT=9  | LARC1   | 881                |
|---|----|---|---------|--------------------|
|   |    | DO >V T=1+NS  | LARC1   | 882                |
|   |    | ΤΤ (τ) = τ1 (Ι)   | I ARC1  | 883                |
|   |    | TMAYF(T) = TMAXI(T)   | LARC1   | 884                |
|   | 20 | CONTINIE  | LARC1   | 885                |
|   |    | GO TO 70  | LARC1   | 886                |
|   | 30 | N2=10   | LARC1   | 887                |
|   |    | NTER  | LARC1   | 888                |
|   |    | UO 40 T=1.NS  | LARC1   | 889                |
|   |    | TT(7)=72(I)   | LARC1   | 890                |
|   |    | TMAXF(T) = TMAX2(T)   | LARC1   | 891                |
|   | 40 |   | LARC1   | 892                |
|   |    | GO TO 70  | LARC1   | 893                |
|   | 50 | N2=29   | LARC1   | 894                |
|   |    | NT=29   | LARC1   | 895                |
|   |    | $D_0 = 60 T = 1 \cdot N_2$  | LARC1   | 896                |
|   |    | TT(T) = T3(T)   | LARC1   | 897                |
|   |    | $TMA \times F(T) = TMA \times 3(T)$   | LARC1   | 898                |
|   | 60 |   | LARC1   | 899                |
|   | 70 | CALL SDLIDI (N2,TT,TMAXF,W,IOP,IJ,A.B,C)  | 1.4RC1  | 900                |
|   |    |   | L ARC1  | 901                |
|   |    | ENTRY TMAX  | LARC1   | 902                |
|   |    | CALL SPLIDZ (N2+TT+TMAXF+W+IJ+T+TAB)  | L ARC1  | 903                |
|   |    |   | LARC1   | 904                |
|   |    |   | 1. ARC1 | 905                |
|   |    |   | 1.ARC1  | 906                |
|   |    |   | LARC1   | 907                |
|   |    | $U_{1}M_{1}M_{2}O(N-10P(2)) = IAB(3)$   | 1 ARC1  | 908                |
|   |    | $\begin{array}{c} \text{CONTROL (23) }  \text{INVER (23) }  \text{M(23) } $ | LAPCI   | 909                |
|   |    | COMMON / MODEL/ MODEL   | LARCI   | 910                |
| С |    | THIS COMMON CONTAINS DIMENSIONS IN MAIN DOGDAY  | LARCI   | 911                |
| č |    | IN THE MAIN PROGRAM. IT IS CALLED TA IN THIS COMMON STATEMENT   | 1.4701  | 912                |
| č |    | SORE DATA   |         | 913                |
| • |    | DIMENSION TI (11) • TAVE1 (11)  | LARCI   | 71 <b>4</b><br>01c |
|   |    | DATA 11/0.11112.5.4.2.6.3.10.14.8.22.5.34.6.40 .50./  | I APC1  | 916                |
|   |    | DATA TAVE1/1088.71.1366.48.1644.26.1922.04.2199 82.2477 59.2755 27  | I ARC1  | 917                |
|   | 1  | 1+3033, 15+3310+93+3374, 42+3459, 08/   | LARC1   | 918                |
| С |    | CORCUN TABULAR DATA   | 1 ARC1  | 910                |
|   |    | DIMENSTON T2(10), TAVE2(10)   | I ARC1  | 920                |
|   |    | 04TA T2/000832167.1.45.5.25.10.25.15.25.20.25.25.25.30.25/  | LARC1   | 921                |
|   |    | UATA TAVE2/1052.59.1052.59.1134.82.1413.71.1920.37.2338.71.2608.71  | LARC1   | 922                |
|   | 1  | 1,2793,71,2938,15,3026,48/  | LARC1   | 923                |
| С |    | FU - CORT HATA  | LARC1   | 924                |
|   |    | DIMENSION T3(29) + TAVE3(29)  | LARC1   | 925                |
|   |    | UATA T3/.2,.4,.5,1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5.5,0,5.5,6.0,6.5.7  | LARC1   | 926                |
|   | 1  | L. 8. 99. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20.   | LARC1   | 927                |
|   |    | DATA TAVE 3/1167. 1219. 1243. 1338. 1421. 1496. 1566. 1631. 1692. 1   | 1.ARC1  | 928                |
|   | 1  | 749. 11804. 1856. 1906. 1944. 1949. 2044. 2126. 2204. 2278. 2347. 2   | LARCI   | 929                |
|   | ć  | 2414 • 2477 • 2538 • 2596 • 2653 • 2707 • 2756 • 2801 • 2840 /  | LARC1   | 930                |
| С |    | SPLINE BOUNDARY CONDITIONS ETC.   | LARC1   | 931                |
|   |    | IJ=1  | LARC1   | 932                |
|   |    | IOP(1)=5  | 1.ARC1  | 933                |
|   |    | IOP (2) =5  | LARC1   | 934                |
|   |    | 60 TU (10,30,50), MODEL   | LARC1   | 935                |
|   | 10 | N3=11   | LARC1   | 936                |
|   |    | NT=7  | LARC1   | 937                |
|   |    | 00 2 <sup>0</sup> T=1*N3  | LARC1   | 93A                |
|   |    | T T (T) = T 1 (1)   | LARC1   | 939                |
|   |    | TAVF'(T) = TAVE1(I)   | LARC1   | 940                |
|   | 20 | CONTINUE  | LARC1   | 941                |
|   |    | GO TU 70  | L.ARC1  | 942                |
|   | 30 | 143=1 V   | LARC1   | 943                |

.

•

.

|   |    | NT-c   |                    | 044     |
|---|----|--|--------------------|---------|
|   |    |  | LANCI              | 944     |
|   |    |  | LARC1              | 945     |
|   |    |  | LARC1              | 946     |
|   |    |  | LARC1              | 947     |
|   | 40 | CONTINHE   | LARC1              | 948     |
|   |    | GO †0 70   | LARC1              | 940     |
|   | 50 | N3=>Y  | I APC1             | 950     |
|   | •  | NT=29  | LAPCI              | 951     |
|   |    | $D_{0} < V = 1.03$   |                    | 053     |
|   |    |  | LARCI              | 956     |
|   |    |  | LARCI              | 753     |
|   |    |  | LARGI              | 954     |
|   | 50 |  | 1_ARC1             | 955     |
|   | 10 | CALL SPLIDI (N3+11+TAVEF+W+IOP+IJ+A+B+C)   | LAHC1              | 956     |
|   |    |  | I,ARC1             | 957     |
|   |    |  | 1ARC1              | 958     |
|   |    | CALL 5PL1D2 (N3+TT+TAVEF+W+IJ+T+TAB)   | LARC1              | 959     |
|   |    | TAVF=TAB(1)  | LARC1              | 960     |
|   |    | RETURN   | 1_ARC1             | 961     |
|   |    | END  | LARC1              | 962     |
|   |    | SURPOUTINE FIN (PN, RP, RR, LAMBDA, DECAY, DT, PLEAK)  | LARC1              | 963     |
| С |    | ORIGINAL ANSWERS   | LARC1              | 964     |
|   |    |  | 1 ARC1             | 965     |
|   |    | E=EYP1_DECAY+DT1   | I ARC1             | 966     |
|   |    | RD=PK/(UECAY+DT)   | LAPC1              | 967     |
|   |    | RP=RLEAK#((PN-RD)#(1) = F)/DFCAY+RD#DT)  |                    | 969     |
|   |    |  | LARCI              | 969     |
|   |    |  | LARCI              | 709     |
|   |    |  | LARCI              | 970     |
|   |    | END<br>SUBSTRUCTING STAN (PAR OD A MARKA SPORT OF A MARKA SA   | 1 ARC1             | 971     |
| ~ |    | SUBDITINE FINI (FN KROLLAMBDA DECATODI KLEAKOLDOR, ROLD)   | LARC1              | 972     |
| L |    | SIMPLE EQUATIONS SECOND HALF   | 1.ARC1             | 973     |
|   |    | REAL LAMBDA  | LARC1              | 974     |
|   |    | E=EXF(_DECAY+D)  | LARC1              | 975     |
|   |    | L1=1+-F  | LARC1              | 976     |
|   |    | S=0.5*(R+R0LD)   | LARC1              | 977     |
|   |    | ALA=LAvHDA+S   | LARC1              | 978     |
|   |    | EL=FXP(=ALA+DT)  | LA <sup>R</sup> C1 | 979     |
|   |    | EM=1•=FL   | LARC1              | 980     |
|   |    | IF (UECAY.EQ.ALA) GO TO 10   | LARC1              | 981     |
|   |    | RP=nLEAK <sup>#</sup> (PN <sup>#</sup> E1/DECAY+S <sup>#</sup> OLD <sup>#</sup> (FM/ALA+E1/DECAY)/(DFCAY+ALA1)                           | LARC1              | 982     |
|   |    | $PN=F^{P}N+S*OLD*(EL-E)/(DECAY-ALA)$   | LARC1              | 983     |
|   |    | 60 TU 20   | LARC1              | 984     |
|   | 10 | $\Re P = P L E_{\Lambda} K^{*} (P N^{+} E_{1} / D E C A Y + S^{*} O L D^{+} (E_{1} - D E C A Y^{+} D T + F) / (D F C A Y + D F C A Y 1)$ | LARC1              | 985     |
|   | •  | PN=F <sup>+</sup> (pN+S+0LD+DT)  | LAPC1              | 986     |
|   | 20 | KETUKN   | LARC1              | 987     |
|   |    | FND  | LARCI              | 999     |
|   |    | SUBDUITING FINZ (PN. 00 1 AMODA, DECAMADIAD) EAK AND DE DOUD   | LARCI              | 707     |
| c |    | The AD BELEASE SECOND GALE   | LARCI              | 707     |
| C |    | LINFOR ACLEASE SECOND HALF   | LARCI              | 990     |
|   |    |  | LARCI              | 991     |
|   |    |  | LARC1              | 992     |
|   |    |  | 1.ARC1             | 993     |
|   |    | S=0.3*(P+R0LD)   | LARC1              | 994     |
|   |    | ALA=LAUHDA+ROLD  | LARC1              | 995     |
|   |    | BH=ne58(R-ROLO)/DT   | LARC1              | 996     |
|   |    | PTERM=(DECAY=LAMBDA) *PZERO(ALA=DECAY+BH+DT)   | LARC1              | 997     |
|   |    | RP=RLEAK* (PN*EI/DECAY+OLD*(E1-LAM8DA*PZEPO(ALA+RH+DT)-E*PTERM)/DEC  | LARC1              | 998     |
|   | I  | ΑΥ)  | LARC1              | 999     |
|   |    | PN=F <sup>#</sup> (pN+0LD <sup>4</sup> (PTERM+1_=EXP((DECAY=LAM8Ua=s)*nT)))  | 1 ARC1             | 1000    |
|   |    | RETURN   | I ARC1             | 1001    |
|   |    | END  | 1 ARC1             | 1000    |
|   |    | SUBROUTINE FINS (PNF+PNT+RPF+RPI+LAMADA+DECAY-DT-DLEAK+NEOLD-NTOLA-  | LARC1              | 1002    |
|   | 1  | RA. PFOID. RB. RIOLD. F. FOID)   | LARC1              | 1004    |
| с | -  | LINFAR FAILURE SECOND HALF   | LANCI<br>1 ADO1    | 1004    |
| - |    | REAL LAMBDA + NFOLD + NTOLD + MO + MA  | 1 4001             | 1004    |
|   |    |  | LANGI              | 1 1 1 1 |

|   |    | É≠EX <sup>P</sup> (_DECAY+DT)                               | LARC1   | 1007 |
|---|----|---|---------|------|
|   |    | E1=1••F   | LARC1   | 1008 |
|   |    | KF=n•5#(RA+RFOLD)   | LARC1   | 1009 |
|   |    | Rt=n•5*(RB+RIOLD)   | I ARC1  | 1010 |
|   |    | RED=LAMBDA+RF   | LARC1   | 1011 |
|   |    | RIP=LAMHDA+RI   | 1 ABC1  | 1012 |
|   |    | A4=N10  1)  | LARCI   | 1013 |
|   |    | AC = NFOID  | LARC1   | 1014 |
|   |    | UF=F=FnLD   | 1 ABC1  | 1015 |
|   |    | UFI)T=DF/UT   | LARCI   | 1016 |
|   |    | De=pF=pI  | LARC1   | 1017 |
|   |    | FIO D=1FOLD   | LARC1   | 1019 |
|   |    | ALPHA=FIOLD*DR  | t APC1  | 1019 |
|   |    | GAM_HEP-ALPHA   | LARC1   | 1020 |
| С |    | GAM <sub>#</sub> KFP&FOLD+RIP&FIOLD                         | LARCI   | 1021 |
|   |    | BET-IRADEDT   | LARCI   | 1022 |
|   |    | BETA=BFT/2.   |         | 1023 |
|   |    | 1F (FIOLD.EQ.0.0) A5=0.0                                    | LARCI   | 1024 |
|   |    | IF (FINLD.NE.0.0) A5=-DFDT+A4/FIOLD                         | LARCI   | 1025 |
|   |    | A1=_A5+DR#FOLD#A4   | LARCI   | 1026 |
|   |    | A2=-DR+(FIOLD-FOLD)+A5                                      | LARC1   | 1027 |
|   |    | A3=nK+nFDT+A5   | 1 ARC1  | 1028 |
|   |    | DT2=DT+DT   | LARC1   | 1029 |
|   |    | M4=r×p(-GAM#DT-BETA#DT2)                                    | I ARC1  | 1030 |
|   |    | MO=FXP1-RFP#DT)   | 1 ARC1  | 1031 |
|   |    | WE=MU/F   | LARC1   | 1032 |
|   |    | DL=nLCAY-RFP  |         | 1033 |
|   |    | AOL_ALPHA+OL  | LARCI   | 1034 |
|   |    | Q4=D4ED()(GAM-DECAY, BETA, DT)                              | LARCI   | 1035 |
|   |    | 1F ("ET.NE.0.0) QD=(1M4/E+ADL#Q4)/BET                       | LARC1   | 1036 |
| С |    | THIS IS US FOR BETA .NF. 0.0                                | 1 ARC1  | 1037 |
|   |    | 1F (UL.FQ. 0.0) GO TO 10                                    | LARC1   | 1038 |
|   |    | Q0=( <sup>Q</sup> F_1.0)/DL                                 | LARCI   | 1039 |
|   |    | Q1=(WE&PZERO(-ALPHA,BFTA,DT)-Q4)/DL                         | LARC1   | 1040 |
|   |    | GO TU 40  | LARC1   | 1041 |
|   | 10 | 40=n í  | I ARC1  | 1042 |
| С |    | THIS IS QO FOR OL = '0.0                                    | 1 ARC1  | 1043 |
|   |    | IF (8FT.EQ.0.0) GO TO 20                                    | LARC1   | 1044 |
|   |    | Q1=nT#94-Q5   | I ARC1  | 1045 |
| С |    | TH15 IS 01 FOR BETA .NE. 0.0, DL = 0.0                      | 1. ARC1 | 1046 |
|   |    | GO TU 40  | LARC1   | 1047 |
|   | 20 | 1F (ALPHA.EQ.0.0) GO TO 30                                  | LARC1   | 1048 |
|   |    | Q1=(04_00)/ALPHA  | I ARC1  | 1049 |
| C |    | THIS IS Q1 FOR BETA = $0.0.0$ DL = $0.0.4$ ALPHA .NE. $0.0$ | LARC1   | 1050 |
|   |    | G0 T <sup>0</sup> 40  | LARC1   | 1051 |
|   | 30 | 01=n•5+DT2  | LARC1   | 1052 |
| С |    | THIS IS Q1 FOR BETA = 0.0, OL = 0.0, ALPHA = 0.0            | LARC1   | 1053 |
|   | 40 | $V_0 = (E_1 / DECAY - E * Q_0) / RFP$                       | LARC1   | 1054 |
|   |    | V4=(PZFRU(GAM+BETA+DT)=E*Q4)/DECAY                          | LARC1   | 1055 |
|   |    | $VI = (V4 - E^{*}Q1)/RFP$                                   | LARC1   | 1056 |
|   |    | IF (BFT.EQ.0.01 GO TO 50                                    | LARC1   | 1057 |
|   |    | $Q^2 = (Q_0 - Q^4 + ALPHA + Q_1) / BET$                     | LARC1   | 1058 |
|   |    | Q3=(Q1_Q5+ALPHA+Q2)/BFT                                     | LARC1   | 1059 |
|   |    | V2=(V0_V4+ALPHA+V1)/RFT                                     | LARC1   | 1060 |
|   |    | V5=(L1/DELAY-GAN*V4-E*Q4)/RET                               | t ARC1  | 1061 |
|   |    | V3=(V1_V5+ALPHA+V2)/8FT                                     | LARC1   | 1062 |
|   |    | RPF=RLFAK*(PNF*E1/DECAY+RF*(A0*V0+A1*V1+A2*V2+A3*V3))       | LARCI   | 1067 |
|   |    | RP1="LFAK+(PhI+E1/DECAY+RT+(A4+V4+A5+V5))                   | L ARC1  | 1064 |
|   |    | PNF=E* (PNF+RF*(A0*Q0+A1*Q1+A2*Q4+A3*Q3))                   | LARC1   | 1065 |
|   |    | PNI= + + + PNI + RI + (A + + Q4 + A5 + Q51)                 | LARC1   | 1066 |
|   |    | GO TU 60  | LARCI   | 1067 |
|   | 50 | CONTINUE  | LARCI   | 1068 |
|   |    | RPF=RLFAK*(PNF*E1/DECAY+RF*(A0*V0+A1*V1))                   | LARCI   | 1069 |

|   | RPI="[FAK#(PNI#E]/DECAY+RT#A4#V4)  | LARC1          | 1070                 |
|---|--|----------------|----------------------|
|   | PNF=└↔(PNF+RF*(A0*Q0+A1*Q1))   | I ARC1         | i071                 |
|   | $PNI = L \phi (PNI + RI + A4 + Q4)$  | LARC1          | 1072                 |
|   | 60 RETURN  | LADCI          | 1075                 |
|   | END  | LARCI          | 1073                 |
|   | SUPPOLITINE CALCI (NEOLD-NIOLD-DA-ROALANDAL DI E VIE DE DE DE DECIS  | LARCI          | 1074                 |
|   | Landon Cheritan Cheritan Contra Cheritan Cheritan Contra Cheritan Contra Cheritan Contra Cheritan Ch | LARCI          | 1075                 |
| ~ |  | LARC1          | 1076                 |
| L | SIMPLE EQUATIONS FIRST HALF  | LARC1          | 1077                 |
|   | REAL NEDINIE   | LARC1          | 1076                 |
|   | REAL NFOLO+NIOLD+LAMBOA+NF+NI+MO+M1+M2+M3+M4+M5  | LARC1          | 1079                 |
|   | IF ((NFOLD+NIDLD).EQ.g.0) GO TO 10   | I ARC1         | 1080                 |
|   |  | I ARC1         | 1081                 |
|   |  | I ADC1         | 1083                 |
|   |  |                | 1000                 |
|   |  | LARCI          | 1003                 |
|   |  | LARCI          | 1004                 |
|   |  | 1.44C1         | )085                 |
|   |  | LARCI          | 1086                 |
|   |  | LARCI          | 1087                 |
|   |  | LVKC1          | 1086                 |
|   | MOEFAP(-DFL)   | LARC1          | 1080                 |
|   | EI=FXP(-RIL)   | LARC1          | 1090                 |
|   | NFP=NFALD*M0   | LARC1          | 1091                 |
|   | NIP=N10LD+EI   | LARC1          | 1092                 |
|   | SUM=NFD+NIP  | LARC1          | 1093                 |
|   | NF=F <sup>+</sup> SIIM   | I ARCI         | į094                 |
|   | NI = (1 - F) + SUM   | 1 ARC1         | 1095                 |
|   |  | I ADO1         | 1094                 |
|   | RT = RT + (A4 - NTP) / RTP   | LADCI          | 1097                 |
|   | GO TO an   | LARCI          | 1077                 |
|   |  |                | 1096                 |
|   |  | LARCI          | 1100                 |
|   |  | LARCI          | 1100                 |
|   |  | LARCI          | 1101                 |
|   |  | LARCI          | 1102                 |
|   |  | LARCI          | 110-                 |
|   |  | LARC1          | 1104                 |
|   | SURFOLTINE CALCZINFOLD INIOLD IRAIRE LAMBDA DI IF INFINI FREFIRETIRE OLD   | LARC1          | 1105                 |
| - |  | LARC1          | 1106                 |
| C | LINFAR RELEASE FIRST HALF  | LARC1          | 1107                 |
|   | REAL NEDINIE   | LARC1          | 1108                 |
|   | REAL NFOLD + NIOLD + LAMBDA + NF + NI  | LARC1          | 1109                 |
|   | IF $((NFOLD+NIOLD1+E^{O}+O+O))$ as to 10   | 1. ARC1        | 1110                 |
|   | RF=RA  | 1 ARC1         | 1111                 |
|   | KI=08  | I ARC1         | 1112                 |
|   |  | I ARCI         | 1117                 |
|   | A4 = N10(1)  | I ARCI         | 1114                 |
|   | EF=FXP(-LAMBDA+DT-0,5+(RFO)D+RF)+CT)   | I ARC1         | 1110                 |
|   | EI = FXP = IAMBDA * DI = 0.5 * (PIO) DAPI (*DI)  | LANC-          | 1114                 |
|   |  | LINKUI         | 1110                 |
|   |  | LARCI          | ) ] ] ]              |
|   |  | LARCI          | 1117                 |
|   |  | LARCI          | 1119                 |
|   |  | 1, ARC1        | 1120                 |
|   |  | LARC1          | 1121                 |
|   |  | LARC1          | 1122                 |
|   | GAMT-RTOLD+LAMBDA  | LARC1          | 1123                 |
|   | BETF-(PF-RFOLO)/DT   | LARC1          | 1124                 |
|   | HETAT =RETF/2.   | LARC1          | )125                 |
|   | MMF==An#LAMBDA#PZERO(GAMF,RETAF,DT)+A0#(1,-EF)   | 1_ARC1         | 1156                 |
|   | BFTT=(pI-RIOLD)/OT   | LARC1          | 1127                 |
|   | BETAI=RETI/2.  | LARC1          | 1126                 |
|   |  |                | • • • •              |
|   | RRI=-A4+LAMBDA+PZERO(GAMI,BETAI,DT)+A4+(1EI)   | LARC1          | 1129                 |
|   | RRÍ=←A₄#LÂMBDA#PZERO(GAMI,BETAI,DT)+A4#(1,−EI)<br>50 T <sup>U</sup> ⊃0   | LARC1          | 1129                 |
|   | RRİ=→A↓#LÄMBDA#PZERO(GAMI,BETAI,DT)+A4#(1,→EI)<br>50 T <sup>()</sup> >0<br>10 NF=0+0   | LARC1<br>LARC1 | 1129<br>1130<br>1131 |

| Herty, b         LARCI         1135           ENN         LARCI         1135           SUPPOUTINE P2ERO(A,B+C)         LARCI         1135           Data Sopi/1/1.7724533590514/         LARCI         1137           Data Sopi/1/1.7724533590514/         LARCI         1130           CFNFV(r)=HEFR(C0-27)         LARCI         1139           Data Sopi/1/1.77245335903514/         LARCI         1130           CFNFV(r)=HEFR(C0-27)         LARCI         1140           SuperSonieC         LARCI         1141           SuperSonieC         LARCI         1144           ARC1=ARCI         LARCI         1154           SopasopireCilleKARCAR  |     | RRF≖0, ń   | LARC1     | 1133 |
|--|-----|--|-----------|------|
| 20         RETINM         LARCI         1136           END         LARCI         1136           SURPOINT NE P2ERO(A, B+C)         LARCI         1137           DATA 50P1/1.777453359051514/         LARCI         1136           CFAFW(7:D1=HERFC(D1=EXP(2*7-2* <sup>4</sup> H*2)*FEHFC(D-7)         LARCI         1136           SURPOINT         LARCI         1146           SURPOINT         LARCI         1146           SURPOINT         LARCI         1146           SURPOINT         LARCI         1146           P2ED0SURDIE         LARCI         1150           SURPSORT         LARCI         1156           SURPSORT  |     | $\Re RI = 0 \cdot \hat{0}$                             | LARC1     | 1134 |
| LND         LARCI         1136           SUBPODITINE         PZERO(A,B,C)         LARCI         1137           DATA         SOB/1/1,77245305090514/         LARCI         1139           CFNEW(FOL)=EXP(Z*7-2,*0*2)*EHFC(D-7)         LARCI         1136           IF         '(FOL)=EXP(Z*7-2,*0*2)*EHFC(D-7)         LARCI         1140           IF         '(FOL)=EXP(Z*7-2,*0*2)*EHFC(D-7)         LARCI         1141           SOB07=ECHI-SOB         LARCI         1144           ARG(F=SOB*C         LARCI         1144           ARG(F=SOB*C         LARCI         1146           ARG(F=SOB*C         LARCI         1146           ARG(F=SOB*C         LARCI         1147           ARG(F=CA)         LARCI         1146           ARG(F=CA)         LARCI         1146           RETINK         LARCI         1146           PZERO*C         LARCI         1151           METINK         LARCI         1153           SOB*SOB         LARCI         1153           SOB*SOB         LARCI         1156           ARG(F=ZOB*C)         LARCI         1156           ARG(F=ZOB*C)         LARCI         1156           RETINK   | 50  | RETURN   | LARC1     | 1135 |
| SUMPOINT ME PZERO (A, B, C)         LARCI 1137           DATA SOPI/I, 77245395090514/         LARCI 1136           CFMFW (7, D) 4ERPC (D) = EVP (Z*7-2, %U*Z)*WEMPC (D-7)         LARCI 1130           IF '*, U=0,0,0 GO TO 30         LARCI 1141           SUMPOINT ISI         LARCI 1142           SUMPOINT SUMPOI   |     | END  | LARC1     | 1136 |
| DATA \$0°1/1.1724530500514/         LARCI 1136           CFNFW (TD) = KERV(D) = KEV(272.*0°2/3°K2/3°K2)         LARCI 1140           1F '8.F0.0.0 GO TO 10         LARCI 1140           SNM=3QUT(B)         LARCI 1143           ARQI=SACHAS         LARCI 1143           PZEOU=QUTERNEW(ARGI+ABG2)/SQB2         LARCI 1146           PZEOU=QUTERNEW(ARGI+ABG2)/SQB2         LARCI 1146           PZEOU=  |     | SUBPONTINE PZERO(A+B+C)                                | LARC1     | 1137 |
| CFNFM(r/D)=HERFC(D)=2p(2*7=2*0;*2)*PEHFC(D=7)         LARC1 1140           IF '#_rU=0.0 GO TO 10         LARC1 1141           SUR=250:*C         LARC1 1142           SUR=250:*C         LARC1 1143           ARQ1=250:*C         LARC1 1144           ARQ2=-A/SGR2         LARC1 1146           PZED0=COPIFFEKE(ARG1+ARG2)/SGR2         LARC1 1146           HETHMN         LARC1 1146           PZED0=COPIFFEKE(ARG1+ARG2)/SGR2         LARC1 1145           CONTINUE         LARC1 1151           SGR=>DGFTC*N         LARC1 1153           SGR=>DGFTC*N         LARC1 1154           SGR=>DGFTC*N         LARC1 1155           SGR=>DGFTC*N         LARC1 1156           ARG1=7SGR*C         LARC1 1157           ARG1=7SGR*C         LARC1 1157   |     | DATA_S0P1/1.772453850905514/                           | LARC1     | 1138 |
| IF         '.H., FU.0,0) GO TO 10         LARCI         1140           IF         '.H., T.O.,0) GO TO 30         LARCI         1141           SHA=3QUTED         LARCI         1142           SHA=3QUTED         LARCI         1143           SHA=3QUTED         LARCI         1143           SHA=3QUTED         LARCI         1144           SHA=3QUTED         LARCI         1144           ARQT=SDI*C         LARCI         1144           ARQT=SDI*C         LARCI         1146           PZENG=         LARCI         1146           HETIMI         LARCI         1146           TO IF         FATATA         LARCI         1146           PZENG=         LARCI         1146           HETIMI         LARCI         1146           SOBADEDT         LARCI         1157           SOBADT         LARCI         1158           SOBADT         LARCI         1158           ARGT=SOB*         LARCI         1158           PZEPO=COPICYNEW(ARG1+ARG2)/SOB2         LARCI         1156           PZEPO=COPICYNEW(ARG1+ARG2)/SOB2         LARCI         1156           PZEPO=COPICYNEW (ARG1+ARG2)/SOB2         LARCI         1156   |     | CFNFW(7+D)=RERFC(D1-ExP(Z+7-2.+0+Z)+RERFC(D-Z)         | LARC1     | 1139 |
| IF       (-0, 1, 0, 0)       (-1, 1, 0, 0)       (-1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1  |     | 1F ·B.FU.0.0) GO TO 10                                 | LARC1     | 1140 |
| SNM=3UUT18)       LARCI       1143         SQL=SCH+SQB       LARCI       1143         ARGI=SCH+SC       LARCI       1144         ARGI=SCH+SC       LARCI       1145         PZEDU=CUPFNEW (ARG1+ARG2)/SQRZ       LARCI       1146         PZEDU=CUPFNEW (ARG1+ARG2)/SQRZ       LARCI       1146         PZEDU=CUPFNEW (ARG1+ARG2)/SQRZ       LARCI       1146         PZEDU=CUPFNEW (ARG1+ARG2)/SQRZ       LARCI       1146         PZEDU=CUPFNEW (ARG1+ARG2)/SQRZ       LARCI       1151         SQL=SQPT(-A*C))/A       LARCI       1153         SQL=SQL=C       LARCI       1155         SQL=SQL=C       LARCI       1155         SQL=SQL=C       LARCI       1155         SQL=SQL=C       LARCI       1155         SQL=SQL=C       LARCI       1156         SQL=SQL=C       LARCI       1156         SQL=SQL=C       LARCI       1157         ARGI=SGL=C       LARCI       1156         SQL=SQL=C       LARCI       1157         ARGI=SGL=C       LARCI       1156         RETIM=K       LARCI       1161         FUNCTINNE       LARCI       1166         FUNCTINN REFC (7)   |     | 1F (B, 1T, 0, 01 GO TO 3n                              | LARC1     | 1141 |
| SUMSOLASON         LARCI         1143           ARG: = SOLAC         LARCI         1144           ARG: = SOLAC         LARCI         1144           ARG: = SOLAC         LARCI         1146           PZEDUG: QPIFFNEW(ARG1+ARG2)/SORZ         LARCI         1146           HETIMN         LARCI         1146           PZEDUG: QPIFFNEW(ARG1+ARG2)/SORZ         LARCI         1146           NETIMN         LARCI         1146           PZEDUG: QPIFFNEW(ARG1+ARG2)/SORZ         LARCI         1153           SOR-SORT(-R)         LARCI         1153           SOR-SORT         LARCI         1154           SOR-SORT         LARCI         1156           ARG: TSOHAC         LARCI         1156           SOR-SORT         LARCI         1156           SOR-SORT         LARCI         1156           ARG: TSOHAC         LARCI         1166           FINO         LA   |     | 2007-2010 (B)  | LARCI     | 1142 |
| LARCI - 144         ARC) = - A/SQB2       LARCI 1145         PZEDUS-QUPIPNEW (ARG1+ARG2)/SQB2       LARCI 1147         LARCI 1147       LARCI 1151         SQB+SQB4       LARCI 1153         SQB+SQB50B       LARCI 1155         ARG1=SGH*G0       LARCI 1155         ARG1=SGH*G0       LARCI 1156         ARG1=SGH*G0       LARCI 1157         ARG1=SGH*G0       LARCI 1156         ARG1=SGH*G0       LARCI 1157         ARG1=SGH*G0       LARCI 1156         ARG1=SGH*G0       LARCI 1157         ARG1=SGH*G0       LARCI 1156         HETIMN       LARCI 1156         ARG1=SGH*G0       LARCI 1156         HETIMN       LARCI 1161         HARG1: ARG2)/SGB2       LARCI 1156         HETIMN       LARCI 1156         HETIMN       LARCI 1156         HETIMN       LARCI 1161         HARG1: ARG2)/SGB2 <t< td=""><td></td><td></td><td>LARCI</td><td>1143</td></t<>  |     |  | LARCI     | 1143 |
| PZED02(QD1*NEW(ARG1.ARG2)/SQRZ         LARC1         1145           HZEN02(QD1*NEW(ARG1.ARG2)/SQRZ         LARC1         1146           HETIMN         LARC1         1147           PZED02(LARC)         LARC1         1148           METIMN         LARC1         1149           PZED02(LARC)         LARC1         1146           METIMN         LARC1         1153           20 PZEND2(LARC)         LARC1         1153           SQB3-SADT(-R)         LARC1         1153           SQB3-SADT(-R)         LARC1         1154           SQB3-SADT(-R)         LARC1         1155           SQB3-SADT(-R)         LARC1         1156           ARG1=Z         (ALWAYS POSITYE)         LARC1         1160           ARG1=Z         (ALWAYS POSITYE)         LARC1         1161           ARG1=Z         (ARG1.ARG2)/SGB2         LARC1         1163           HETUMN         LARC1         LARC1         1164           HETUMN         LAR  |     |  | LVHCI     | 1144 |
| HETINAN       LARCI 1147         10       IF (A, FG + 0, 0) GO TO 20       LARCI 1147         11       IF (A, FG + 0, 0) GO TO 20       LARCI 1147         11       IF (A, FG + 0, 0) GO TO 20       LARCI 1147         11       IF (A, FG + 0, 0) GO TO 20       LARCI 1147         12       IF (A, FG + 0, 0) GO TO 20       LARCI 1147         13       GONTINIE       LARCI 1151         14       SG AS SOB - CR + 1       LARCI 1153         15       SG GONTINIE       LARCI 1153         15       SG GONTINIE       LARCI 1153         15       ARG = 5, AB + SOB       LARCI 1153         15       ARG = 5, AB + SOB       LARCI 1153         15       ARG = 5, AB + SOB       LARCI 1153         15       ARG = 5, AB + SOB       LARCI 1153         15       ARG = 7, SOB + SOB       LARCI 1153         16       HETINAN       LARCI 1154         17       IARC (A, ARG + A, ARG + S, ARG + AR  |     | ARU7-1/JUN2<br>07500-101 85N5w/ADG1-ADG21/SADZ         |           | 1145 |
| 10       IF (AAC) (I) (G) TO 20       LARCI       1149         11       LARCI       1149         PZEROB(I) (I) (FXP) (LARCI)/A       LARCI       1149         12       PZEROB(I) (LARCI)/A       LARCI       1150         20       PZEROB(I) (LARCI)/A       LARCI       1151         21       PZEROB(I) (LARCI)/A       LARCI       1152         23       CONTINUE       LARCI       1154         30       SOB3-SOB (SOB)       LARCI       1155         30       SOB3-SOB (SOB)       LARCI       1156         30       RAGI=Z       LARCI       1156         ARGI=Z       LARCI       1156       LARCI       1156         ARGI=Z       LARCI       1156       LARCI       1156         ARGI=Z       LARCI       1157       LARCI       1156         ARGI=Z       LARCI       1157       LARCI       1156         ARGI=Z       LARCI       1160       LARCI       1160         FIND       LARCI       1160       LARCI       1166         FIND       LARCI       1160       LARCI       1166         FIND       LARCI       1160       LARCI       1166  |     | PETARN   |           | 1140 |
| D PZED0:(1.*EXP(-A*C))/A       LACI 1149         PXEND::       LARCI 1150         PZEND::       LARCI 1151         20 PZEND::       LARCI 1151         20 PZEND::       LARCI 1153         20 CONTINIE       LARCI 1153         20 GARDINE:       LARCI 1153         20 CONTINIE       LARCI 1155         20 CONTINIE       LARCI 1156         20 CONTINE       LARCI 1157         20 CONTINE:       LARCI 1156         20 CONTINE:       LARCI 1166         20 CONTINE:       LARCI 1166         20 CONTINE:       LARCI 1166         20 CONTINE:       LARCI 1166         20 CONTINE:       LARCI 1167         20 CONTINE:       LARCI 1167         20 CONTINE:       LARCI 1177 <t< td=""><td>10</td><td></td><td></td><td>1147</td></t<>   | 10  |  |           | 1147 |
| http://hv       LARCI       1157         20       PZER0ar       LARCI       1151         NETINA       LARCI       1152         30       CONTINUE       LARCI       1153         30       S0B-300T(-R)       LARCI       1154         30       ARGI-350HBC       LARCI       1156         ARGI-27       ALWAYS POSITIVE)       LARCI       1156         ARGI-27       ALWAYS POSITIVE)       LARCI       1157         ARGI-27       ALWAYS POSITIVE)       LARCI       1156         ARGI-27       ALWAYS POSITIVE)       LARCI       1157         ARGI-27       ALWAYS POSITIVE)       LARCI       1156         ARGI-27       ALWAYS POSITIVE)       LARCI       1157         ARGI-27       ALWAYS POSITIVE)       LARCI       1157         ARGI-27       ALWAYS POSITIVE)       LARCI       1157         ARGI-27       ALARCI       1157       LARCI       1157         ARGI-27       ALARCI       1160       LARCI       1161         FUNCTION OFFO (Z)       LARCI       LARCI       1162         DATA       SPI/1.07245385095516/       LARCI       LARCI       1176         DATA   | 10  | $P7FR^{O} = (1 - FXP(-A^{*}C))/A$                      | LARC1     | 1140 |
| 20       FŽER03-r       LARCI       1150         NETINA       LARCI       1152         30       CONTINIE       LARCI       1153         30       LARCI       1154       LARCI       1155         30       ARGI=SCH+SOB       LARCI       1155         ARGI=SCH+SOB       LARCI       1156         ARGI=SCH+SOB       LARCI       1157         ARGS=SCH+SOB       LARCI       1156         ARGI=SCH+SOB       LARCI       1156         ARGI=SCH+SOB       LARCI       1156         ARGS=SCH+SOB       LARCI       1156         ARGI=SCH+SOB       LARCI       1157         ARGS=SCH+SOB       LARCI       1156         ARGS=CH+SOH       LARCI       1156         ARGI=SCH+SOH       LARCI       1160         END       LARCI       1166         END       LARCI       1166         END       LARCI       1166         HETHHN       LARCI       1166         END       LARCI       1166         MERFC=CL       LARCI       1166         ODHERFC       LARCI       1167         UATA       EST       LARCI   |     | RETURN   | LARC1     | 1150 |
| METHEN         LARCI         1152           30         CONTINIE         LARCI         1153           30         SOB-SODT(-R)         LARCI         1154           30         SOB-SODT(-R)         LARCI         1154           30         SOB-SODT(-R)         LARCI         1154           30         SOB-SODT(-R)         LARCI         1156           30         SOB-SODT(-R)         LARCI         1157           30         ARG1=Z         (AWAYS POSITYVE)         LARCI         1156           ARG1=Z         (AWAYS POSITYVE)         LARCI         1156           ARG1=Z         (AWAYS POSITYVE)         LARCI         1157           ARG1=Z         (AWAYS POSITYVE)         LARCI         1161           HETHEN         LARCI         1161         LARCI         1161           FUNCTION         REFC (Z)         LARCI         1162         LARCI         1163           10         HETHEN         LARCI         1164 <t< td=""><td>50</td><td>PZERUar</td><td>LARC1</td><td>1151</td></t<>  | 50  | PZERUar  | LARC1     | 1151 |
| 30       CÖNTİNHE       14801       1153         S082-S0PT(-R)       LARCI       1154         S082-S0B+S0B       LARCI       1155         ARG1=S0H*C       LARCI       1157         ARG1=S0H*C       LARCI       1157         ARG2=SA/S0B2       LARCI       1157         ARG2=A/S0B2       LARCI       1157         ARG2=CNEF*C(Z)       LARCI       1157         RET(MN       LARCI       1161         FINACTION REFC (Z)       LARCI       1163         REFC=GERFC(Z)       LARCI       1164         FTHMS       LARCI       1165         REFC=GERFC(Z)       LARCI       1166         REFTHS       LARCI       1166         FTHING       LARCI       1166         REFTHS       LARCI       1166         REFTHS       LARCI       1166         REFTHS       LARCI       1167         REFTHS       LARCI       1   |     | KETURA .   | LARC1     | 1152 |
| S08_SOPT(=R)         LARCI         1154           S0APSSOB         LARCI         1154           ARG1=SDH*C         LARCI         1157           ARG1=Z         (ALWAYS POSITYVE)         LARCI         1157           ARG5=Z         (ALWAYS POSITYVE)         LARCI         1157           ARG5=A_S08Z         LARCI         1158           PZE00=C0PI*CFNEW(ARG1+ARG2)/S0BZ         LARCI         1160           END         LARCI         1167           FUNCTION         REFC         LARCI         1161           FUNCTION         REFC         LARCI         1164           HERTINN         LARCI         1163         LARCI         1164           RERFC=AERFC(Z)         LARCI         1164         LARCI         1166           NERFC=AERFC(Z)         LARCI         1166         LARCI         1167           COMPLEX         STAC         LARCI         1167         LARCI         1167           DATA EDS/1.0E=157         LARCI         1177         LARCI         1177           LARCI         1177         LARCI         1177         LARCI         1177           LARCI         1177         LARCI         1177         LARCI         11   | 30  | CONTINUE   | 1 ARC1    | 1153 |
| SOR2=SOBSOB       LARCI 1156         ARG1=Z (ALWAYS POSITIVE)       LARCI 1157         ARG2=Z,SOB2       LARCI 1157         ARG2=Z,SOB2       LARCI 1157         ARG2=Z,SOB2       LARCI 1159         PZEP0=QPICTON       LARCI 1159         RETUMN       LARCI 1161         FINACTIN REREC (Z)       LARCI 1161         FINACTIN REREC (Z)       LARCI 1163         REFC=AERFC(Z)       LARCI 1166         RETUMN       LARCI 1167         COMPLEY STTVC       LARCI 1167         DATA EDS/L.0EF15/       LARCI 1177         DATA EDS/L.0EF15/       LARCI 1177         DATA CTV/LYCASUBSD905516/       LARCI 1177         LARCI 1177       LARCI 1177  |     | SQB=SQPT (-R)  | LARC1     | 1154 |
| ARG1 = 5,04%       LARCI 1157         ARG3 = Z (ALWAYS POSITYVE)       LARCI 1157         ARG3 = Z (ALWAYS POSITYVE)       LARCI 1157         PZEP0=cQ0P1*CFNEW(ARG1*ARG2)/S0B2       LARCI 1156         PZEP0=cQ0P1*CFNEW(ARG1*ARG2)/S0B2       LARCI 1156         PRTUMN       LARCI 1160         END       LARCI 1167         FINMTIAN RERFC (Z)       LARCI 1166         FINMTIAN RERFC (Z)       LARCI 1166         REFC=CaCERFC(Z)       LARCI 1166         HETTUKN       LARCI 1166         REFC=CaCERFC(Z)       LARCI 1166         RETURN       LARCI 1167         COMPLEX SET:       LARCI 1167         DATA SOPI/1:/T2ASUBS09551A/       LARCI 1171         DATA SOPI/1:/T2ASUBS09551A/       LARCI 1177         DATA SOPI/1:/T2ASUBS09551A/       LARCI 1177         DATA SOPI/1:/T2ASUBS09551A/       LARCI 1177         DATA SOPI/1:/T2A       LARCI 1177         LARCI 1177       LARCI 1177         DATA SOPI/1:/T2A       LARCI 1177         LARCI 1174       LARCI 1177         LARCI 1174       LARCI 1177         LARCI 1174       LARCI 1177         LARCI 1177       LARCI 1177         LARCI 1177 <tdlarci 1177<="" td=""></tdlarci>  |     | SQA2=SQB+SQB   | LARC1     | 1155 |
| ARG1#Z (ALWAYS POSITIVE)       LARC1 1157         ARG5#Z, ASU82       LARC1 1158         PZEPD=c0PI*CFNEW(ARG1+ARG2)/SOB2       LARC1 1150         RETUMN       LARC1 1157         PZEPD=c0PI*CFNEW(ARG1+ARG2)/SOB2       LARC1 1161         FINACTION REFFC (2)       LARC1 1161         FINACTION REFFC (2)       LARC1 1163         REFC=AERFC(2)       LARC1 1164         HETUMN       LARC1 1166         REFC=AERFC(2)       LARC1 1166         HETUMN       LARC1 1166         FINACTION GERFC (2TEMP)       LARC1 1166         COMPLEX SATEA       LARC1 1167         COMPLEX SATEA       LARC1 1171         UATA ENS/1.0E=15/       LARC1 1177         UATA ENS/1.0E=15/       LARC1 1177         UATA ENS/1.0E=15/       LARC1 1177         LARC1 1177       LARC1 1177         ZCMPLY(0, 0, 4.ZEMP)       LARC1 1177         LARC1 1177       LARC1 1177   |     | ARG1=SoB#C   | LARC1     | 1156 |
| A MG 5# A JS082       LARC1       1159         P Z E PO = <0P1 * CFNEW (ARG1 + ARG2) / SOB2  |     | ARG1=Z (ALWAYS POSITIVE)                               | LARC1     | )157 |
| PZEPG=q0P1°C*NEW(ARG1*ARG2)/S0B2       LARC1       1159         RETURN       LARC1       1161         FINO       LARC1       1161         FINO       LARC1       1162         IF       (ARq12).GT.44.01       GO TO 10       LARC1       1163         REMPC=apERFC(Z)       LARC1       1164         RETURN       LARC1       1166         RETURN       LARC1       1167         END       LARC1       1166         RETURN       LARC1       1167         END       LARC1       1167         FLUACTION GEFFC (ZTEMP)       LARC1       1167         COMPLEX S.T.Z       LARC1       1167         DATA EPS71.0E=15/       LARC1       1170         DATA EPS71.0E=15/       LARC1       1177         DATA EPS71.0E=15/       LARC1       1177         DATA EPS71.0E=15/       LARC1       1177         LARC1       1172       LARC1       1177         LARC1       1170       LARC1       1177         LACC1       TARC1       1177       LARC1       1177         LaCMPLY       LARC1       1177       LARC1       1177         LACMPLY       LARC1   |     |  | LARC1     | 1158 |
| METOPN       LARC1       1100         END       LARC1       1161         FUNNTION RERFC (Z)       LARC1       1162         IF (ARG(Z).GT.44.0) GO TO 10       LARC1       1162         REMFC=GERFFC(Z)       LARC1       1164         NETUMN       LARC1       1166         10 RERFC=ACERFC(Z)       LARC1       1166         RETUMN       LARC1       1167         END       LARC1       1166         FUNCTION QERFC (ZTEMP)       LARC1       1167         COMBLEX S.T.Z       LARC1       1167         DATA EPS/1.0F-15/       LARC1       1177         DATA SOPU/1.772453350905516/       LARC1       1177         11 F (ZTEMP=EQ.0,01 GO TO 30       LARC1       1177         12 COMPLX(0.0.7EMP)       LARC1       1177         14 (U=SOPUX)       LARC1       1177         15 ST+1.0       LARC1       1175         16 CONTINUE       LARC1       1177         17 TAX       LARC1       1177         16 CONTINUE       LARC1       1177         17 TAX       LARC1       1177         16 CONTINUE       LARC1       1176         17 TAX       LARC1       1177  |     | PZEPUSSUPI *CFNEW (ARG1+ARG2)/SQB2                     | LARC1     | 1159 |
| LANCI 1161<br>FINN-TIAN REFFC (7)<br>IF (ARs(2), GT.4,0) GO TO 10<br>REFFC=GEFFC(2)<br>REFFC=GEFFC(2)<br>REFFC=GEFFC(2)<br>REFFC=AEFFC(2)<br>REFTURN<br>REFFC=AEFFC(2)<br>RETURN<br>REFTURN<br>REFTURN<br>REFTURN<br>REFTURN<br>REFTURN<br>REFTURN<br>REFTURN<br>REFFC=AEFFC(2)<br>REFTURN<br>REFTURN<br>REFFC=AEFFC(2)<br>REFTURN<br>REFTURN<br>REFFC=AEFFC(2)<br>REFTURN<br>REFFC=AEFFC(2)<br>REFFC=AEFFC(2)<br>REFFC=AEFFC(2)<br>REFFC=AEFFC(2)<br>REFFC=AEFFC(2)<br>REFFC=AEFFC<br>REFTURN<br>REFFC=AEFFC(2)<br>REFFC=AEFFC<br>REFTURN<br>REFFC=AEFFC<br>REFTURN<br>REFFC=AEFFC<br>REFTURN<br>REFFC=AEFFC<br>REFTURN<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC=AEFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REFFC<br>REF |     | RETORN   | LARC1     | 1100 |
| Index       LAPC1       1164         IF (ARq(2),GT.46.0) GO TO 10       LAPC1       1163         RERFC=qERFC(2)       LARC1       1164         NFTINKN       LARC1       1164         10       HERFC=AERFC(2)       LARC1       1166         NFTINKN       LARC1       1166         RETNKN       LARC1       1166         RETNKN       LARC1       1167         END       LARC1       1167         FUNCTION GERFC (ZTEMP)       LARC1       1167         COMPLEX S.T.Z       LARC1       1171         DATA SOPT/1.772453850905516/       LARC1       1177         IF (ZTFMPEQ.0.010 GO TO 30       LARC1       1177         Z=CMPLX(0.0.7.ZEMP)       LARC1       1174         II=SOPT/2       LARC1       1177         Lar       LARC1       1177         Lar       LARC1       1177         Lar       LARC1       1177         CONTINNE       LARC1       1177         Lar   |     | LIND<br>FUNDATION REFEC (7)                            | 1_ARC1    | 1101 |
| HP (CR(2): G(2): G(2);   |     | TE $ABC(7)$ GT $A$ $A$ CO TO 10                        |           | 1102 |
| HETHINN       LARCI       1164         10       HERFC=ALERFC(2)       LARCI       1166         11       HETHNN       LARCI       1167         11       HARCI       1167       LARCI       1167         11       HARCI       1170       LARCI       1171         11       HARCI       1170       LARCI       1171         11       HARCI       1170       LARCI       1171         11       HARCI       HARCI       1172       LARCI       1177         11       IF       HARCI       HARCI       1176       LARCI       1176         11       IST       HARCI       HARCI       1176       LARCI       1177         11       IST       HARCI       HARCI       HARCI       1176       LARCI       1177         11       IST       HARCI       HARCI       HARCI       HARCI   |     |  | LARCI     | 1164 |
| 10       HERFC = A ERFC (2)       LARC1       1166         HET11MN       LARC1       1167         END       LARC1       1167         FUNCTION GERFC (2TEMP)       LARC1       1167         COMPLEY S+T+2       LARC1       1167         DATA SOPI/1.072453850905516/       LARC1       1170         DATA SOPI/1.072453850905516/       LARC1       1177         LaRC1       1177       LARC1       1177         LaSOPI/1.072453850905516/       LARC1       1177         LaSOPI/2       LARC1       1176         T=Z/U       LARC1       1176         S=T+1.0       LARC1       1177         L=1       LARC1       1176         K=1       T=Z/U       LARC1       1176         S=T+1.0       LARC1       1177       L=1         I       L=1       LARC1       1177         U=2       LARC1       1176       LARC1       1177         U=1       L=1       LARC1       1177       L=1       LARC1       1177         L=1       L=1       LARC1       1178       LARC1       1179         D=2./(K+1)*D)       GO TO 20       LARC1       1186       LARC1 <td></td> <td>RETURN</td> <td>LARCI</td> <td>1165</td>  |     | RETURN   | LARCI     | 1165 |
| HET1JRN       LARC1       1167         END       LARC1       1167         FUNCTION GERFC (ZTEMP)       LARC1       1167         COMPLEY S*T*Z       LARC1       1167         DATA EOS/1.0E-15/       LARC1       1170         DATA SOPI/1.772453850905516/       LARC1       1177         LF (ZTFMP=EQ.0,01 GO TO 30       LARC1       1177         Z=CMPLY(0.0.4,ZTEMP)       LARC1       1174         (I=SOP1/2       LARC1       1174         T=Z/U       LARC1       1177         L=1       LARC1       1177         L=1       LARC1       1177         L=1       LARC1       1177         L=1       LARC1       1177         L=2       LARC1       1177         L=1       LARC1       1178         L=2       LARC1       1178         L=2       LARC1       1183         S=5×1       LARC1       1184  | 10  | RERFC=AERFC(2)   | LARC1     | 1166 |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $  |     | RETURN   | LARC1     | 1167 |
| FUNCTION GERFC (ZTEMP)LARCI1160COMPLEX S+T+Z1.ARCI1170DATA EnS/1.0E-15/LARCI1171DATA SOPI/1.772453850905516/LARCI1177DATA SOPI/1.772453850905516/LARCI1177IF (ZTEMP_EQ.0.01 GO TO 30LARCI1177Z=CMPLX(0.0.7EMP)LARCI1174(I=SOPI/2LARCI1175T=Z/DLARCI1177L=1LARCI1177K=1LARCI1177I=1LARCI1177UCONTINIJELARCI1176K=K+1LARCI1179IC CONTINIJELARCI1183S=S+TLARCI1183IF (CARS(S).EU.0.0) GO TO 20LARCI1183IF (CARS(S).EU.0.0) GO TO 20LARCI1184IF (CARS(S).EU.0.0) GO TO 20LARCI1186IF (CARS(S).EU.0.0) GO TO 20LARCI1186IF (CARS(S).EU.0.0) GO TO 20LARCI1186IF (CARS(S).EU.0.0) GO TO 20LARCI1187IF (L.[T.4]) GO TO 10LARCI1187NERFC=AINAG(S)LARCI1189NERFC=AINAG(S)LARCI1189NERFC=AINAG(S)LARCI1189NERFC=AINAG(S)LARCI1192<  |     |  | LARC1     | 1168 |
| $\begin{array}{c} COMPLEYS,T,\mathcal{A} & 1.ARC1 & 1170 \\ DATA EpS/1,0E=15/ & LARC1 & 1177 \\ DATA SoPI/1,772453850905516/ & LARC1 & 1177 \\ IF (4TFMP_EQ.0,01 GO TO 30 & LARC1 & 1173 \\ \mathcal{L=CMPLY(0,0,\mathcal{ATEMP}) & LARC1 & 1176 \\ II=SOPI/2 & LARC1 & 1176 \\ S=T+1,0 & LARC1 & 1176 \\ S=T+1,0 & LARC1 & 1176 \\ S=T+1,0 & LARC1 & 1176 \\ S=T+1,0 & LARC1 & 1176 \\ S=T+1,0 & LARC1 & 1177 \\ L=1 & IARC1 & 1176 \\ MRC1 & IARC1 & 1183 \\ S=S+I & LARC1 & 1183 \\ S=S+I & LARC1 & 1183 \\ S=S+I & LARC1 & 1184 \\ 1F (CARS(5), E0, 0, 0) GO TO 20 & LARC1 & 1186 \\ IF (CARS(5), E0, 0, 0) GO TO 20 & LARC1 & 1186 \\ \mathsf{IF (CARS(5), CT, EPS) GO TD 10 & LARC1 & 1186 \\ \mathsf{MRC1 & IARC1 & 1186 \\ MRC1 & LARC1 & LARC1 & 1186 \\ MRC1 & LARC1 & LARC1 & LARC1 & 1186 \\ MRC1 & LARC1 & \mathsf{L$  |     | FUNCTION GEREC (ZTEMP)                                 | LARC1     | 1169 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |     | COMPLEX SITIS  | 1.ARC1    | 1170 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |     | DATA EPS/1.0E-15/                                      | LARC1     | 1171 |
| 1F $(21 \mu P_{0} \in Q_{0}, 0, 0)$ $(173)$ $\Delta = CM^{0} \downarrow \chi(0, 0, 0, 0)$ $(0, 0, 0, 0)$ $(173)$ $\Delta = CM^{0} \downarrow \chi(0, 0, 0, 0)$ $(0, 0, 0, 0)$ $(174)$ $(1 = SO^{0} I / 2)$ $LARC1$ $(175)$ $T = Z/D$ $LARC1$ $(176)$ $S = T_{*} I_{*} \hat{0}$ $LARC1$ $(176)$ $L = 1$ $LARC1$ $(176)$ $K = 1$ $LARC1$ $(176)$ $I = T = Z/D$ $LARC1$ $(176)$ $S = T_{*} I_{*} \hat{0}$ $LARC1$ $(176)$ $I = 0$ $CONT^{1}N_{1}E$ $LARC1$ $(176)$ $K = K + 1$ $LARC1$ $(176)$ $LARC1$ $(176)$ $I = T = X^{2}(n)$ $LARC1$ $(176)$ $LARC1$ $(176)$ $S = S + T$ $LARC1$ $LARC1$ $(183)$ $LARC1$ $(183)$ $S = S + T$ $LARC1$ $LARC1$ $(184)$ $LARC1$ $(185)$ $S = S + T$ $LARC1$ $LARC1$ $(185)$ $LARC1$ $(186)$ $I = (CAn)S(S) + EQ_{*}(0, 0)$ $GO$ $TO = 10$ $LARC1$ $LARC1$ <td></td> <td>DATA SOPI/1.//2453850905516/</td> <td>LARC1</td> <td>1172</td>  |     | DATA SOPI/1.//2453850905516/                           | LARC1     | 1172 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   |     | 1 + (2 + 1 + 1 + 2 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 | LARC1     | 1173 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   |     |  | LARCI     | 11/4 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   |     |  | LARCI     | 11/5 |
| L=1       1, APC1       17A         K=1       1, APC1       179         10 CONTINUE       LARC1       180         K=K+1       LARC1       181         T=T#2#0       LARC1       183         S=S+T       LARC1       183         S=S+T       LARC1       184         1F       (CANS(S)*EQ*0*0) GO TO 20       LARC1       184         1F       (CANS(S)*GT*EPS) GO TD 10       LARC1       184         L=L+I       LARC1       184       LARC1       184         UFRFC=AINAG(S)       LARC1       184       LARC1       184         VFRFC=AINAG(S)       LARC1       184       LARC1       184         0FRFC=AINAG(S)       LARC1       184       LARC1       196         30       QERFC=AINA       LARC1       197       LARC1       193         NETURN       LARC1       193       LARC1       194   |     | 5-1-1 6  |           | 1179 |
| K±1       1.APC1       1179         10 CONTINUE       LARC1       1180         K=K+1       LARC1       1181         T=T*Z*N;       LARC1       1182         D=2./((K+1)*D)       LARC1       1183         S=S+T       LARC1       1183         1F (CARS(S)*E0.0.0)       GO TO 20       LARC1       1184         1F (CARS(T)/CABS(S)*GT*EPS)       GO TD 10       LARC1       1185         L=L+I       LARC1       1187       LARC1       1186         VERFC=AINAG(S)       LARC1       1189       LARC1       1189         VERFC=AINAG(S)       LARC1       1189       LARC1       1189         20 PRINT A0* Z*K*L       I ARC1       1190       LARC1       1191         30 GERFC=AO       LARC1       1192       LARC1       1193         HETHRN       LARC1       1193       LARC1       1193         HETHRN       LARC1       1193       LARC1       1194   |     |  |           | 1170 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$  |     |  |           | 1170 |
| K=K+1       LARC1       1181         T=T+24+13       LARC1       1182         D=2./((K+1)+D)       LARC1       1183         S=S+T       LARC1       1184         1F (CARS(S)+E0+0+0) GO TO 20       LARC1       1184         1F (CARS(T)/CABS(S)+GT+EPS) GO TD 10       LARC1       1186         L=L+T       LARC1       1186         UFRFC=A INAG(S)       LARC1       1189         NERFC=A INAG(S)       LARC1       1189         0 PRINT 40+ Z+K+L       LARC1       1191         GO TO 10       LARC1       1192         30 QERFC=0.0       LARC1       1193         RETURN       LARC1       1193         LARC1       1194       LARC1         LARC1       1193       LARC1         LARC1       1194       LARC1         10 QERFC=0.0       LARC1       1193         RETURN       LARC1       1194  | 10  | CONTINUE   | LARC1     | 1180 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   |     | κ=κ+1  | LARC1     | 1181 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$  |     | f=Τφζφη  | LARC1     | 1192 |
| S=S+T       LARC1       1184         1F       (CARS(S).EQ.0.0)       GO       TO       20         IF       (CARS(T)/CABS(S).GT.EPS)       GO       TD       10       LARC1       1185         L=L+I       LARC1       1186       LARC1       1186         UERFC=AINAG(S)       GO       TO       10       LARC1       1186         UERFC=AINAG(S)       LARC1       1188       LARC1       1189         RETURN       LARC1       1189       LARC1       1190         20       PRINT 400 / Z+K+L       IARC1       1191       LARC1       1192         30       QERFC=0.0       LARC1       1193       LARC1       1193         RETURN       LARC1       1194       LARC1       1194         10       VERFC=0.0       LARC1       1193         RETURN       LARC1       1195       LARC1       1195   |     | D=2./((K+1)*D)   | LARC1     | 1183 |
| 1F       (CARS(S).EQ.0.0)       GO TO 20       LARC1       )185         IF       (CARS(T)/CABS(S).GT.EPS)       GO TD 10       LARC1       )185         L=L+I       LARC1       )187       LARC1       )187         IF       (L.IT.4)       GO TO 10       LARC1       )187         UERFC=AINAG(S)       LARC1       1188       LARC1       )187         VERFC=AINAG(S)       LARC1       1189       LARC1       )190         20       PRINT & 00 + Z+K+L       IARC1       )191       LARC1       )192         30       QERFC=0.0       LARC1       1192       LARC1       )193         RETURN       LARC1       1193       LARC1       )195  |     | S=S+T  | LARC1     | 1184 |
| IF       (CARS(T)/CABS(S).GT.EPS)       GO TD 10       LAPC1       1186         L=L+I       LARC1       1187       LARC1       1187         IF       (L+I T+4)       GO TO 10       LARC1       1188         DERFC=AINAG(S)       LARC1       1188       LARC1       1189         DERFC=AINAG(S)       LARC1       1190       LARC1       1191         GO PRINT 40+ Z+K+L       I ARC1       1192       LARC1       1192         30       QERFC=0.0       LARC1       1193         RETHRN       LARC1       1194       LARC1       1194         10       LARC1       1192       LARC1       1193         11       LARC1       1194       LARC1       1194         11       LARC1       1193       LARC1       1194   |     | 1F (CANS(S) .EQ.0.0) GO TO 20                          | LAPC1     | )185 |
| L=L+1       LARC1       )187         IF       (L+1 T+4)       GO TO 10       LARC1       )188         UERFC=AINAG(S)       LARC1       )189       LARC1       )190         PO       PRINT & 0+ Z+K+L       IARC1       )191         GO TO 10       LARC1       )192         30       QERFC=0       LARC1       )193         RETURN       LARC1       1193         KETURN       LARC1       )195  |     | IF (CARS(T)/CABS(S).GT.EPS) GO TD 10                   | LAPCI     | 1186 |
| LARCI       1188         DERFC=AINAG(S)       LARCI       1189         RETURN       LARCI       1190         20       PRINT 40+ Z+K+L       I ARCI       1191         GO TO JO       LARCI       1192         30       QERFC=0.0       LARCI       1193         RETURN       LARCI       1194         LARCI       1193       LARCI       1193         LARCI       1194       LARCI       1193         HETURN       LARCI       1195       LARCI       1195   |     |  | LAMCI     | )187 |
| RETURN     LARC1     1189       PRINT A0+ Z+K+L     I ARC1     1191       GO TO JO     LARC1     1192       30 QERFC=0.0     LARC1     1193       RETURN     LARC1     1194  |     |  | LARUI     | 1188 |
| 20       PRINT A0+ Z+K+L       1 ARC1       1191         G0       τ0       10       1 ARC1       1192         30       GERFC=ñ+0       LARC1       1193         RETHRN       LARC1       1194  |     | RETURN   |           | 1100 |
| GO TU JO     LARCI 1192       30 QERFC=ñ.0     LARCI 1193       HETHRN     LARCI 1194  | 20  |  |           | 1101 |
| 30 GERFC=ñ.0<br>HETHRN LARCI 1193<br>LARCI 1194<br>LARCI 1194<br>LARCI 1194  | 6.0 | GO TU JO   | 1 4 8 0 1 | 1192 |
| RETIIRN LARCI 1194<br>LARCI 1194<br>LAPCI 1195   | 30  | WERFC=0.0  | LARCI     | 1193 |
| LAPC1 1195   |     | KETHRN   | LARC1     | 1194 |
|  |     |  | LAPC1     | 1195 |

С

с

|   | 40 FORMAT (* S=0.0 FOR Z=0.E10.3,* K=*.I10.* L=*.Tin)                              | LARCI              | 1196  |
|---|--|--------------------|-------|
|   | ENO  | LARC-1             | 1197  |
|   | FUNCTION AEREC (Z)   | LARC1              | 1198  |
|   | DATA EPS/1.0E-15/  | LARC1              | 1190  |
|   | OATA SOPI/1-772453850905516/   | LARC1              | 1200  |
|   | IF (2 - FQ - 0 - 0) GQ TQ 40   | LARC1              | 1201  |
|   | $CON = 1 \cdot 0 / (Z + SQPI)$   | LARC1              | 1202  |
|   | U=7+Z  | LARC1              | 1203  |
|   | D=0,5  | LARC1              | 1204  |
|   |  | LAPC1              | 1204  |
|   | S=1,0+7  | LARC1              | 1204  |
|   |  | LAPC1              | 1207  |
|   | K = Î  | APCI               | 1200  |
|   | 10 CONTINUE  | LARCI              | 1200  |
|   | K=K+1  | LARCI              | 1210  |
|   |  | LARCI              | 1211  |
|   | TSAVL=T  | I ARC1             | 1212  |
|   | Τ=Τ+ΟΖή  | LARC1              | 1213  |
|   | S=S+T  | LARC1              | 1214  |
|   | IF (T. T. TSAVE) GO TO 20  | LARC1              | )215  |
|   | IF $(S_{\bullet}, F_{\bullet}, 0, 0)$ GO TO 30                                     | LARC1              | 1216  |
|   | IF (ABS(T/S).GT.EPS) GO TO 10  | LAPC1              | 1217  |
|   | L=L+1  | LARC1              | 1218  |
|   | 1F (L <sub>0</sub> , T.4) GO TO 10   | LARC1              | 1219  |
|   | 20 CONTINIE  | LARC1              | 1220  |
|   | AFRFC=CON+S  | LA <sup>R</sup> C1 | 1221  |
|   | RETIKN   | LARC1              | 1222  |
|   | 30 PRINT 50. Z.K.L   | LARC1              | 1223  |
|   | GOTOÍO   | LARC1              | ) 224 |
|   | 40 AERFUEA.0   | LARC1              | 1825  |
|   | RETURN   | LARC1              | 1226  |
| С |  | LARC1              | 1227  |
|   | 50 FORMAT (* SEV.0 FOR ZE*+E10.3,* KE*+II0,* LE*+I10)                              | LARC1              | 1228  |
|   | ENU<br>Silveruittine cal ca (neolo nitolo da rollamona di Estada ne ne ne de des   | LARCI              | 1229  |
|   | 1960 D. DICINI CALCS (NFOLD INIO), U IRA IRBILAMBDA DI I F IFALD INF INTI MAFIRATI | LARCI              | 1230  |
| С |  | LARCI              | 1231  |
| • |  | LARCI              | 1232  |
|   | DATA SOPI/1,772453850905514/   | LARCI              | 1234  |
|   | IF $(NEDLD+NIOLD) = F(-0,0)$ GO TO 70  | LARC1              | 1235  |
|   |  | LARCI              | 1236  |
|   | $A_{A} = N_1 D_1 U$  | 1 ARC1             | 1237  |
|   | KF=n•5% (RA+RFOLD)   | I ARC1             | 1238  |
|   | KI=n·5%(KB+RIOLD)  | LARC1              | 1239  |
|   | RFP=KF+LAMBDA  | LARC1              | 1240  |
|   | RIP= <sup>R</sup> I+LAMBOA   | LARC1              | 1241  |
|   | RFL=KF0*DT   | LARC1              | 1242  |
|   | RIL=KJ0+OT   | LARC1              | 1243  |
|   | MO=FXF(-RFL)   | LARC1              | 1244  |
|   | LI=F <sup>X</sup> P(-RIL)  | LARC1              | 1245  |
|   | P0=(1,MU)/RFP  | LARC1              | 1246  |
|   | DFar-Fold  | LARC1              | 1247  |
|   | <u>UFD+=D=/DT</u>  | LARC1              | 1248  |
|   | F I = 1 + − F  | LARC1              | 1249  |
|   | FIOLUEIFOLD  | LARC1              | 1250  |
|   | IF (TF. NE. RI) GO TO 30   | LVHC1              | 1251  |
|   | 1F (r.;;T.0.0) GO TO 10  | LARC1              | 1252  |
|   |  | LAHC1              | 1253  |
|   |  | LARC1              | 1254  |
|   |  | LARCI              | 1255  |
|   | 001=0/_00  | LARCI              | ) 256 |
|   |  | LARC1              | 1257  |
|   | TO TA (. ALAMCIATAN) ON I() SA   | LANCI              | 1628  |

|    | NI=0.0  | LARC1  | 1259 |
|----|---|--------|------|
|    | RRI=0, õ  | I ARC1 | 1260 |
|    | NF=40+w0  | I ARC1 | 1261 |
|    | RRF=R¢A0*P0   | LARC1  | 1262 |
|    | GO T <sup>U</sup> A0  | LARC1  | 1263 |
| 20 | NI=A4#FI#FI/FIOLU   | LARC1  | 1264 |
|    | NF=MU*(A0+DF*A4/FIOLD)  | LARC1  | 1265 |
|    | PART=D=DT + RI + A4 + (1 + RFL) + RFL) + M0) / (FIOLD + RFP + RFP)  | LARC1  | 1266 |
|    | RRF=PApT+RF#A0#P0   | LARC1  | 1267 |
|    |   | 1 ARC1 | 1269 |
|    |   | I ARC1 | 1260 |
| 30 | IF (+.GT.0.0) GO TO 4n  | LARC1  | 1270 |
|    | NF=n•0  | LARC1  | 1271 |
|    | RRF=0_Å   | 1 APC1 | 1272 |
|    | NI=F1#A4  | I ARC1 | 1273 |
|    | RP1=RT+ (A4-NI)/RIP   | LARC1  | 1274 |
|    | GO TU RO  | I ARCI | 1275 |
| 40 | 1F (FO)D.LT.1.0) GO TO 50   | LARC1  | 1276 |
|    | (II=n•0   | I ARC1 | 1277 |
|    | RRIEU.  | LARC1  | 1278 |
|    | NF= <sup>0</sup> + <sup>0</sup>   | LARC1  | 1279 |
|    | KQF=KF3A0*P0  | 1 APC1 | )280 |
|    | GO T <sup>U</sup> AO  | LARC1  | 1281 |
| 50 | DIS <sup>=</sup> DI <sup>*</sup> DI   | LARC1  | 1282 |
|    |   | LARC1  | 1283 |
|    | A1=(UFoT+DR#FOLD#FIOLD)#A4/FIOLD  | LARC1  | 1284 |
|    | A5=_UFOT#A4/FIDLU   | LAPC1  | 1285 |
|    | AP=_UR + (FIOLU-FOLD) +A5   | LARC1  | 1296 |
|    | A3=hFDT#A5  | LARC1  | 1287 |
|    | ALPHA=FIOLD#DR  | LARC1  | 1288 |
|    | GAN=REP FOLD +RIP FIOLD   | LARC1  | 1299 |
|    | IF (DF.EQ.0.0) GO TO 60   | LARC1  | 1290 |
|    | BET-DRADFOT   | LARC1  | 1291 |
|    |   | LARC1  | 1292 |
|    | IF (DETA-LI-0.0) PRINT 90, BETA+OF+DR   | LARC1  | 1293 |
|    | IF. (PETA-LI-0.0) BETA=0.0  | LARCI  | 1294 |
|    |   | LARC1  | 1295 |
|    | 2017-2014-201   | LARC1  | 1296 |
|    |   | LARC1  | 1297 |
|    |   | LARC1  | 1298 |
|    |   | LARCI  | 1299 |
|    | WI-MUSENFUSION SOUTS  | LARCI  | 1300 |
|    |   | LAPCI  | 1301 |
|    |   | LARCI  | 1302 |
|    | M1=CQD+#W7/SQH2   |        | 1303 |
|    |   | LARCI  | 1304 |
|    | M3=(A) DHA#M2+M1=M5)/BFT  |        | 1305 |
|    | P4=CUP19W6/SUB2   |        | 1305 |
|    | P5=(1,-GAN*P4-M4)/8FT   |        | 1307 |
|    | P1=(P4-M1)/REP  |        | 1300 |
|    | P2= (P0_P4+A1 PHA+P1) /BFT  | LARCI  | 1310 |
|    | P3= (A) PHA*P2+P1-P5)/BFT   |        | 1311 |
|    | NF=A0+40+A1+41+A2+M2+A3+M3  |        | 1312 |
|    | NI=A48444A5#M5  |        | 1312 |
|    | $RF = KF \phi (A \cap P \cup \phi A ) \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi A ) \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi P \cup \phi A ) \phi A ) \phi A ) \phi P \cup \phi A ) \phi A$ | LARCI  | 1913 |
|    | Rg1=K1 # (A4*P4+A5*P5)  |        | 1314 |
|    | GO T <sup>O</sup> BO  |        | 1312 |
| 60 | 14=FXP(-GA14*1)T)   |        | 1315 |
|    | M1=(M4_M0)/ALPHA  |        | 1310 |
|    | P4=(I +=M41/GAM   | LARCI  | 1310 |
|    | P1=(P4_P0)/ALPHA  | LARC1  | 1320 |
|    | NF=AU#M0+21#M1  | LARC1  | 1321 |
|    |   |        |      |

|   | N1= 4 4 4 4  | LARCI              | 1322    |
|---|--|--------------------|---------|
|   | RRF=KF+ (A0*P0+A1*P1)  | LARC1              | 1323    |
|   | RRT-RTAA40P4   | I ARC1             | 1324    |
|   |  | I ARC1             | 1325    |
|   |  | LARC1              | 1326    |
|   |  | LARC1              | 1327    |
|   |  | LARC1              | 132a    |
|   |  |                    | 1320    |
|   |  | LARCI              | 1330    |
| ~ | AC RETION  |                    | 1331    |
| C | ON ENGLAT 14 PETA NEGATIVE IN CALC - RETA  |                    | 1332    |
|   | $\frac{1}{100}$  |                    | 1332    |
|   | END ETA SET TO ZEROW)  | LAPCI              | 1333    |
|   |  |                    | 1334    |
|   |  |                    | 1.557   |
|   |  |                    | 1220    |
| ~ |  |                    | 1330    |
| L | $CASE = 1 = U_0 (1 + 0) = U_0 (1 + 2)$ $CASE = U_0 (1 + 0) = 0$ $CASE = 0$    |                    | 1330    |
|   |  |                    | 1334    |
| ~ |  |                    | 1341    |
| L | $(AS^{*}, A^{*}, U, U^{*}, U^$ |                    | 1341    |
|   |  |                    | 1342    |
| ~ |  |                    | 1.3 * 3 |
| L |  |                    | 1344    |
|   | 20  IF  (0.51.2)  GO IO  30  |                    | 1344    |
|   | FNEW-POERFC("))-EXP(=2*2**********************************   |                    | 1347    |
| ~ |  |                    | 1347    |
| C |  |                    | 1340    |
|   | 11 FNEW -7.5 EAR (D*D) *PGERFL(-1))*EAR(-2*2*2.*A,"D) *PGERFL(D-A)   |                    | 1344    |
|   |  |                    | 1351    |
|   | ENU<br>ENUETEN SOLINE (TIME OIN)   |                    | 1001    |
|   | TUNCTION SELINE (TIME 41N)<br>DINENCEON JUNG 1. 1131. 72/1131. 73/1131. EV/20.1131. #V/20.   |                    | 1351    |
|   | $1 \times 1 \times 20.1131$  | I ARC1             | 1354    |
|   | DIMENSTON TE(20.113) + T(20) + E(113)  | I ARC1             | 1355    |
|   | DIMENSTON T1 (200) + T2 (200) + T3 (200) + T4 (200) + T5 (200) + T6 (200)  | TT LARCI           | 1356    |
|   |  | LARC1              | 1357    |
|   | DINE STON TB (200) + T9 (200) + T10 (200) + T11 (200) + T12 (60)   | LARCI              | 1358    |
|   | DATA I: /14551674189520732236287252626572782   | PAT LARCI          | 1359    |
|   | 1 • • 3 • 16 • • 3126 • • 3232 • • 3 = 33 • • 3431 • • 3525 • • 3616 • • 3624 • • 3630 • • 3634 • •  | 1454 LARCI         | 1360    |
|   | 2,,1691,,1891,,2070,,2232,,2380,,2521,,2650,,2775,,2896,,3012,   | 3120 LARCI         | , 361   |
|   | 3.3225 .3323 .3420 .3517 .3610 .3620 .3627 .3633 .1452 .7688 .   | 1806 LARCI         | 1352    |
|   | 4 • • 2 • 65 • • 2227 • • 23 / 2 • • 25 1 4 • • 26 4 0 • • 276 4 • • 2887 • • 30 0 0 • 31 1 0 • • 32 1 2 • •   | 3312 LARC1         | 1363    |
|   | 5 3410 3506 3600 3612 3622 3631 1450 1695 1881 2060  | 2222 LARC1         | 1364    |
|   | 6, 2364 , 2507, 2630, 2752, 2872, 2987, 31 nn + 32nn , 3300, 3308, 5   | 3402 LARCI         | 1365    |
|   | 7.3584.3602.3618.3629.1449.1602.1877.2052.2214.2357  | 2495 LARCI         | 1366    |
|   | 8 2420 2741 2857 2967 3075 3180 3285 3481 3547   | 3593 LARCI         | 1367    |
|   | 4, 3, 16, 3626, 1) 446, 1679, 1872, 2044, 2207, 2350, 2490, 2610, 1  | 2730 LARCI         | 1365    |
|   | \$.,285n,2 <sup>9</sup> 56,3002,3167,327),3371,4464,355n,3584,3614   | 3623 LARCI         | ) 369   |
|   | \$1444, 1076.1868, 2036. 2000. 2340. 2480. 2600. 2719. 2837.   | 2945 1, ARC1       | 1370    |
|   | 5.,3150,,3155.,3257.,3357.,3448.,3534.,35763612,,36201442.,  | 1673 LARC1         | 1371    |
|   | 5,,1863,2027,2185,2330,2470,2590,4710,2825,2935,3040,3   | 3145 LARC1         | 137;    |
|   | 5 · · 3 · 45 · · 3343 · · 3431 · · 3517 · · · 3567 · · 3610 · · J617 · · 1440 · · 1670 · · 1859 · ·  | 2018 LARC1         | 1371    |
|   | \$,,21'0,,2315,,2460,,2580,,2699,2812,,2925,,3035,3135,,3235,  | 3379 LARC1         | 1374    |
|   | \$3415.,3500.,3550.,3600.,3615.,1438.,1467.,1854.,2009.,2159.,3  | 23n5 LARCI         | 1375    |
|   | \$,,24 <sup>5</sup> 0,,2572,,2686,,2800,,2910,,3020,,3120,,3220,,3315,.3400,,  | 3493 LARCI         | 1376    |
|   | \$3c37,,35903612./   | LARC1              | 1377    |
|   | DATA T2/143616641850200021512297244525642K782  | 2790 LARCI         | 1376    |
|   | 1,,2000,,3010,,3110,,3205,,3295,,3383,,3447,,3530,,3580,,3609,   | 1494 LARC1         | 1370    |
|   | 2.,1461.,1846.,1996.,2146.,2292.,2440.,2556.,2670.,27842804.,  | 3nnn LAPG1         | 138(    |
|   | 3.,3100.,3192.,3281.,3366.,3450.,3522.,3570.,3606.,1432.,1658  | 1841 LARCI         | 1381    |
|   | 4.,1942.,2141.,2287.,2433.,2548.,2663.,2778.,2884.,2990.,3085.,  | 3175 <u>1</u> ARC1 | j 39;   |
|   | 5.,3265.,3350.,3433.,3515.,3560.,3603.,1430.,1655.,j836.,jQ98.,j   | 2136 LARCI         | j 38·   |
|   | 6  | 3336 1 ARC1        | 1384    |

| /•;3416.;3498.;3577.;2416 LARC1<br>8.;2531.;2646.;2760.;2870.;2970.;3060.;3150.;3240.;320.;3400.;3491 LARC1  |   |
|--|---|
| 8.+2531.+2646.+2760.+2870.+2970.+3060.+3150.+3240.+3320.+3400.+3441 LARC1  | 1305  |
|  | 1384  |
|  | 1500  |
| 7.,3546,,3586,,1427,,1649.,1827,,1980,,2126.,2272,,2408,,2520,,2630 LARC1  | 1387  |
| \$ + + 2740, + 2850 + + 2960 + + 3040 + + 3120 + + 3220 + + 3308 + + 3380 + + 2464 + + 3520 + + 3571 + ARC1  | 1388  |
|  |   |
| 3.414-5,41040,41023,419/5,42122,42207,44400,42510,42610,42730,42860 LARCI  | 1304  |
| 529 <sup>5</sup> 03020310032003288336034333510355734231643 LARC1   | 1390  |
|  | 1.20.   |
|  | 1371  |
| »••30°8,•318/••32//••3340••3400••3500••3543••1421_•1640••1914_•1947 LARC1  | 1392  |
| 5 . 2115 . 2257 . 2386 . 2493 . 2593 . 2710 . 2820 . 2912 . 3000 . 3077 . 3175 I ARCI  | 1393  |
|  |   |
|  | 1 374   |
| \$23402486256627002810290529903066316232553346   ARC1  | 1395  |
| 5 . 20/5 . 3647 . 2514 /   | 1204  |
|  | 1.720   |
| UATA T3/1417.,1632.,1805.,1958.,2108.,2247.,2373.,2480.,2579.,2690 LARC1   | 1397  |
| 1290029002980305531503244329233423450  | 1398  |
|  | - 200   |
| 2. + 1 - 20, + 1000 + 1 - 3. + 2104 + + 2241 + + 2.106 + + 24/3 + 25/2, + 26KA + + 2/9A + 2494 LAKUI   | 1.379   |
| 3 • + 29 10 • 3044 • + 3137 • + 3233 • + 3285 • + 3350 • + 3433 • + 3487 • + 1413 • + 1624 • + 1797 LARC1  | 1400  |
| 4 1949 2100 2236 2360 2467 2564 2671 2770 2878 2060 3022 14001   | 1401  |
|  | 1.01  |
| 2.,3125,,3222.,3211,,334434173415.,1410.,1020,17941945.,2095 LARC1   | 1402  |
| 6++2231,+2353++2460,+2557++2662++2769++2867++2950 +3022+3112-32++ 1 ARC1   | 1403  |
|  |   |
| -+5205, 5330, 53400, 53402, 51400, 51010, 51791, 51741, 52090, 52225, 52346 LARCI  | 1404  |
| 8,2454,2550,2652,2758,2856,2940,3011,3100,3200,32652,3324 LARC1  | 1405  |
| 9-13287 13450-11405-11612-11788-11937-12884-12214 13240 - 2448 - 2514 1APC1  | 1406  |
|  | 1400  |
| ₽•+25 <sup>-</sup> 3,+21+7•+25 <sup>4</sup> 7•+2930•+3000++3058++3191++3246 <sub>*</sub> +3312•+3373•+3457 LARC1   | 1407  |
| 5. 1402 .1608. 1785. 1933. 2079. 2211. 4333. 2442 .2537. 2633. 2737 LARCI  | 1408  |
|  |   |
| 3. + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 3 + 1 = + 1 + 1 + 2 + 3 + 2 + 3 + 3 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1   | 1409  |
| 5 • • 1781 • • 1928 • • 20 (4 • • 2206 • • 2326 • • 2436 • • 4531 • • 2624 • • 2726 • • 2823 • • 2916 LAPC1  | 1410  |
| 5. 2006 3163. 3143. 3215. 2283. 3249. 3412. 1208 1600. 1777 1996 1APC1   | 1411  |
|  | 1411  |
| 3.+2024.+2200.+2220.+2220.+2410.+2227.+2017.+2117.+2812.+2900.+2975.+3050 LARCI  | 1412  |
| 5.3145.3200.3267.3333.3400.1396.1568.1773.1920.2063.2193 LARCI   | 1413  |
| \$ + 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1   |   |
| - 2413-2423-2410-2410-2410-2410-2410-2403-240-4034-44110-3144 LAGI   | 1717  |
| a, 32 <sup>2</sup> 0, 3317, 3390, / [ARC1  | 1415  |
| DATA T4/1394+11596+11769+11916+12058+12186+12310+12420+12505+12655 LARC1   | 1416  |
| 1  | 1417  |
|  | 1 - 1 - 1   |
| 215'4,17'03.17'2,12'54,2053.2'8'05.2'2'05.2'2'001.27'00.27'00.2'2'00   | 1418  |
| 3++2855, 12930++3010++3085++3153++3222++3280++3360++1360+1522++1761   ARC1   | 1419  |
|  | 1420  |
|  | 1 6 7 / 1   |
|  | 1420  |
| 5.,3000307031403211.,3260.,33401389.,1590  | 1421  |
| 5.,30003070314032113260334013891590175717542043 LAPC1  | 1421  |
| 5.,3000307031403211.,3260334013891590.,175717042043 LAPC1<br>5.,21672290240024932586267827522826290079833056 LARC1   | 1421  |
| 5.,30003070314032113260334013891590  | 1421<br>1422<br>1423  |
| 5.,3n00307031403211326033401389159n  | 1421<br>1422<br>1423<br>1423  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,,1757,,1754,.20Å3 LAPC1<br>6.,2167,2290,2400,.2493,.2586,2678,2752,2826,2900,.2983,.30Å6 LARC1<br>7.,3128,3200,3240,,3320,1386,1588,1754,1900,.2038,2160,226Å LARC1<br>8.,2386,2479,2573,2667,2740,2813,2887,2945,3040,3170,3175 LARC1<br>9.3260,3300,1384,1586,1750,2813,2887,2945,3040,3170,3175 LARC1   | 1421<br>1422<br>1423<br>1423  |
| 5.,3000307031403211.,3260334013891590  | 1421<br>1422<br>1423<br>1423<br>1424<br>1425  |
| 5.,30003070314032113260334013891590  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,,1757,,1754,.20Å3 LAPC1<br>6.,2167,2290,2400,2243,.2586.2678,2752,2826,.2900,.2983,.30Å6 LARC1<br>7.,3128,3200,3240,3320,1386,1588,1754,1900,2038,2160,2260 LARC1<br>8.,2386,2479,2573,2667,2740,2813,2887,2945,3040,3170,3175 LARC1<br>9.320,3300,1384,1586,1750,1895,2032,2153,2270,2372,2466 LARC1<br>5.,2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.,1382,1584,1746,1890,2027,2147,2260,2359,2453,2547,2644 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1427  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1960,.2038.2160,.2266 LARC1<br>8.2386,.2479,.2573,.2667,.2740.2813.2887.2945,.3040.3170,.3175 LARC1<br>9.3220,.3300.1384.1586.1750.1895.2032.2153,.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3724.3100,.3150.3270.2464 LARC1<br>5.13 <sup>8</sup> 2,.1584.1746,.1890.2027.2147.2260.2359,.2453.2547.26Å4 LARC1<br>5.2722,.2785.2860.2930.3000.2873.2948.3175.23160.2359,.2453.2547.26Å4 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1427  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1384,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2157,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900.2038.2160,.2200 LARC1<br>8.2386,.2479.2573,.2667.2740.2813.2887.2945.3040.3170.3175 LARC1<br>9.3220.3300.1384.1586.1750.1895.2032.2153.2270.2372.2446 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.3200 LARC1<br>5.1382.1584.1746.1890.2027.2147.2260.2359.2453.2547.2644 LARC1<br>5.2722.2785.260.2930.3000.3070.3155.3160.3260.3260.2654.2644 LARC1  | 1421<br>1422<br>1423<br>1423<br>1424<br>1425<br>1426<br>1427<br>1428  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,,1757,,1764,.20Å3 LAPC1<br>6.,2167,2290,2400,.2493,.2586,2678,2752,2826,2900,.2983,.3066 LARC1<br>7.,3128,3200,3240,.3320,1386,1588,1754,1900,2038,2160,2266 LARC1<br>8.,2386,2479,2573,2667,2740,2813,2887,2945,3040,3170,3175 LARC1<br>9.320,3300,1384,1586,1750,1895,2032,2153,2270,2372,2466 LARC1<br>5.,2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.,2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.,2784,1746,1890,2027,2147,2260,2359,2453,2547,2644 LARC1<br>5.,2722,2785,2860,2930,3000,3070,3115,3160,3260,1542 LARC1<br>5.,1742,1885,2022,2140,2250,2345,2440,2535,2633,2710,2779 LARC1  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1427<br>1428<br>1429  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900,.2038.2160,.2200 LARC1<br>8.2386,.2479,.2573,.2667,.2740.2813.2887.2945,.3040.3170,.3155 LARC1<br>9.3260,.3000.1384.1586.1750.1895.2032.2153,.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3200,.3200 LARC1<br>5.1382.1584.1746,.1890.2027.2147.2260.2359,.2453.2547.2644 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3260.3740.1592 LARC1<br>5.1742.1885.2022.2140.2250.2345.2440.2535,.2633.2710.2779 LARC1<br>5.1742.31885.2022.3140.3080.3133.3240.1378.360.3780.2778 LARC1  | 1421<br>1422<br>1423<br>1423<br>1425<br>1426<br>1427<br>1427<br>1428<br>1429<br>1430  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2157,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1960.2038.2160,.2266 LARC1<br>8.2386,.2479.2573,.2667.2740.2813.2887.2945.3040.316.2266 LARC1<br>9.3220.3300.1384.1586.1750.1895.2032.2153.2270.2372.2446 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3260,.3260 LARC1<br>5.13 <sup>8</sup> 2,.1584.1746.1890.2027.2147.2260.2359,2453.2547.2644 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3760.1380.1592 LARC1<br>5.17 <sup>4</sup> 2,.1885.2022.2140.2250.2345.2440.2535.2643.2710.2779 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.1738.1880 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1429  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,,1757,.1764,.20Å3 LAPC1<br>6.,2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.,3128,.3200.3240,.3320.1386.1588.1754.1900.2038.2160.2266 LARC1<br>8.,2386,.2479.2573,.2667,.2740.2813.2887.2945.3040.3110.3175 LARC1<br>9.320,.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.,2560,.2655.2733.2867.2740.2813.2948.3024.3100.3150.3270.2466 LARC1<br>5.,2560,.2655.2733.2867.2740.2813.2948.3024.3100.3150.3270.2466 LARC1<br>5.,2560,.2655.2733.2867.2747.2948.3024.302.2153.2547.2644 LARC1<br>5.,1382,.1584.1746.1890.2027.2147.2260.2359.2453.2547.2644 LARC1<br>5.,2722.2785.2860.2930.3000.3070.3115.3160.3260.1340.1542 LARC1<br>5.,1742.1885.2022.2140.2250.2345.2440.2535.2633.2710.2779 LARC1<br>5.,2844.2909.2975.3040.3080.3133.3240.1378.1680.5738.1880.2779 LARC1<br>5.,2844.2909.2975.3040.2335.2430.2525.26622.2705.2769.2835.2900.1ARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1431  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900,.2038.2160,.2200 LARC1<br>8.2386,.2479,.2573,.2667,.2740.2813,.2887.2945,.3040.3170,.3175 LARC1<br>9.3260,.2655.2733,.2667.2740.2813.2887.2945,.3040.3170,.3175 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150,.3200 LARC1<br>5.1382,.1584.1746,.1890.2027.2147.2260.2359,.2453.2547.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.3740.4159, LARC1<br>5.1382,.1584.2746,.2930.3000.3070.2147.2260.2359,.2633.2547.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.2147.2260.2555.2633.2710.2779 LARC1<br>5.2744.2909.2975.3040.3080.3133.3240.1378.1680.1738.1880.LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.2669.2769.2835.2900 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.2669.2769.2835.2900 LARC1<br>5.2844.2909.2975.3040.2335.2430.2525.26622.2765.2769.2835.2900 LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.277 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1431<br>1431<br>1432  |
| 5.,3000,.3070,.3140,.3211,,3260,.3340,.1388,.1590,,1757,,1764,.20&3 LAPC1<br>6.2167,2290,2400,2493,2586,2678,2752,2826,2900,2983,3066 LARC1<br>7.3128,3200,3240,3320,1386,1588,1754,1900,2038,2160,220 LARC1<br>8.2386,2479,2573,2667,2740,2813,2887,2945,3040,3170,3175 LARC1<br>9.320,3300,1384,1586,1750,1895,2032,2153,2270,2372,2466 LARC1<br>5.2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.2560,2655,2733,2800,2873,2948,3024,3100,3150,3200 LARC1<br>5.2560,2655,2733,2800,2873,2948,3024,3100,3150,3700,270,270,2464 LARC1<br>5.2560,2655,2733,2800,207,2147,2260,2359,2453,2547,2644 LARC1<br>5.2722,2785,2860,2930,3000,3070,3115,3160,3260,370,2547,2644 LARC1<br>5.2742,1885,2022,2140,2250,2345,2440,2535,2633,2710,2779 LARC1<br>5.2844,2909,2975,3040,3080,3133,3240,1378,1680,1738,1880 LARC1<br>5.2844,2909,2975,3040,3080,3133,3240,1378,1680,1738,1880 LARC1<br>5.2844,2909,2975,3040,3080,3133,3240,1378,1875,2011,2127 LARC1<br>5.2950,3025,3060,3117,3220,1376,1578,1735,1875,2011,2127 LARC1<br>5.2230,2355,2420,2555,2692,2695,2765,2769,2815,2905,2769,2835,2900,148C1<br>5.2230,2325,2420,2515,2612,2695,2765,2769,2816,2875,2905,3040,400  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1431<br>1432  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20&1 LAPC1<br>6.,2167,.2290.2400,.2493.2586.2678.2752.2826,.2900,.2983.30E6 LARC1<br>7.,3128,.3200,.3240,.3320,.1386.1588.1754.1900,.2038,.2160,.2260 LARC1<br>8.,2386,.2479,.2573,.2667,.2740,.2813,.2887,.2945,.3040,.3170,.3175 LARC1<br>9.320,.3300.1384.1586.1750.1895.2032.2153,.2270.2372.2466 LARC1<br>5.,2560,.2655,.2733,.2800,.2873.2948,.3024.3100,.3150,.3200 LARC1<br>5.,2560,.2655.2733,.2800,.2873.2948,.3024.3100,.3150,.3200 LARC1<br>5.,1382,.1584.1746,.1890.2027,.2147.2260.2359,.2453,.2547,.2644 LARC1<br>5.,2722.2785.2860.2930.3000.3070.3115.3160,.3260.1380,.1582 LARC1<br>5.,1742,.1885.2022,.2140.2250,.2345,.2440.2535,.2633,.2710,.2779 LARC1<br>5.,2844,.2909,.2975,.3040.3080.3133.3240.1378,.1680   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1431<br>1432<br>1433  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20Å3 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900,.2038.2160,.2200 LARC1<br>8.2386,.2479,.2573,.2667,.2740.2813.2887.2945,.3040.3170,.3175 LARC1<br>9.3260,.3000.1384.1586.1750.1895.2032.2153,.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3200,.3200 LARC1<br>5.1382.1584.1746,.1890.2027.2147.2260.2359,.2453.2547.2644 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3260.1589 LARC1<br>5.1742.1885.2022.2140.2250.2345.2440.2535,.2633.2710.2779 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.1738.1890 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.1738.2700 LARC1<br>5.2844.2909.2975.3040.2355.2430.2555.26622.2765.2769.2835.2700.1ARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2950.4325.2420.2515.2612.2695.2758.2816.2875.2925.3000 LARC1<br>5.2930.43200.7   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1427<br>1427<br>1429<br>1430<br>1431<br>1432<br>1433<br>1434  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20&1 LAPC1<br>6.2167,.2290,.2400,.2493,.2586,.2678,.2752,.2826,.2900,.2983,.3066 LARC1<br>7.3128,.3200,.3240,.3320,.1386,.1588,.1754,.1900,.2038,.2160,.2206 LARC1<br>8.2386,.2479,.2573,.2667,.2740,.2813,.2887,.2945,.3040,.3170,.3175 LARC1<br>9.3220,.3300,.1384,.1586,.1750,.1895,.2032,.2153,.2270,.2372,.2466 LARC1<br>5.2560,.2655,.2733,.2800,.2873,.2948,.3024,.3100,.3150,.3200 LARC1<br>5.1382,.1584,.1746,.1890,.2027,.2147,.2260,.2359,.2453,.2547,.2644 LARC1<br>5.2722,.2785,.2860,.2930,.3000,.3070,.3115,.3160,.3260,.1380,.1592 LARC1<br>5.1742,.1885,.2022,.2140,.2250,.2345,.2440,.2535,.2633,.2710,.2779 LARC1<br>5.2844,.2909,.2975,.3040,.3080,.3133,.3240,.1378,.160,.1738,.1890 LARC1<br>5.2950,.3025,.3060,.3117,.3220,.1376,.1578,.1735,.1875,.2011,.2127 LARC1<br>5.2950,.3025,.2420,.2515,.2612,.2695,.2758,.2816,.2875,.2925,.3011,.2127 LARC1<br>5.2950,.3025,.2420,.2515,.2612,.2695,.2758,.2816,.2816,.2412,.2566,.4021<br>5.3040,.3100,.3200,/<br>UARC1<br>5.3040,.3100,.3200,/<br>UARC1<br>5.3040,.3100,.3200,/<br>UARC1<br>5.404,.2250,.2318,.2412,.2566,.2055,.2256,.2318,.2412,.2566,.401<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4801<br>1.4 | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1431<br>1432<br>1433<br>1435  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.2043 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900.2038.2160.2266 LARC1<br>8.2386,.2479.2573,.2667,.2740.2813.2887.2945,.3040.3110.3155 LARC1<br>9.3200.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3270.2466 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3164.3260.33.2547.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3164.3260.3740.1592 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3164.3260.3740.1592 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3164.3260.3749.1592 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3164.3260.3749.1592 LARC1<br>5.2723.2785.2860.2930.3080.3133.3240.1378.3760.3778.3890 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.360.3778.3890.2479 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.3769.2769.2835.2900.1ARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.31875.2011.2127 LARC1<br>5.2950.3025.3060.3117.3220.1376.3578.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.3060.3117.3220.1376.3578.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.3060.3117.3220.1376.3578.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.2022.2140.2515.2695.2759.2816.2816.2875.2925.3000 LARC1<br>5.2950.3025.3060.3117.3220.3376.32695.2120.2225.2318.2412.2506 LARC1<br>5.2950.3025.2027.2515.2695.2025.2120.2255.2695.2318.2412.2506 LARC1<br>5.2950.3025.3060.4117.3220.3176.3176.3176.3176.3175.2055.2318.2412.2506 LARC1<br>5.2950.3025.3060.3117.314.1870.2005.2120.2255.2318.2412.2506 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1431<br>1433<br>1435<br>1435  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.20&3 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900,.2038.2160,.2200 LARC1<br>8.2386,.2479,.2573,.2667,.2740.2813,.2887,.2945,.3040.3170,.3175 LARC1<br>9.3220,.3300.1384.1586.1750.1895.2032.2153,.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3200, LARC1<br>5.1382,.1584.1746,.1890.2027.2147.2260.2359,.2453.2547,.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.7380.1592 LARC1<br>5.1742.1885.2022.2140.2250.2345.2440.2535,.2633.2710,.2779 LARC1<br>5.2844,.2909.2975,.3040.3080.3133.3240.1378,.1680.1738,.1880.LARC1<br>5.2844,.2909.2975,.3040.3080.3133.3240.1378,.1680.1738,.1880.LARC1<br>5.2950,.3025,.3060,.3117.3220.1376.1578.1735,.1875.2011,.2127 LARC1<br>5.2930,.2325.2420,.2515.2612.2695.2758.2816,.2875,.2925,.3000 LARC1<br>5.3040.3100.3200./<br>DATA T5/1374.1575.1731.1870.2005.2120.2255.2318.2412.2566 LARC1<br>1.2640,.2673.2736,.2800.2850.2900.2973.3025,.3079.3180.1377 LARC1  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1429<br>1430<br>1431<br>1432<br>1433<br>1434<br>1435  |
| 5.3000.3070.3140.3211.3260.3340.1388.1590.1757.177.3764.2083 LAPC1<br>6.2167.2290.2400.2493.2586.2678.2752.2826.2900.2983.3066 LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1900.2038.2160.2206 LARC1<br>9.326.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560.2655.2733.2667.2740.2813.2887.2945.3040.3170.3270.LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.2846.LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.32547.2644.LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3255.2647.2644.LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.3770.LARC1<br>5.2744.2909.2975.3040.3080.3133.3240.1378.1680.3778.1890.LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.3778.1895.2900.1ARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2950.3025.3060.2515.2612.2695.2758.28816.2875.2905.3011.2127 LARC1<br>5.2950.3025.3060.2117.3220.1376.1578.1735.3186.2875.2905.3001 LARC1<br>5.2950.2325.2420.2515.2612.2695.2758.28816.2875.2905.3001 LARC1<br>5.2950.2325.2420.2515.2612.2695.2120.2255.2318.2412.2566 LARC1<br>5.2950.2325.2420.2515.2612.2695.2120.2255.2625.2638.2412.2566 LARC1<br>5.2950.3025.2640.2613.2755.2612.2695.2120.2255.263.2758.2816.2875.2905.2011.2127 LARC1<br>5.2950.2325.2420.2515.2612.2695.2120.2255.2638.2412.2566 LARC1<br>1.2860.200.2673.2766.2800.2850.2900.2973.3025.3079.3180.1372.LARC1<br>2.2600.2673.2766.2800.2850.2200.2273.3055.200.2575.2664 LARC1<br>2.2600.2673.2766.2800.2850.2200.2273.3055.200.2575.2664 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1429<br>1430<br>1437<br>1433<br>1435<br>1436<br>1437  |
| 5.,3000,.3070,.3140,.3211,.3260,.3340,.1388,.1590,.1757,.1764,.2043 LAPC1<br>6.2167,.2290.2400,.2493.2586.2678.2752.2826,.2900.2983.3066 LARC1<br>7.3128,.3200.3240,.3320.1386.1588.1754.1900.2038.2160.2266 LARC1<br>8.2386,.2479.2573,.2667.2740.2813.2887.2945.3040.3110.3175 LARC1<br>9.3200.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560,.2655.2733,.2800.2873.2948.3024.3100,.3150.3720,.2466 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3259.2647.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.359.2647.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.359.2647.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3760.3770.2779 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3760.3780.1592 LARC1<br>5.2722.2785.2860.2930.3080.3133.3240.1378.360.37738.3890 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.3780.3778.3890 LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.3769.2835.2900 LARC1<br>5.2950.3025.3060.3117.3220.1376.3578.378.375.2905.2769.2835.2900 LARC1<br>5.2950.3025.3060.2515.2612.2695.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.3060.2515.2612.2695.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.3060.2515.2612.2695.2759.2816.2875.2925.3000 LARC1<br>5.2950.3025.2020.2515.2612.2695.2759.2816.2875.2925.2011.2127 LARC1<br>5.2950.3025.2020.2515.2612.2695.2120.2275.2318.2412.2506 LARC1<br>2.2950.2325.2420.2515.2612.2695.2120.2275.2318.2412.2506 LARC1<br>2.2950.2325.2420.2515.2612.2695.2120.2225.2518.2612.2506 LARC1<br>2.2950.2225.250.2420.2515.2605.2120.2225.2518.2612.2506 LARC1<br>2.2603.2712.2784.2240.2515.2600.2800.2900.2273.3079.3180.1374.1374.1374.1374.1374.1374.2506 LARC1<br>2.2604.2673.2736.2800.2850.2900.2973.3075.3079.3180.1374.2506 LARC1<br>2.2605.2100.2673.2736.2800.2800.2900.2973.3075.3079.3180.1374.1374.4801<br>2.2712.2781.2837.2809.2900.2946.3000.2973.3075.3079.3180.1374.4801<br>2.2712.2781.2837.2809.2946.3000.2073.3005.2100.2575.2644 LARC1<br>2.2712.2781.2837.2809.2946.3000.2073.3005.2100.2373.3075.3174.400.2575.2644 LARC1<br>2.2712.2781.2837.2809.2946.3000.2100.2220.2310.2371.2371.3774.4800.2075.2644   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1426<br>1427<br>1427<br>1430<br>1431<br>1433<br>1435<br>1436<br>1437  |
| 5.3000.3070.3140.3211.3260.3340.1388.1590.1757.177.374.2012.2014<br>6.2167.2290.2400.2493.2586.2678.2752.2826.2900.2983.3066 LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1900.2038.2160.2201 LARC1<br>8.2386.2479.2573.2667.2740.2813.2887.2945.3040.3170.3175 LARC1<br>9.320.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.3200 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.338.2710.2779 LARC1<br>5.2744.2909.2975.3040.3080.3133.3240.1378.1680.3778.1680.1738.1680.LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.3778.1680.1778.1680.<br>5.2950.3025.3060.3117.3220.1376.1578.1735.2695.2769.2835.2901.ARC1<br>5.2930.2325.2420.2515.2612.2695.2758.28616.2875.2905.3001 LARC1<br>5.2930.2325.2420.2515.2612.2695.2758.2816.2875.2905.3001 LARC1<br>5.3040.3100.3200.7 LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3079.3180.1377.LARC1<br>2.460.2673.2736.2800.2850.2900.2973.3025.3079.3190.1377.LARC1<br>2.472.1866.2000.2110.2220.2319.2255.26425.2500.2575.2664 LARC1<br>2.472.2781.2837.2890.2940.2910.2973.3025.3079.3190.1377.LARC1<br>2.472.2781.2837.2800.2850.2900.2973.3025.3079.3190.1377.LARC1<br>2.472.3074.41575.4731.41870.2005.2005.2120.2255.2669.3079.3190.1377.LARC1<br>2.474.374.41575.4731.41870.2005.2005.2120.2255.2669.2750.2750.2664 LARC1<br>2.474.374.41575.4734.41575.4731.41870.2005.2005.2120.2255.2667.2318.2412.25644 LARC1<br>2.472.2781.2837.2800.2850.2900.2973.3025.3079.3190.1377.LARC1<br>2.472.4781.2837.2800.2850.2900.2973.3055.3079.3190.1377.LARC1<br>2.472.42781.2837.2800.2946.3000.3059.3140.3055.3079.3190.1377.LARC1<br>2.472.4774.4866.2000.210.2220.2310.2973.3055.3079.3140.1377.LARC1<br>2.472.42781.2837.2890.2946.3000.3059.3140.3059.3140.3079.3140.1377.LARC1  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1427<br>1429<br>1430<br>1432<br>1433<br>1434<br>1435<br>1436<br>1437<br>1437  |
| 5.3000.3070.3140.3211.3260.3340.1388.1590.1757.177.3764.2083 LAPC1<br>6.2167.2290.2400.2493.2586.2678.2752.2826.2900.2983.3066 LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1900.2038.2160.2206 LARC1<br>8.2386.2479.2573.2667.2740.2813.2887.2945.3040.310.3156.LARC1<br>9.320.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560.2655.2733.2867.2740.2813.2887.2945.3040.310.350.270.LARC1<br>5.2560.2655.2733.2860.2873.2948.3024.3100.3150.3200.2875.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.35547.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.3770.2644 LARC1<br>5.2722.2785.2860.2930.3000.3070.3115.3160.3260.3770.2770 LARC1<br>5.2742.1885.2022.2140.2250.2345.2440.2535.2633.2710.2770 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1378.1680.3788.1880.4871<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.3185.2011.2127 LARC1<br>5.2950.3025.3060.2515.2612.2695.2758.28816.2875.2955.3060 LARC1<br>5.2950.3025.3060.2117.3220.1376.1578.1735.3079.318.2412.2566 LARC1<br>1.2730.2255.2420.2515.2612.2695.2758.28816.2875.2955.3060 LARC1<br>5.2750.2025.2766.2800.2815.226.2000.2973.3025.2318.2412.2566 LARC1<br>2.2712.2781.2837.2890.2946.3000.3059.3140.2509.2755.2664 LARC1<br>2.3712.2781.2837.2890.2946.3000.3059.3140.2509.2755.2664.LARC1<br>4.1862.1992.27105.2215.225.2390.2345.2390.2487.2558.2629.2760.2575.2664 LARC1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1427<br>1438<br>1437<br>1433<br>1435<br>1437<br>1437<br>1437  |
| 5.3000.3070.3140.3211.3260.3340.1384.1590.1757.177.207.207.207.207.207.207.207.207.207.2   | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1427<br>1427<br>1429<br>1431<br>1432<br>1433<br>1435<br>1435<br>1436<br>1437<br>1437  |
| 5.3000.3070.3140.3211.3260.3340.1384.1590.1757.1767.1764.2043 LAPC1<br>6.2167.2290.2400.2493.2586.2678.2752.2887.2900.7983.3066 LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1900.2038.2160.2200 LARC1<br>8.2386.2479.2573.2667.2740.2813.2887.9945.3040.310.3155 LARC1<br>9.320.300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560.2655.2733.2667.2740.2813.2948.3024.3100.3150.3700.3700 LARC1<br>5.2560.2655.2733.2667.2740.2813.2948.3024.3100.3150.3700.3700 LARC1<br>5.2560.2655.2733.2667.2027.2147.2260.2359.2453.2547.2644 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3150.3700.1592 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3138.2747.2644 LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3137.2633.2710.2779 LARC1<br>5.2744.2909.2975.3040.3080.3133.3240.1374.1580.3778.1840.LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2930.2325.2420.2515.2612.2695.2754.2816.2875.2905.3011.2127 LARC1<br>5.2930.2325.2420.2515.2612.2695.2754.2816.2875.2905.3079.3140.1372 LARC1<br>1.2640.2673.2736.2800.2850.2900.2973.3025.3079.3140.1372.2644 LARC1<br>1.2640.2673.2736.2800.2850.2900.2973.3025.3079.3140.1372.2644 LARC1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48C1<br>2.48           | 1421<br>1422<br>1423<br>1424<br>1425<br>1425<br>1426<br>1426<br>1427<br>1428<br>1428<br>1428<br>1431<br>1431<br>1433<br>1434<br>1435<br>1436<br>1437<br>1438<br>1436                          |
| 5300, 3070.3140.3211.3260.3340.1388.1590.1757.1074.2013 LAPC1<br>6.2167.2290.2400.2493.2586.2678.2752.2826.2900.2093.3056.LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1970.2038.2160.2205.2466<br>8.2479.2573.2667.2740.2813.2887.2945.3040.3150.3270.2466<br>9.320.3300.1384.1586.1750.1895.2032.2153.2270.2372.2466<br>LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.3200.3200<br>LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3260.3200<br>LARC1<br>5.2722.2785.2660.2930.3000.3070.3115.3160.3260.3270.2644<br>LARC1<br>5.2742.2785.2660.2930.3000.3070.3115.3160.3260.3270.2779.LARC1<br>5.2742.2785.2660.2930.3000.3070.3115.3160.3260.3270.2779.LARC1<br>5.2742.2785.2660.2930.3000.3070.3115.3160.3260.3270.2779.LARC1<br>5.2742.2785.2660.3025.2140.2250.2345.2440.2535.2663.2710.2779.LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1374.1580.1374.1780.1592<br>LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2950.3025.2420.2515.2612.2695.2768.2816.2875.2095.3000.2875.2636<br>LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3075.3079.3140.1372.2656<br>LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3079.3140.1372.2656<br>LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3079.3140.1372.2664<br>LARC1<br>2.2950.2325.2420.2515.2612.2695.2120.2275.2318.2412.2556<br>LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3079.3140.1372.2664<br>LARC1<br>2.240.2273.2781.2837.2890.2946.3000.3059.3140.1371.1571.1723.LARC1<br>2.260.2575.2664.LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.3060.2575.2664<br>LARC1<br>2.240.22781.2837.2890.2946.3000.3059.3140.1371.1571.1723.LARC1<br>2.260.2575.2878.2932.285.2420.2715.2754.2467.2554.2669.2760.2755.2664<br>2.2712.2781.2837.2893.2845.3043.3120.1369.3140.1371.1571.1723.LARC1<br>2.2625.2878.2932.2855.3240.2475.25548.2600.3059.3140.1371.1571.2770.2664<br>2.2864.2874.2807.2761.2847.25548.2600.2670.2741.29412.2844 LARC1<br>5.2945.2878.2932.2865.3043.3120.1369.3140.2741.29412.2844 LARC1<br>5.2945.2878.2930.2340.2475.2548.2600.2670.2741.29412.2844 LARC1<br>5.2945.2878.2930.2240.2475.2548.2600.2670.2741.29412.2844 LARC1  | 1421<br>1422<br>1423<br>1424<br>1425<br>1426<br>1426<br>1427<br>1428<br>1427<br>1438<br>1437<br>1433<br>1435<br>1436<br>1437<br>1438<br>1439<br>1440<br>1441                                  |
| 5300, 3070.3140.3211.3260.3340.1384.1580.1757.177.174.2014.2014 LAPC1<br>6.2167.2290.2400.2493.2586.2678.2757.2826.2900.2098.3166.LARC1<br>7.3128.3200.3240.3320.1386.1588.1754.1900.2038.2160.2201 LARC1<br>9.326.300.1384.1586.1750.1895.2032.2153.2270.2372.2466 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.377.2466 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.377.2466 LARC1<br>5.2560.2655.2733.2800.2873.2948.3024.3100.3150.370.270.2464 LARC1<br>5.2722.2784.2860.2930.3000.3070.3015.315.360.3559.2453.2547.2644 LARC1<br>5.2722.2784.2860.2930.3000.3070.3015.3140.3260.7340.1374.2464 LARC1<br>5.2722.2784.2860.2930.3000.3070.3153.3240.1374.360.7380.1592 LARC1<br>5.2844.2909.2975.3040.3080.3133.3240.1374.360.3770.2770 LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2950.3025.3060.3117.3220.1376.1578.1735.1875.2011.2127 LARC1<br>5.2050.3025.2060.2515.2612.2695.2758.2816.2875.2025.3000 LARC1<br>5.2050.3025.2060.2515.2612.2695.2758.2816.2875.2025.2318.2412.2564 LARC1<br>5.2050.3025.2420.2515.2612.2695.2758.2816.2875.2011.2127 LARC1<br>5.2050.3025.200.2515.2612.2695.2120.2225.2318.2412.2564 LARC1<br>5.2050.200.2673.2736.2800.2850.2900.2973.3025.3079.3140.1371.2127 LARC1<br>2.270.2255.2878.2900.2515.27515.2612.2695.2120.2255.2600.2575.2664 LARC1<br>1.2600.2673.2736.2800.2850.2900.2973.3025.30079.3140.1371.7571.1727 LARC1<br>2.2712.2781.2837.2890.2946.3000.3059.3140.1371.7571.2774.2464 LARC1<br>3.2712.2781.2837.2890.2946.3000.3059.3140.1371.7571.2742.4472<br>4.162.1992.2105.2215.2946.3000.2100.2205.2120.2275.2548.2629.2761.2764.2474<br>4.162.1992.2105.2215.2946.3000.2100.2005.2120.2275.2000.2575.2664 LARC1<br>3.2712.2781.2837.2890.2946.3000.3059.3140.1371.7571.2742.4472<br>4.162.1992.2105.2215.2946.3000.2100.2477.2558.2669.2760.2670.2741.2864 LARC1<br>3.2712.2781.2837.2890.2946.3000.3059.3140.1371.7571.2742.4472<br>4.162.1992.2105.2215.2946.3000.210.2475.2548.2600.2677.2741.2812.275.2754.2664 LARC1<br>3.2712.2784.2837.2890.2475.2548.2600.2677.2741.2842.4472.2755.2675.2664.2755.2664.24725.2755.2664.2755.2755.2754.2664.24725.2754.27   | 1421<br>1422<br>1423<br>1425<br>1425<br>1426<br>1426<br>1427<br>1427<br>1427<br>1429<br>1431<br>1437<br>1433<br>1435<br>1436<br>1437<br>1437<br>1437<br>1437<br>1437<br>1437<br>1441<br>1441  |
| 5.,300, 3070, 3140, 3211, 3260, 3340, 1389, 1590, 1757, 1764, 2013 LAPC1<br>6.2157, 2290, 2400, 2493, 2586, 2678, 2752, 2826, 2900, 2983, 3066 LARC1<br>7.3128, 3200, 3240, 3320, 1386, 1588, 1754, 1900, 2038, 2160, 2206 LARC1<br>9.3266, 2479, 2573, 2667, 2740, 2813, 2887, 2945, 3040, 3170, 3175 LARC1<br>9.3260, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, 3200 LARC1<br>5.2560, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, 3200 LARC1<br>5.2722, 2785, 2860, 2930, 3000, 3070, 3115, 3160, 3260, 1380, 1582 LARC1<br>5.2722, 2785, 2860, 2930, 3000, 3070, 3115, 3160, 3260, 1380, 1582 LARC1<br>5.2744, 2909, 2975, 3040, 3080, 3133, 3240, 1379, 1580, 1738, 1680 LARC1<br>5.2844, 2909, 2975, 3040, 3080, 3133, 3240, 1379, 1580, 1738, 1680 LARC1<br>5.2950, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2779 LARC1<br>5.2940, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127 LARC1<br>5.2940, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127 LARC1<br>5.2940, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127 LARC1<br>5.2940, 2325, 2420, 2515, 2612, 2695, 2789, 2816, 2875, 2925, 3000, LAPC1<br>5.2940, 3100, 3200,/<br>DATA T5/1374, 15/5, 1731, 1870, 2005, 2120, 2225, 2318, 2412, 2566 LARC1<br>1.2640, 2673, 2736, 2800, 2850, 2900, 2973, 3055, 3079, 3190, 1377, 1472, LARC1<br>3.2712, 2781, 2837, 2800, 2950, 2900, 2973, 3055, 3079, 3190, 1377, LARC1<br>5.2950, 2072, 215, 2215, 2305, 2340, 305, 3140, 1371, 1571, 1773 LARC1<br>1.2740, 2673, 2736, 2800, 2850, 2900, 2973, 3055, 3079, 3190, 1372, LARC1<br>1.2740, 2673, 2736, 2800, 2850, 2900, 2973, 3055, 3079, 3190, 1372, LARC1<br>3.2712, 2781, 2837, 2809, 2944, 3000, 3059, 3140, 1371, 1571, 1773 LARC1<br>5.2825, 2876, 2932, 2985, 3043, 3120, 1369, 1369, 1770, 1868, 1994, LARC1<br>6.200, 2210, 2300, 237, 2479, 2470, 2475, 2548, 2600, 2670, 2741, 2912, 2844 LARC1<br>6.200, 2210, 2300, 236, 3100, 1367, 1566, 1716, 1864, 1975, 2909, 2955, 148C1<br>5.2929, 2470, 3026, 3100, 1367, 1566, 1716, 1864, 1975, 2909, 2955, 148C1   | 1421<br>1422<br>1423<br>1424<br>1425<br>1425<br>1425<br>1426<br>1427<br>1427<br>1427<br>1427<br>1427<br>1427<br>1437<br>1437<br>1437<br>1437<br>1437<br>1437<br>1437<br>1447<br>144           |
| 5., 3000, 3070, 3140, 3211, 3260, 3340, 1384, 1590, 1757, 1764, 2013 LAPC1<br>6., 2167, 2290, 2400, 2493, 2586, 2678, 2752, 2826, 2900, 2983, 3056, LARC1<br>8., 236, 2479, 2573, 2667, 2740, 2813, 2887, 2945, 3040, 3110, 3175 LARC1<br>9., 3200, 3300, 1384, 1586, 1750, 1895, 2032, 2153, 9270, 2372, 2466, LARC1<br>5., 2560, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, 3200, LARC1<br>5., 13 <sup>8</sup> 2, 1584, 1746, 1890, 2027, 2147, 2260, 2359, 2453, 2547, 2644, LARC1<br>5., 2760, 2655, 2733, 2800, 300, 3070, 3115, 3160, 3760, 1380, 1592, LARC1<br>5., 13 <sup>8</sup> 2, 1584, 1746, 1890, 2027, 2147, 22640, 2359, 2453, 2547, 2644, LARC1<br>5., 13 <sup>8</sup> 2, 1584, 1746, 1890, 2027, 2147, 22640, 2359, 2453, 2547, 2644, LARC1<br>5., 13 <sup>8</sup> 2, 1584, 1746, 1890, 2930, 3000, 3070, 3115, 3160, 3760, 1780, 1592, LARC1<br>5., 13 <sup>8</sup> 2, 1584, 1746, 1890, 2935, 2345, 2440, 2535, 2633, 2710, 2779, LARC1<br>5., 2744, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1580, 1738, 1880, LARC1<br>5., 2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1580, 1738, 1880, LARC1<br>5., 2050, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5., 2050, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5., 2050, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5., 2050, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5., 2050, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5., 2050, 2673, 2736, 2800, 2850, 2900, 2973, 3025, 3079, 3140, 1372, LARC1<br>2., 264, 2771, 2837, 2890, 2944, 3000, 3059, 3140, 2500, 2575, 2664, LARC1<br>3., 2712, 2781, 2837, 2890, 2944, 3000, 3059, 3140, 1371, 1371, 177, LARC1<br>2., 206, 2673, 2736, 2710, 2745, 305, 2759, 2759, 2759, 2769, 2760, 2775, 2864, LARC1<br>5., 2045, 2876, 2970, 3026, 3100, 1367, 1566, 1716, 1854, 1975, 2000, 2275, 2864, LARC1<br>6., 200, 2270, 200, 2380, 2475, 2548, 2600, 2730, 2860, 2800, 2800, 2876,  | 1421<br>1422<br>1423<br>1423<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425  |
| 5., 3000, 3070, 3140, 3211, 3260, 3340, 1388, 1590, 1757, 1764, 2013 LAPC1<br>6., 2167, 2290, 2400, 2493, 2586, 2678, 2752, 2824, 2900, 2083, 3160, 2290, LAPC1<br>8., 2366, 2479, 2573, 2667, 2740, 2813, 2887, 2945, 3040, 3110, 3175 LARC1<br>9. 320, 3300, 1384, 1586, 1750, 1895, 2032, 2153, 2270, 2372, 2466 LARC1<br>5., 2560, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, LARC1<br>5., 2560, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, 2844 LARC1<br>5., 2760, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3200, 2874, 2644 LARC1<br>5., 2785, 2860, 2930, 3000, 3070, 3115, 3140, 3760, 1592 LARC1<br>5., 2785, 2860, 2930, 3000, 3070, 3115, 3140, 2751, 2774 LARC1<br>5., 2744, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1680 LARC1<br>5., 2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1680 LARC1<br>5., 2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1680 LARC1<br>5., 2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1680 LARC1<br>5., 2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1670, 27835, 2900, 1ARC1<br>5., 2950, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127 LARC1<br>5., 2950, 3025, 3060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127 LARC1<br>5., 2950, 2673, 2736, 2800, 2850, 2900, 2973, 3075, 3079, 3140, 1372 LARC1<br>1., 2600, 2673, 2736, 2800, 2850, 2900, 2973, 3075, 3079, 3140, 1372 LARC1<br>1., 2600, 2673, 2736, 2800, 2850, 2900, 2973, 3075, 3079, 3140, 1371, 1571, 1723 LARC1<br>1., 2600, 2673, 2736, 2800, 2850, 2900, 2973, 3025, 3070, 275, 2664 LARC1<br>1., 2600, 2673, 2736, 2800, 2100, 22310, 2407, 3075, 3079, 3140, 1371, 1571, 1723 LARC1<br>5., 2825, 2876, 2932, 2985, 3063, 3120, 1367, 1566, 1716, 1854, 1776, 2741, 2817, 2844 LARC1<br>5., 2045, 2876, 2932, 2985, 3043, 3120, 1369, 3140, 1371, 1571, 1723 LARC1<br>6., 204, 2710, 7300, 2380, 2475, 2548, 2600, 2670, 2741, 2844 LARC1<br>5., 2045, 2876, 2932, 2985, 3043, 3120, 1366, 1716, 1854, 1975, 2000, 275, 2844 LARC1<br>5., 2045, 2876, 2932, 2985, 3043, 3120, 1366, 1716, 1854, 1975, 2000, 2745, 2745 LARC1<br>5., 2045, 2876, 2932, 2985,  | 1421<br>1422<br>1423<br>1425<br>1426<br>1426<br>1427<br>1427<br>1427<br>1427<br>1427<br>1437<br>1437<br>1433<br>1435<br>1436<br>1437<br>1437<br>1437<br>1437<br>1436<br>1441<br>1444<br>1444  |
| 5.,300, 3070, 3140, 3211, 3260, 3340, 1384, 1590, 1757, 1764, 2043 LARC1<br>6.2167, 2290, 2400, 2493, 2586, 2678, 2759, 2826, 2900, 2983, 3166, LARC1<br>8.2167, 2290, 3240, 3320, 1386, 1588, 1754, 1900, 2038, 2160, 220, LARC1<br>8.2366, 2479, 2573, 2667, 2740, 2813, 2887, 2945, 3040, 310, 3175, LARC1<br>9.320, 3300, 1384, 1586, 1750, 1895, 2032, 2153, 2270, 2372, 2446, LARC1<br>5.2560, 2655, 2733, 2800, 2873, 2948, 3024, 3100, 3150, 3270, LARC1<br>5.13 <sup>8</sup> 2, 1584, 1746, 1890, 2027, 2147, 2260, 2355, 2633, 2547, 2644, LARC1<br>5.272, 2785, 2860, 2930, 3000, 3070, 3115, 3140, 3760, 1740, 1592, LARC1<br>5.2744, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1892, LARC1<br>5.2844, 2909, 2975, 3040, 3080, 3133, 3240, 1374, 1680, 1738, 1890, LARC1<br>5.2950, 3025, 2060, 3117, 3220, 1376, 1578, 1735, 1875, 2011, 2127, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, 1ARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 3025, 2420, 2515, 2612, 2695, 2788, 2816, 2875, 2925, 3060, LARC1<br>5.2950, 2673, 2736, 2800, 2850, 2900, 2973, 3025, 3079, 3180, 1372, LARC1<br>2.1673, 1727, 1866, 2000, 2810, 2200, 2973, 3025, 3079, 3180, 1372, LARC1<br>2.1673, 1727, 1866, 2000, 2810, 2800, 2973, 3025, 3079, 3180, 1372, LARC1<br>2.1673, 2781, 2837, 2890, 2946, 3000, 3059, 3140, 1371, 1571, 172, LARC1<br>5.2925, 2876, 2932, 2985, 3043, 3120, 1367, 1566, 1716, 1864, 1975, 200, 2575, 2644, LARC1<br>5.2925, 2876, 2932, 2985, 3043, 3120, 1369, 3480, 2730, 2741, 2812, 2844, LARC1<br>5.2945, 2876, 2970, 3046, 3100, 1367, 1566, 1716, 1864, 1975, 2000, 2970, 2975, LARC1<br>5.2945, 2876, 2970, 3046, 3100, 1367, 1566, 1716, 1864, 1975, 2000, 2970, 2945, LARC1<br>5.2940, 2970, 2370, 2463, 2554, 2590, 26750, 2730, 2869, 29  | 1421<br>1422<br>1422<br>1423<br>1425<br>1425<br>1425<br>1426<br>1427<br>1427<br>1429<br>1429<br>1429<br>1429<br>1433<br>1435<br>1436<br>1437<br>1437<br>1437<br>1439<br>1449<br>1444<br>14445 |
| 5.,3000,3070,3140,3211,3260,3340,1344,1590,1757,1764,204,204<br>2167,2290,2400,2493,2586,2678,2759,2826,2900,2083,3166,LARC1<br>8,2386,2479,2573,2667,2740,2813,2887,2945,3040,316,2270,2372,2446,LARC1<br>9,320,3300,1384,1586,1750,1895,2032,2153,2270,2372,2446,LARC1<br>5,2560,2655,2733,2800,2873,2948,3024,3100,3150,3270,2446,LARC1<br>5,2560,2655,2733,2800,2873,2948,3024,3100,3150,3270,2446,LARC1<br>5,2560,2655,2733,2800,2873,2948,3024,3100,3150,3270,2446,LARC1<br>5,1382,1584,1746,1890,2027,2147,2260,2359,2453,2547,2644,LARC1<br>5,2760,2655,2733,2800,2873,2948,3024,3100,3579,2453,2547,2644,LARC1<br>5,2760,2655,2733,2800,2875,2440,2535,2640,2535,2633,2710,2779,LARC1<br>5,2742,1885,2022,2140,2250,2345,2440,2535,2633,2710,2779,LARC1<br>5,2844,2909,2875,3040,3080,3133,3240,1374,1680,7738,1890,LARC1<br>5,2950,3025,32060,3117,3220,1376,1578,1735,1875,2011,2127,LARC1<br>5,2950,3025,32060,3117,3220,1376,1578,1735,1875,2011,2127,LARC1<br>5,2950,3025,32060,2117,3220,1376,1578,1735,3079,3180,1372,LARC1<br>5,2950,3025,2060,2117,3220,1376,1578,1735,3079,3180,1372,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,2742,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,2742,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1371,1571,1732,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1372,2742,LARC1<br>1,2260,2673,2736,2800,2850,2900,2973,3025,3079,3180,1371,1571,1732,LARC1<br>5,2045,2876,2932,2985,3043,3120,1366,1716,1854,1975,2000,2745,2742,LARC1<br>5,2045,2876,2932,2985,3043,3120,1366,1716,1854,1975,2090,2745,2745,LARC1<br>5,2045,2876,2932,2985,3043,3120,1366,1716,1854,1975,2090,2745,2745,LARC1<br>5,2046,2970,300,2380,275,2548,2600,2785,2730,2860,2700,2744,2875,2740,2745,2745,2745,2746,2745,2745,2745,2745,2745,2745,2745,2745  | 1421<br>1422<br>1423<br>1423<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425<br>1425  |

| \$••1704.•1841.•1948.•2056.•2164.•2260.•2240.•2240.•2500.•2547.•2647.•2643   | 1 1448               |
|--|----------------------|
| \$.,2700, 2755, 2808, 2866, 2921, 2970, 3020, 1359, 1554, 1700, 1837   ARC   | 1 1449               |
| \$.,1939,2042.,2146.,2250.,2330.,2412.,2488.,2555,2622.,2691.,2741 LARC  | 1 1450               |
| \$ 2900 2855 2910 2955 3000 1358 1551 1695 1832 1334 2036 LARC   | 1 1451               |
| \$ + + 21 38 + 2240 + 2320 + 2400 + 2475 + 2542 + 2611 + 2669 + 2726 + 2784 + 2842 LARC  | 1 1452               |
| 52900 ·29452980./  | 1 1453               |
| UATE T6/135615481690182819292030213023102382 LARC  | 1 1454               |
| I + 2400 + 2525 + 2600 + 2656 + 2713 + 2767 + 2821 + 2875 + 2922 + 2966 + 1354 1 AHC   | 1 1455               |
| 2. 1545 1685 1824 1924 2024 2120 220 2300 2367 2434 2510 1 APC   | 1 1456               |
| 3. 25 <sup>8</sup> 6 . 2643. 2700. 2750. 2800. 2850. 2900. 2940. 1352. 1542. 1680. LARC  | 1 1457               |
| 4 • 1920 • 1920 • 2020 • 2115 • 2210 • 2283 • 2350 • 2417 • 2505 • 2573 • 2635 • APC   | 1 1458               |
| 5 . 26 <sup>4</sup> 0 . 2735 . 2780 . 2835 . 2880 . 2920 . 1350 . 1530 . 1675 . 1814 . 1917 I ARC  | 1 1459               |
| 6 • • 2015 • • 2110 • • 2240 • • 2267 • • 2333 • • 2400 • • 2400 • • 2560 • • 2620 • • 2660 • • 2720 1 ARC   | 1 1460               |
| 7. 2750 2820 2860 2800 1348 1536 1670 1812 1915 2010 216 1480  | 1 1461               |
| 8. 21 YO . 2260 . 2325 . 2390 . 2465 . 2530 . 4590 . 2690 . 2690 . 2740 . 2800 LARC  | 1 1462               |
| 9 • 2840 • 2880 • 1346 • 1533 • 1665 • 1808 • 1905 • 200 • 2095 • 2180 • 225 • 180   | 1 1463               |
| \$ •2315 •2380 •2450 •2500 •2500 •2600 •2650 •2750 •2750 •2860 • 480   | T 1464               |
| 3. 1344 1530 1660 1804 1895 1985 2080 2170 2240 2310 2370 LAR  | 1 1465               |
| 5 . 24 30 . 2480 . 2530 . 2580 . 2637 . 2683 . 2733 . 2786 . 2840 . 1342 . 1527 1 ARC  | 1 1466               |
| 5 1655 1806., 1885. 1970. 2055. 2150 4230. 2365 2360 2410 2440 LARC  | 1 1467               |
| 5 + 2510 + 2560 + 2623 + 2667 + 2717 + 2768 + 2820 + 1340 + 1524 + 1650 + 1791 LARC  | 1 1468               |
| 5.,1875,1960,2045,2130,2215,2290,4350,2400,2450,22500,2550 LARC  | 1 1469               |
| \$.,2610,,2650,,2700,,2750,,2800,,1338,,1521,,1645,,1784,,1967,,1950 LARC  | 1 1470               |
| \$ . 12133 . 12116 . 2200 . 12262 . 12341 . 12387 . 12440 . 12490 . 2540 . 2600 . 12645 LARC   | 1 1471               |
| \$2490.+2740.+2787./   | 1 1472               |
| DATA T7/1336.,1518, 1640.,17741858.,1942.,2026211021832256 LARC  | 1 1473               |
| 1 · · 2312 · · 2375 · · 2430 · · 2480 · · 2530 · · 2588 · · 2640 · · 2680 · · 2730 · · 2775 · · 1334 LARC  | 1 1474               |
| 2,1515 .1635,1765,1849,1933,2016,2100,2167 .2233,2300, 2363   ARC  | 1 1475               |
| 3 , 2420 . 2470 . 2520 . 2575 . 2630 . 2670 . 4720 . 2762 . 1332 . 1512 . 1630 LARC  | 1 )476               |
| 4.1755.+1840.+1924.+2008.+2084.+2150.+4216.+2284.+2350.+2410.+2460 LARC  | 1 1477               |
| 5 + 2510 + 2565 + 2620 + 2660 + 2710 + 2750 + 1330 + 1509 + 1625 + 1745 + 1830 LARC  | i j478               |
| 6.,1915,2006.2007,2133.2200.2207.237.2400,2450.22568.2558 LARC   | I 1479               |
| 726102650270027371328150616201735182719101990 LARC   | ;1 1 <sup>48</sup> 0 |
| 8 . 12057 . 2123 . 12190 . 2255 . 2300 . 2375 . 12438 . 12490 2550 . 2600 . 2640 LARC  | 1 1 <sup>48</sup> 1  |
| 9.,2683, 2725, 1326, 1503, 1615, 1725, 1825, 1905, 1980, 2047, 2116 LARC   | 1 1482               |
| *++2180++2235++2285++2255++2400++2467++4533++2575++2620++2667++2712 LARC   | 1 1483               |
| 3. 1324 1500. 1610. 1720. 1820. 1900. 1970. 2037 2108. 2170. 2224 LAR  | 1 1484               |
| \$++22'0.+2332++23'5++243'++2500++250++2600++2550++2600++2000  | 1 1485               |
| " • 1605 • 1715 • 1810 • 1890 • 1960 • 2030 • 2100 • 2160 • 2210 • 2260 • 2310 LARC  | 1 1486               |
| 5 100, 2410, 2400, 2510, 2500, 210, 2687, 1320, 1490, 1400, 1710 LAR   | 1 1487               |
|  | 1488                 |
|  | , 1 1469             |
| *  | , ] 1470             |
| $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$  | 1491                 |
| $= - \frac{1}{2} + $ | ·1 1476              |
| 1012170.022490123(U00234300200102430020010243002002012012012012012002010020000000000   |                      |
|  | /J  474              |
| 2+2/3+2/2+3+22/4+22/4+22/4+24/4+24/4+20/4+2744+2/4/4+2+24/2+2+24/4+2+2+24/2+2+2+2+2+   | ·1 1473              |
| $5_{2} + 2_{2$   | 1 1407               |
| 5 + 1930 + 1901 + 1975 + 2040 + 2100 + 2150 + 2200 + 2250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 3200 + 3250 + 320   | 1 1400               |
|  | , 1770<br>1 • 690    |
| 8 + 1957 + 2026 + 2082 + 203   | 1 1500               |
| 9 - 2249 - 2500 - 1306 - 1452 - 1559 - 1649 - 1732 - 1810 - 1875 - 3020 - 2001 - 1402  | 1 1500               |
| 3 + 2 - 5 - 2 - 5 + 2 - 5 + 2 - 5 + 2 - 5 + 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2  | 1 1507               |
| $5 \cdot 1304 \cdot 1446 \cdot 1553 \cdot 1638 \cdot 1724 \cdot 1800 \cdot 1800 \cdot 1925 \cdot 2000 \cdot 2015 \cdot 21638 \cdot 1724 \cdot 1800 \cdot 1925$   | 1 1507               |
| \$ 2150 2200 2250 2300 237 237 2374 2416 2450 2560 1300 1411 140   | 1 1504               |
| $\frac{1}{3} + 15(57) + 15(3) + 17(5) + 17(5) + 17(6) + 18(5) + 19(5) + 19(5) + 10(5) + 1$   | 1 1504               |
| \$ 22/3 2275 2317 2360 2403 2405 245 1360 1435 1541 1636 164 400   | 1 1506               |
| 5.1708 1779 1840 1908 1960 2015 2065 215 2166 2217 2250 1 AR   | 1 1507               |
| 5 · + 2300 · + 2350 · + 2373 · + 2437 · + 2520 · + 1296 · + 1430 · + 1535 · + 1617 · + 1700 · + 1760 · 1480  | 1 1508               |
| \$, 1843, 1900, 1952, 2010, 2060, 2107, 2153, 2200, 2244, 2246, 2354, 480  | 1 1509               |
| 5.,23 <sup>8</sup> 2.,2422.,2500./   | 1 1510               |

| DATA T9/1292.11424.1528.1609.1694.1759.1825.18911948.2045  | LARC1  | 1511  |
|--|--------|-------|
| 1.,2055, ,2100, ,2146, ,2192, ,2235, ,2278, ,2321, ,2364, ,2407, ,2480, ,1280  | LARC1  | 1512  |
| 2.,1418,1520.,1600,,1687.,1751,1816.,1881.,1942,,2000,,2050,,2053  | LARC1  | 1513  |
| 3.,2139,2184,2227,2270,2313,2356,2400,2460,1284,1412,1512  | LARC1  | 1514  |
| 4 • • 15 4 • 1680 • • 1744 • 1808 • • 1872 • • 1936 • • 1990 • • 2043 • • 2086 • • 2129 • • 2175   | LARC1  | 1515  |
| 5 2217 .2260 2305 2348 2387 2440 1280 1406 1505 1588 1674  | ARC1   | 1516  |
| 6. 1737 1800. 1863. 1923. 1980. 2026. 2072. 2120 2170. 2212 2256   | 1 ARC1 | 1517  |
| 7. 2375 2337 2374 2374 2220 1276 1400 1500 1500 1500 1667 1670 170   | LARCI  | 1518  |
| 8,1454,1910,1960,2015,2065,2115,2165,2200,2240,2280,2326   | LARC1  | 1519  |
| 9-2360 22400-1272-1395-1494-1576-1660-1723 1787 1845 1905  | LARC1  | 1520  |
| \$ + 1955 · 2010 + 2000 - 2110 + 2160 + 2190 - 2230 + 2270 + 2310 + 2345 - 2396  | LARCI  | 1521  |
| 5. 1268 1389 1488 1571 1654 1716 1780 1842 1897 1966 2000  | LARC1  | 1522  |
| \$ 20 <sup>5</sup> 0 2100 2140 2180 2220 2260 2300 2330 2360 1244 1306   | 1 ARC1 | 1521  |
| $5 \bullet 1422 \bullet 1565 \bullet 1647 \bullet 1710 \bullet 1773 \bullet 1837 \bullet 1800 \bullet 1907 \bullet 1987 \bullet 1000 \bullet 1987 \bullet 1000 \bullet 1773 \bullet 1807 \bullet 1800 \bullet 1987 \bullet 1000 \bullet 1773 \bullet 1807 \bullet 1800 \bullet 1987 \bullet 1000 \bullet 1773 \bullet 1807 \bullet 1800 \bullet 1987 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1000 \bullet 1773 \bullet 1800 \bullet 1773 \bullet 1800 \bullet 1900 \bullet 1773 \bullet 1800 \bullet 1770 | LARCI  | 1524  |
| \$ 2160 2165 2210 2247 2281 2315 2360 1260 1379 JA75 1550  |        | 1525  |
|  | I APC1 | 1524  |
| \$ 2200 2233 2267 2300 2320 1256 1374 1476 1553 1623 1700  | LARCI  | 1527  |
| 5 + 1752 + 1805 + 1857 + 1910 + 1962 + 2012 + 2047 + 2047 + 2012 + 110 + 1757 + 2047 + 2012   | LARCI  | 1528  |
| $5_{2}$  | LAPC1  | 1520  |
| UATA TIC/1252 1368 1463 1547 1627 1484 1742 1795 1986 106  | 1 4001 | 1530  |
| 10, 1950, 2000, 2033, 2067, 2112, 2156, 2200, 2227, 2254, 239, 134   | I ARCI | 1531  |
| 28 + 136 + 1457 + 1541 + 1620 + 1675 + 1736 + 1785 + 1875 + 1877 + 198   | I ARC1 | 1535  |
| 30, 2000, 2250, 22100, 2130, 2160, 2160, 2200, 2220, 2266, 1244, T257, 145   | LADC1  | 1537  |
| 41 $1535$ $1613$ $1665$ $1717$ $1769$ $1891$ $1907$ $1005$ $1605$ $1960$ $1005$  | 1 APC1 | 1534  |
|  | LARC1  | 1535  |
| $57 \cdot 1550 \cdot 17(9 \cdot 215) \cdot 1760 \cdot 1911 \cdot 1862 \cdot 1912 \cdot 1066 \cdot 1900 \cdot 2015 \cdot 2055 \cdot 1070 \cdot 1915$  | LARCI  | 1536  |
| 74 - 2/20 - 2/63 - 2/91 - 2220 - 1226 - 1366 - 1429 - 1220 - 126 - 146   | 1 APCT | 1537  |
|  | LARCI  | 1538  |
| 95, 2177, 2200, 1232, 1340, 1432, 1517, 1587, 1643, 1696, 1777, 170  | LAPC1  | 15.39 |
| \$2, 1839, 1876, 1909, 1942, 1975, 2022, 2060, 2100, 2128, 2157, 218   | LARC1  | 1540  |
| \$3. · 1 228. · 1 334. · 1 425. · 1 511. · 1 575. · 16 37. · 1690. · 1732. · 1776. · 1815. · 185   | ARCI   | 1541  |
| \$3.,1885.,1917.,1950.,2000.,2033.,2066.,2100.,2133.,2166.,1224.,132   | I ARC1 | 1542  |
| 38, 1414, 1505, 1562, 1615, 1667, 1700, 1740, 1780, 1825, 1860, 190  | I ARC1 | 1543  |
| \$0. +1 925 + 1970 + 2000 - 2044 + 2075 + 2122 + 2150 + 1220 + 1322 + 1411 + 150   | LARC1  | 1544  |
| 50, 1550, 1600, 1033, 1667, 1700, 1740, 1780, 1820, 1860, 1900, 194  | LARC1  | 1545  |
| \$0,,1980,,2022,,2050,,2111,,2134,,1216,,1317,,1404,,1475,,1527,,158   | LARC1  | 1546  |
| 501020166310951730177018101849188819261960200  | LARCI  | 1547  |
| \$0,,2025,,2100,,2116,/  | 1 ARC1 | 1548  |
| DATA T11/1212.1311.1400.1450.1500.1550.1605.1660.1690.172  | LARC1  | 1549  |
| 10, 1/60, 1800, 1838, 1876, 1913, 1940, 1978, 2000, 2050, 2100, 120  | LARCI  | 1550  |
| 28 . + 1 306 . + 1373 . + 1400 . + 1481 . + 1540 . + 1587 . + 1635 . + 1672 . + 1710 . + 1745 . + 178  | 1.ARC1 | 1551  |
| 31, 1815, 1850, 1700, 1920, 1955, 1990, 2025, 2080, 1200, 1300, 134  | LARCI  | 1552  |
| 47. +1395 + 1463 + 1520 + 1565 + 1610 + 1655 + 1700 + 1731 + 1762 + 1794 + 182   | LAPCI  | 1553  |
| 55,,,863,,1900,,1933,,1967, 2000, 2060,,1189,,1283, 1335, 1300, 144  | LARCI  | 1554  |
| 65,,1500,,1550,,1600,,1637,16(5,,1710,,1745,,1780,,1810,.)842,,188   | LARC1  | 1555  |
| 10. 1916. 1950. 1983. 2040. 1178. 1268. 1371. 1374. 1427. 14Rn. 153  | LARC1  | 1556  |
| 80. + 158 + 1600. + 1650. + 1700. + 1733. + 1767. + 1794. + 1821. + 1860 igin. + 193   | LARC1  | 1557  |
| 93.,1967.,2020.,1167.,1251.,1300.,1350.,1410.,1460.,1510.,1560.,157  | LARC1  | 1558  |
| \$5.+1625.+1666.+1700.+1733.+1767.+1800.+1833.+1847.+19001950.+194   | LARC1  | 1559  |
| \$0.,1156.,1234.,1280.,1335.,1393.,1444.,1490.,1546.,1556.,1566.,1466.,148   | LARC1  | 156n  |
| \$2,,1°67,,1700,,1733,,1767,,1800,,1833,,1867,,1900,,1940,,1145,,191   | LARC1  | 1561  |
| \$7. 1266. 1318. 1375. 1420. 1450. 1520. 1535. 1545. 1598. 1433. 146   | 1 ARC1 | 1562  |
| \$6,,1/01,,1733,1765,1775,1833,1865,1895,1134,1190,1240,134  | LARC1  | 1563  |
| 50. 1356. 1400. 1430. 1465. 1500. 1530. 1565. 1606. 1632. 1665. 176  | LARC1  | 1564  |
| \$0.,1 (3n.,1765.,1800.,1830.,1850.,1123.,1170.,122n.,127n.,132h.,135  | LARCI  | 1565  |
| *5. +1 39 +1424. +1458. +1492. +1520. +1550. +1580. +1607. +1635 7645. +169  | LARC1  | 1566  |
| \$2.,1720.,1750.,1800./  | LARC1  | 1567  |
| UATA T12/1110+,1140+,1200++1240++1280+,1320+,1350++1380+,1410+,)44   | LARC1  | 1568  |
| 10.*1476.*1560.*1525.*1550.*1575.*1600.*1425.*1656.*1675.*1730.*165  | 1 APC1 | 1569  |
| 20.,1110.,1150.,1190.,1270.,1245.,1270.,1300.,1325.,1350.,1390.,141  | LARC1  | 1570  |
| 30.,1435.,1455.,1490.,15201545.,1570.,16001630.,1000   | LARC1  | 1571  |
| 45. • 1 400. • 1125. • 1150. • 1175. • 1200. • 1225. • 1250. • 1275. • 1300. • 1325. • 135   | LARC1  | 1572  |
| >0.,f375.,1460.,1425.,1450.,14751500./   | LARCI  | 1573  |

|              | EQUIVALENCE (T1(1), TE(1,1)) + (T2(1), TE(1,11)) + (T3(1), TF(1,21)) + ( | LARC1  | j 574   |
|--------------|--|--------|---------|
|              | 1T4(1).TE(1.31)), (T5(1).TE(1.41)), (T6(1).TE(1.51)), (T7(1).TE(1.6      | LARC1  | 1575    |
|              | 21)]. (T8(1),TE(1,71)). (T9(1),TE(1,81)). (T10(1),TE(1,91)). (T11(1)     | LARC1  | 1576    |
|              | 3) • TF (1.101)) • (T12(1) • TF (1.111))                                 | LARC1  | 1577    |
|              | DO 10 TT=1.10  | LARC1  | 1578    |
|              | DO 10 T=2+19   | LARC1  | 1579    |
|              | DO 10 1=2+112  | I ARC1 | 1580    |
|              | TE(1*,1)=0+25*(TE(1-1+,1)+TE(1+1+,1)+TF(1+,1+1)+TE(1+,1+1))              | LARC)  | 1581    |
| 10           | CONTINUE   | I ARC1 | 1582    |
| • •          |  | LARC1  | 1583    |
|              | WRITE (12,660) (.)+ (TF(T,.)) + T=1+20) + (51+112)                       | 1 ARC1 | 1584    |
|              | CA(1) A D V (1)  | I ARC1 | 1585    |
|              |  | LAPC1  | 1586    |
| 20           |  | LARCI  | 1587    |
| <i>r</i> , v |  |        | 1589    |
|              |  | LARCI  | 1580    |
| 30           |  |        | 1590    |
| 50           |  | LAPCI  | .591    |
|              |  |        | 1502    |
|              |  | LARC1  | 1592    |
|              |  |        | 1 5 9 4 |
|              |  | LARCI  | 1574    |
|              |  |        | 1504    |
|              |  |        | 1070    |
|              |  |        | 1598    |
|              |  |        | 1500    |
|              |  |        | 1600    |
|              |  |        | 1601    |
|              |  |        | 1601    |
|              | $F_{Y,Y} + i(3) = -iT_{F} + i(3) + F_{F} + i(3) + F_{F} + i(3) + D_{F}$  |        | 1602    |
| 40           |  | 1 APC1 | 1604    |
|              |  | 1 ARC1 | 1605    |
|              | FY(1)1)=TF(2)I)=TF(1),T  | LARC1  | 1606    |
|              | $FY(20, \tau) = TF(20, \tau) - TF(19, \tau)$                             | LARCI  | 1607    |
| 50           | CONTINUE   | 1 ARC1 | 1608    |
|              | CALL SPL2D1 (113+F+20+T+TE+FX+FY+EXY+20+THD+71-72-73)                    | I ARC1 | 1609    |
|              | RETURN   | I APC1 | 1610    |
|              | ENTRY SPL  | I ARC1 | 1611    |
|              | SPL=5PL2D2(BIN+TIME+113+F+20+T+TE+FX+FY+FX+70+0+0)                       | LARC1  | 1612    |
|              |  | LARC1  | 1613    |
|              |  | LARC1  | 1614    |
| 60           | FORMAT (/1X+I3+20F6+0)   | LARCI  | 1615    |
|              | END  | LARCI  | 1616    |

COPYSE .END OF FILE

С

•

٠

-

|   | FUNCTION ERFC(Z)  | C335A |
|---|---|-------|
|   | DIMENSION A (3) . B (3) . C (5) . D (6) . E (4)   | C335A |
|   | Data (a (1) • I=1•8) /883.473942603495•1549.67931240372,                                      | C332A |
|   | C1347.19413409759.723.040002777529.255.500494694958.  | C335A |
|   | C59.2400101129141.8.37653103141970564189559442610/  | C335A |
|   | DATA(B(I)•I=1•?)/883.478?426034??;2546.57854380?75•   | C332A |
|   | C3337.22136998926.2606.71201526511.1333.56997567996.  | 0332A |
|   | C460.285123691601.103.500254397688.14.8470122375234.1.0/                                      | C333A |
|   | Data (C (I) • I = 1 • 5) / 1 • 63271618512628 • 2 • 35360143283567 •                          | C333A |
|   | C3.03185804944392895157182255506564189583547936/  | C335A |
|   | DATA(D(I)•I=1•6)/1.29314873038422•5.08080210486983•   | C335A |
|   | C4.96496300826808.5.87382846427043.1.58662479494697.1.0/                                      | C335A |
|   | DATA(E(I)•I=1•4)/5•.75•-1.875•1.772453850905516/  | C335A |
|   | ERFC = 0.0  | C335A |
|   | IF (Z .GE. 26.) RETURN  | C335A |
|   | IF ( Z.GE. 0.5) GO TO 1   | C3324 |
|   | ERFC = 1.0 - ERF(Z)   | C3329 |
|   | RETURN  | C3324 |
| 1 | ERFC = EXP(-2+Z)  | C335A |
|   | GD TD 6   | C3328 |
|   | ENTRY PRERFC  | C3324 |
|   | IF (Z .SE. 0.5) 60 TO 7   | C3328 |
|   | ERFC = EXP(2+2) + (1.0 - ERF(2))  | C335A |
|   | RETURN  | C335A |
| 7 | ERFC = 1.0  | C335A |
| ó | IF (Z .GE. 100.) GD TD 3  | C335A |
|   | IF (Z .GE. 8.0) 60 TO 2   | C3328 |
|   | P=(A(1)+Z+(A(2)+Z+(A(3)+Z+(A(4)+Z+(A(5)+Z+(A(6)+Z+(A(7)+Z+A(8)))))                            | C3328 |
|   | C>>>> / (B (1) +Z+ (B (2) +Z+ (B (3) +Z+ (B (4) +Z+ (B (5) +Z+ (B (6) +Z+ (B (7) +Z+ (B (3) + | C335A |
|   | CZ+B(9)))))))   | C335A |
|   | GO TO 4   | C335A |
| 2 | P= (C (1)+Z+ (C (2)+Z+ (C (3)+Z+ (C (4)+Z+C (5))))/   | C335A |
|   | C (D (1) +Z+ (D (2) +Z+ (D (3) +Z+ (D (4) +Z+ (D (5) +Z+D (6) ) ) ) )                         | C335A |
|   | GD TD 4   | C3324 |
| 3 | ₩ = 1./(Z+Z)  | C335A |
|   | ₽=(1.+₩+(E(1)+₩+(E(2)+₩+E(3))))/(E(4)+Z)  | C335A |
| 4 | ERFC = ERFC+P   | C3329 |
|   | RETURN  | C3329 |
|   | END   | C333A |

## APPENDIX D

## PLOTS

.

.

|     | PROGRAM PLOTS (INP+OUT+FILM+FSET12=FILM)  | PLOTS          | 2   |
|-----|---|----------------|-----|
|     | DIMENSTON X(14) + TEMPE(14)   | PIOTS          | 3   |
|     | DIMENSTON BIN(101) . TIME(101) . TPIDT(101) . TM(101) . TA(101)                               | PLOTS          | 4   |
|     | COMMUN /SPEC/ TEMPF.X   | PLOTS          | 5   |
|     | COMMUN /SPECM/ N2+TT (29) +TMAXE (29)   | PLOTS          | 6   |
|     | COMMUN /SPECA/ N3+T3(29)+TAVEF (29)   | PLOTS          | 7   |
|     | IN TAVED. THE IS CALLED TT IN THIS COMMON STATEMENT   | PLOTS          | 8   |
|     | COUMUL /CJECT/ IXI + TXR + IYT + IYB + XHN + XMX + YMX + YHN                                  | PLOTS          | 9   |
|     | COMMUN /CJECE/ XMIN+XMAX+INIVALX+KX+YMIN+YMAX+INIVALY+KY                                      | PLOTS          | 10  |
|     | CONMON /TMODEL/ MODEL   | PLOTS          | 11  |
|     | COMMON /LUNEH/ IXSAVE.IYSAVE.IX2.IY2  | PLOTS          | 12  |
|     | NCHAH=27  | PIOTS          | 13  |
|     | $Z = T F^{MP} O(0,0)$   | PLOTS          | 14  |
|     |   | PIOTS          | 15  |
|     | $D_{B=1}$ , $Z$ (NTOT-1)  | PLATS          | 16  |
|     | $y_1 = 2^0 \cdot ((NTO) - 1)$   | PLOTS          | 17  |
|     | DO 1 U T=1+NTOT   | PLOTS          | 18  |
|     | $B_{TN}(I) = (1-1) * DB$  | PIOTS          | 19  |
|     | $T_{IMF}(I_{1}=(I-1)*DT$  | PIOTS          | 20  |
|     | $TP(OT(\tau)) = TEMP(BIN(\tau))$  | PIOTS          | 21  |
| 10  | CONTINUE  | PLOTS          | 25  |
| • • |   | PLOTS          | 23  |
|     | PRINT GO. (I.BIN(I), TPLOT(I), T=1.NTOT)  | PIOTS          | 24  |
|     | CALL PLOPE (BIN.TPLOT.NTOT.1.0.NCHAP.0  | PLOTS          | 25  |
|     | URE VOLUME FRACTION.36.20HCORE VOLUME FRACTION.20.23HTEMPERATURE                              | PLOTS          | 26  |
| ;   | 2DFGptFs K) +23+0+0+2+21  | PLOTS          | 27  |
|     | CA(1) = P(0)PB = (X + TEMPE + 14 + 1) = 1 + 1 + 1 + 2 + 0 + 4 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 | PLOTS          | 28  |
|     | CA(1) ADV (1)   | PIOTS          | 29  |
|     | DO = 24 m(DE1 = 1 + 3   | PLOTS          | 30  |
|     |   | PIOTS          | 31  |
|     | T = TAVEO(0.0)  | PIOTS          | 32  |
|     | UQ 2V T = I • N TOT   | PLOTS          | 33  |
|     | TM(T) = TMAX(TIME(I))   | PLOTS          | 34  |
|     | $TA(T) = \dot{\tau}AVE(TIME(I))$  | PLOTS          | 35  |
| 20  | CONTINUE  | PLOTS          | 34  |
|     | PRINT KO, MODEL   | PLOTS          | 37  |
|     | PRINT 70+ (I+TIME(I)+TM(I)+TA(I)+I≕1+NTOT)  | PLOIS          | 38  |
|     | XMIN=0.   | PLOTS          | 39  |
|     | XMAx=2ñ.  | PLOTS          | 4 0 |
|     | INTVALX=10  | PLOTS          | 41  |
|     | N X = 0   | PLOTS          | 47  |
|     | YMIN=100.   | PLOTS          | 43  |
|     | YMAX#3800 •   | PLOTS          | 44  |
|     | 1NTVALY=7   | PLOTS          | 45  |
|     | к <b>ү</b> = 0  | PLOTS          | 46  |
|     | CALL PLOPB (TIME+TM+NTOT+1+0+1RM+=2++8++8++31HTEMPERATURE VS. TTME                            | PLOTS          | 47  |
|     | 1 AFTER LOFC+31+12HTIME (HOURS)+-12+23HTEMPERATURE (DEGREES K)+23.0                           | PLOTS          | 4 R |
|     | 2+0+2+21  | PLOTS          | 49  |
|     | CAL: PLOPB (TT+TMAXF+N2+1+=1+=1RX+0+8++++++++++++++++++++++++++++++++++                       | PLOTS          | 50  |
|     | CAL1 P1 0P8 (TIME+TA+NTOT+1+0,-1+A+=2++8++++0+0+0+0+12+0+0+0+2+2)                             | PLOTS          | 51  |
|     | CALL PLUPB (T3+TAVEF+N3+1+=1+=1RX+0++8++8++0+0+0+0+0+0+0+0+0+2+2)                             | PLOTS          | 52  |
|     | CALL CONVRT (9.0+JX+XMN+XMX+IXL+IXR)  | PLOTS          | 53  |
|     | 1F (MODEL.EQ.1) CALL CONVET (3200.+IY+YMN+YMX+TYR+TYT)  | PLOTS          | 54  |
|     | IF (MODEL+NE+11 CALL CONVRT (3050++IY+YMN+YMX+IYR+TYT)  | PLOTS          | 55  |
|     | CALI, DLCH (JX+1Y+4+4HTMAX+1)   | PLOTS          | 56  |
|     | CALL CONVRT (12.+IX+XMN+XMX+IXL+IXR)  | PLOTS          | 57  |
|     | IF (MONEL.EQ.11 CALL CONVPT (2750IY.YMN.YMX.TYQ.TYT)  | PLOTS          | 58  |
|     | IF (MODEL.NE.1) CALL CONVET (2600.+IY+YMN+YMY+IYR+IYT)  | PLOTS          | 59  |
|     | CALI DICH (IX+IY+4+4HTAVE+1)  | PLOTS          | 6 n |
|     | IF (MONEL, EQ. 1) CALL NI, CH (100, 1000, 9, 9HSNRS 0ATA, 2)                                  | PLOTS          | 61  |
|     | IF (MODEL+E0+21 CALL DLCH (100+1000+11+11HCOPCON DATA+?)                                      | P <u>1</u> 0TS | 62  |
|     | IF (MODEL.EQ.3) CALL DLCH (100+1000,9+9HAYER DATA+2)  | PLOTS          | 63  |

|   | CALL ADV (1)   | PLOTS  | 64      |
|---|--|--------|---------|
|   | 30 CONTINIE  | PLOTS  | 6       |
|   |  | PLOTS  | 67      |
|   |  | PLOTS  | 6.      |
|   |  | PLOTS  | 61      |
|   |  | PLOTS  | 69      |
| c |  | PIOTS  | 70      |
| C | AD FORMAT (STATHTATTADOTALDY LIVETEND VICUTE THANKS  | PLOTS  | ~ 7     |
|   | 50 FORMAT (1X-15-5X-5F 2 EV-510 2)   | PLOTS  |         |
|   | $\begin{array}{c} 60 \\ \hline 60 \\ \hline 80  | PLOIS  | · · · · |
|   | I)   | PLUIS  | 7.      |
|   | 70 FORNAT (1X+15+5X+F8-2-2F15-2)   |        | 7.      |
|   | END  | PLUIS  | 7       |
|   | SUHROUTINE PLOTI   |        | 7.      |
|   | DIMENSTON F8(131) + F18(131) + F28(131) + F38(131) + F48(131) + +++++++++++++++++++++++++++++++++  | PLOTS  | 70      |
|   | I. FT(131), F1T(131), F2T(131), F3T(131), F4T(131)   | PLOTS  | 8       |
|   | DIMENSTON TILLE(5)   | PIOTS  | 8       |
|   | LOGTCAL LAGE+BISO  | PLOTS  | 8;      |
|   | COMPON /F/ F1+F2+F3+F4   | PIOTS  | 8       |
|   | COHNUN /LA/ LAGE.AGE.MFUEL, ISO, BISU  | PINTS  | 8/      |
|   | COMMON /LJNEW/ IXSAVE.TYSAVE.TX2.TY2   | PLOTS  | 84      |
|   | COMMON /CJE0// IXL+1XR+IYT+IYB+XMN+XMX+YMX+YMN   | PLOTS  | 80      |
| ~ | COMMON /CJEOB/ XMTN,XMAX,TNTVALX,KX,YMIN,YMAX,TNTVALY,KY   | PLOTS  | 8.      |
| C |  | PLOTS  | 88      |
| ~ |  | PLOTS  | 89      |
| C | INITIA, IAE SPLINE   | PLOTS  | 91      |
|   |  | PLOTS  | 9 ;     |
|   |  | PLOTS  | 9;      |
|   |  | PLOTS  | 91      |
|   |  | PLOTS  | 94      |
|   |  | PLOTS  | 95      |
|   | PRINT 150 MEUEL AGE ALAGE  | PLOIS  |         |
|   |  |        | 21      |
|   | $DO 1^{0} = 1 + NN$  |        | 97      |
|   | T = 1100 + (1-1) + 10  | PLOTS  | 100     |
|   | FB(T) = FRACB(T)   | PLOTS  | 101     |
|   | $F_{1B}(1) = F_{1}$  | PLOTS  | 107     |
|   | F28(1) = F2  | PLOTS  | 10-     |
|   | F 3B (1) = F 3   | PLOTS  | 104     |
|   |  | PLOTS  | 105     |
|   |  | PLOTS  | 104     |
|   | F + (T/=FRAL) (1)<br>F1 + (T = FRAL) (1)   | PLOTS  | 107     |
|   |  | PLOTS  | 108     |
|   | F3+11=F3   | PLOTS  | 109     |
|   | F 4 T / I 1 - F 4  | PLOTS  | 110     |
|   | 10 CONTINUE  | PLOIS  | 111     |
|   | PRINT 160  | PLUIS  | 112     |
|   | PRINT 170+ (I+TT(I)+F1B(I)+F2B(I)+F3B(I)+F4B(I)+F4B(I)+F4B(I)+T+T+I+I+I+I+I+I+I+I+I+I+I+I+I+I+I+I+I  |        | 112     |
|   | XMIN=1200.   |        | 114     |
|   | XMAx=2400•   | PLOTS  | 114     |
|   | INTVAL x=6   | PLOTS  | 117     |
|   | K X = n  | PLOTS  | 116     |
|   | YNIN=0.0   | PLOTS  | 110     |
|   | YMAx=1.0   | PLOTS  | 120     |
|   | INTVALY=10   | PLOTS  | 121     |
|   |  | PIOTS  | ĨŹŻ     |
|   | UALI PLOPE (TT+FIB+NN+1+0+NCHAR+0+7+8+0+0+23HTEMPERATURE (DEGPE  | PLOTS  | 123     |
|   | 115 KI - 23,28HFRACTION OF FAILED PARTICLES.28.0.0.2,2)  | PLOTS  | 124     |
|   | CALL PLOPE (II++28+NN+1+0+-NCHAR+0++7++8++0+0+0+0+0+23+0+0+0+0+2+2)  | PLOTS  | 125     |
|   | UALL FLUFD (11+FJM+NN+1+U+=NCHAR+0++7++R_+0+0+0+0+0+0+0+0+0+0+2+2)   | P1 OTS | 126     |

|    | CALI P1 0PB: (TT)F4B,NN+1+0,=NCHAR,0+,7+,R+,0+0+0+=23+0,0+0+0,2+2)   | PLOTS  | 127  |
|----|--|--------|------|
|    | IF (MFHEL.FQ.1) CALL DLCH (250.5.24.24HFT. ST. VPAIN FHE MODEL.2)  | PLOTS  | 125  |
|    | IF (MFRELLEQ.2) CALL DLCH (250.5.24.24HLATEST BASSAR FUEL MODEL.2)   | PLOTS  | 129  |
|    | IF (MFHEL.NE.1) GO TO 20   | PLOTS  | 130  |
|    | CALI CONVRT (1480IX.XMN.XMX.IXL.IXR)   | PLOTS  | 131  |
|    | CALL CONVRT (0.6.IY.YMN,YMX,IYB,IYT)   | PLOTS  | 132  |
|    | $CAL(-D_1CH)$ (IX+IY+1+1H4+1)  | PLOTS  | 137  |
|    | CALL CONVRT (1580TX.XMN.XMX.1XL.IXR)   | PLOTS  | 134  |
|    | $CAL_{I} D_{L}CH (IX \cdot IY \cdot 1 \cdot 1H3 \cdot 1)$  | PLOTS  | 135  |
|    | CALL CONVRT (1690.,TX.XMN,XMX,IXL,IXR)   | PLOTS  | 136  |
|    | CALI DICH (IX + IY + 1 + 1 + 2 + 1)  | PLOTS  | 137  |
|    | CALL CONVRT (1810. TX . XMN . XMX . IXL . IXR)   | PLOTS  | 139  |
|    | CALI  DI CH  (IX, IY, 1, 1H), 1)   | PLOTS  | 130  |
|    | DE UT OU   | PLOTS  | 14(  |
| 20 | CALL CONVRT (2100. IX XMN XMX IX IX IX )   | PLOTS  | 14   |
|    | CALL CONVRT (+0-+IY+YMN+YMX+IYB+IYT)   | PLOTS  | 14:  |
|    | $GALI  DICH  (IX \bullet IY \bullet 1 \bullet 1 H 1 \bullet 1)$  | PLOTS  | 14   |
|    | CALL CONVET (2000 TX.XMN.XMX.IXL.1XE)  | PLOTS  | 144  |
|    | CALI  (II GH (IX + IY + 1 + 1 H + 2 + 1))  | PLOTS  | 144  |
|    | CALL CONVET (2000 IX.XMN.XMX.IXI IXE)  | PLOTS  | 14/  |
|    | CALL CONVET (+DE+IY+YMN+YMX+TYE+1YT)   | PLOTS  | 14-  |
|    | [A] = [A]  | DLATS  | 141  |
|    | CA(1) = CONRT (1800 - 1717 - 200 - |        | 140  |
|    |  | PLOTS  | 15   |
|    |  | PL018  | 1.5  |
| 20 |  | PLOTS  | 15   |
| 30 |  | PLUIS  | 17/  |
|    |  | PLOIS  | 15   |
|    |  | PLOTS  | 1.74 |
|    |  | PLOTS  | 15   |
|    | POINT TOOL MEURICAOR CAOR  | PLOTS  | 170  |
|    |  | P[ 015 | 15   |
|    | PRINT 100<br>Denni 170 - Altitata Estata Estata Estata estata estata en el suc   | PLOTS  | 15/  |
|    | $\begin{bmatrix} r_{1}r_{1} & r_{1}r_{2} & r_{1}r_{1}r_{1}r_{1}r_{1}r_{1}r_{1}r_{1}$   | PLOTS  | 159  |
| •  | CALL FLORD CLIVELINNA INUNCHARGO FAR ON THE ADDRESS THE APPRATURE (DEGRE   | PLOIS  | 160  |
| •  | (A1) = (OP) (TI ET N) + (A NOUAR AT TERES (A)) (A) (A) (A) (A) (A) (A) (A) (A) (A  | PLOTS  | 10   |
|    | CAL: = [0,0,0] (TT = 2,0,0) = (CHAR, 0, -1, -1, -1, -1, -2, -2, -0, -0, -2, -2)  | P[.015 | 167  |
|    | CALL F OFB (117731900, 1909-NCHAP 0.0.7948.0000, 0-230000, 0-0.222)  | PLOTS  | 16:  |
|    | $\begin{array}{c} CALI & P[0PB (11)PP(1)NN(1)0) = NCHAR(0) = (7.9R_{0})(9.0)(9.0)(9.0)(0,0)(7.2)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)$   | PLOTS  | 104  |
|    | IF ("FIFT - EQ-1) CALL DICH (250-5,24,24HFT ST. VOATN FIFF MODEL -2)   | PLOTS  | 160  |
|    | IF (WELL-EW-2) CALL BECH (250-5+24-24HEATEST GASSAR FUEL MOBEL-2)  | PLOTS  | 16/  |
|    | IF (MFHIL-NE-11 GO TO 40   | PLOTS  | 10   |
|    | $CALI = CONVK^{+} (1480 \bullet I A, XMN \bullet XMX \bullet I A \cup I A )$   | PLOS   | 16/  |
|    | CALL CONVET (0.601Y TANNOTAXITYD 1YT)  | PLOTS  | 169  |
|    | CALI DI CH (IX + IY + 1 + 1H4 + 1)   | PLOTS  | 17   |
|    | CALL CONVET (1980++1X+XMN+XMX+IXL+IXR)   | PLOTS  | 17   |
|    | CALI DICH (IX+IY+1+1+3+1)  | PLOTS  | 17;  |
|    | CALL CONVET (1690., IX.XMN, XMX, IXL, IXF)   | ΡLΟΤS  | 17:  |
|    | $CAL_{I}  D_{I} CH  (IX + IY + 1 + 1H2 + 1)$   | PLOTS  | 174  |
|    | CALL CONVET (1810+, IX, XMH, XMX, IXL, IXE)  | PLOTS  | 179  |
|    | CALL DECH (1X+IY+1+1H1+1)  | PLOTS  | 176  |
|    |  | PLOTS  | 17   |
| 40 | CALL CONVRT (1970IX.XMN.XMX.IXL.IXR)   | PLOTS  | 17   |
|    | CALL CONVRT (+05+IY+YMN+YMX+IY8+IY7)   | PLOTS  | 179  |
|    | CALL DI CH_ 11X+IY+1+1H1+1)  | PLOTS  | 18   |
|    | CALL CONVRT (1930_,IX,XMN,XMX,IXL,IXR)   | PLOTS  | 18   |
|    | CALL CONVRT (+08+IY+YMN+YMX+IYB+IYT)   | PLOTS  | 18;  |
|    | CALI DICH (IX•IY•1•1H2•1)  | PLOTS  | 18   |
|    | CALL CONVRT (I900IX.XNN.XMX.IXL.IXR)   | PLOTS  | 18   |
|    | CALL CONVRT (+09+IY+YMN+YNX+IYH+IYT)   | PIOTS  | 189  |
|    | CALI DICH (IX-IY+1+1H3-1)  | PLOTS  | 18   |
|    | CALL CONVRT (I870: TX.XMN+XMX+IXL+IXR)   | PLOTS  | 18   |
|    | CALL CONVRT (0.1+IY-YMN+YMX+IYB+IYT)   | PIOTS  | 18/  |
|    | CAL1 DI CH (IX+IY+1+1H4+11   | PLOTS  | 18   |
|    |  |        |      |

| 50  | CONTINIE  | PIOTS  | 190  |
|-----|---|--------|------|
|     |   | DLOTS  | 101  |
|     | CAL = DLCH (100, 1005, 43, 117, F, 1)   |        | 192  |
|     | CAL = ADV - (1)   |        | 105  |
|     |   | PLOTS  | 104  |
|     |   | PLOTS  | 174  |
|     |   |        | 175  |
|     |   | PLOIS  | 190  |
|     |   | PLOIS  | 197  |
|     | $I = \left( \frac{1}{2} \left( \frac{1}{2} \right) + \frac{1}{2} \left( \frac{1}{2} \right)$ | PLOTS  | 198  |
|     | r = (1 + 4n(1) + 6 + 6 + 0 + 0) + 7 + 4n(1) = r = 1   | PLOTS  | 199  |
|     |   | PLOTS  | 200  |
|     | IF (F1T(I), EG.0.0) F1T(I) = FLTM1T   | PLOTS  | 201  |
|     | $IF (r > (I) \cdot E^{(n)} \cdot U \cdot U) F > I(I) = F L IMII$  | PLOIS  | 205  |
|     | IF (F3T(I) + E(0 + 0) + F3T(I) = FLIMIT   | ρίοτς  | 203  |
|     | $IF (F4+(I) \cdot F(V \cdot 0 \cdot 0) F4+(I) = FLIMIT$   | PLOTS  | 204  |
|     | $IF (\Gamma^{T}(I) \bullet E^{O} \bullet 0 \bullet 0) FT(T) = FLTMIT$   | PLOTS  | 205  |
| 60  | CONTINUE  | PLOTS  | 206  |
|     | YMIN=3.   | PLOTS  | 207  |
|     | YMAX=0_0  | PLOTS  | 20g  |
|     | INTVALY=3   | PLOTS  | 209  |
|     | к Y = <sup>0</sup>  | PLOTS  | 210  |
|     | CALL PLOPB (TT+F1B+NN+-1+0+NCHAR+0++7++8++0+0+234TEMPERATURE (DEAP  | PLOTS  | 211  |
|     | LEES K),-23+28HFRACTION OF FAILED PARTICLES+28+0.0,2,2)   | PLOTS  | 212  |
|     | CALL PLOPB (TT,F2B,NN,-1+0,-NCHAR,0,,7,,8,+0,0,0,-23,0,0,0,0,2,2)   | PLOTS  | 213  |
|     | CALL PLOPB (TT+F38+NN,-1+0,-NCHAR,0+7++8+0+0+0+0+-23+0+0+0+2+21   | PLOTS  | 214  |
|     | CALL PLOPB (IT+F4B+NN+=1+0+=NCHAR+0++7++R+0+0+0+0+-23+0+0+0+2+2)  | PIOTS  | 215  |
|     | IF (MFUEL.EQ.1) CALL DICH (250.5.24.24HFT. ST. VPATN FUEL MODEL.2)  | PIOTS  | 216  |
|     | IF (MFUEL-EQ.2) CALL DICH (250+5+24+24HIATEST GASSAR FUEL MODEL -2)   | PIOTS  | 217  |
|     | IF (MFUEL-NE-1) GO TO 70  | PLOTS  | 218  |
|     | CALL CONVET (1420. TX XMN. XMX. 1XL . IXR)  | PLOTS  | 210  |
|     | CALL CONVET (4+TY-YMN-YMX+TYB-TYT)  | PLOTS  | 220  |
|     | $CA1 + D(CH) (TX \cdot TY \cdot 1 \cdot 1 \cdot H \cdot 1)$   | PLOTS  | 221  |
|     | CALL CONVRT (1530+-TX-XMN+XMX+IXI+1XR)  | PLOTS  | 222  |
|     | CALL DICH (IX+IY+1+1H3+1)   | PLOTS  | 222  |
|     | CALL CONVRT (1640 + TX + XMN + XMX + 1XL + TXR)   | PLOTS  | 224  |
|     | CA(1) D(CH) (TX + TY + 1 + 1 + 2 + 1)   | PLOTS  | 225  |
|     | CALL CONVET (1760 - 172 - 200 - 212 - 128)  | PLOTS  | 224  |
|     |   |        | 227  |
|     |   |        | 220  |
| 70  | CALL CONVET (1740-1X-XMN-XMX-1XL-TXP)   |        | 220  |
|     |   |        | 230  |
|     | $CA1 = D_1 CH_1 (T^X + T^Y + 1 + 1) (T^Y + 1 + 1)$  |        | 231  |
|     | CA(1) = CONVRT (1800 - 17 - 7M) + 7M + 7M + 7M = 17P)   |        | 230  |
|     | CALL CONVET (= 2.0 at  |        | 232  |
|     |   |        | 23,  |
|     | CAL = CONT (1000 + 17 MM + 1)   |        | 234  |
|     |   | P[015  | 237  |
|     |   |        | 235  |
|     | CALL CONVERT (2000 - 17, 100 - 17,  | PLUIS  | 230  |
|     |   |        | 230  |
|     |   | 61014  | 2.39 |
| ۵.۵ |   | PLOTS  | 240  |
| ~0  |   | PLOTS  | 241  |
|     |   | P1.015 | 242  |
|     | $CAE_{1} = 0 [CH (100 + 100 + 43 + 11   E + 1)]$  | PLOTS  | 243  |
|     | CALL ADVIST   | PIOTS  | 244  |
|     | CALL FLOTD (1),FII,NN.=1,0,NCHAK.00,//+,80,0.+234TEMPERATURE (DEAR  | PLOTS  | 245  |
| 1   | SEES NJ. == 534 CONTRACTION OF FAILED PAPTICLES+CA+A+A+2,C)   | PLOTS  | 246  |
|     | LALI PLOPE (11+F21+NN+=1+0+=NCHAH+0++7++8+0+0+0+0+2+23+0+0+0+2+23   | P1_0T5 | 247  |
|     | UALI PLUPH (TT+F3T+NN+=1+0+=NCHAR+0.+7++R+0+0+0+0+2+23+0+0+0+2+21   | PLOTS  | 24B  |
|     | LALI PLOPE (TT+F4T+NN-1+0-NCHAR,07.,A.+0.0,0+-23,0+0.0.0,92+2)  | PLOTS  | 249  |
|     | 11 (MEHEL.EQ. 1) CALL OLCH (250.5.24.24HET, ST. VRAIN FUEL MODEL.2)   | PLOT5  | 250  |
|     | IF (METIEL . EQ. 2) CALL NLCH (250, 5, 24, 24HI & TEST BASSAR FUEL MODEL, 2)  | PLOTS  | 251  |
|     | IF (MFHEL.NE.1) GO TO 90  | PLOTS  | 252  |

|    |     | CALI, CONVRT (1400IX.XMN.XMX.) (L.IXR)                               | PLOTS     | 253 |
|----|-----|--|-----------|-----|
|    |     | CALL CONVRT (4.IY.YMN.YMX.IYE.IYT)                                   | PLOTS     | 254 |
|    |     | CALL DICH (IX + IY + 1 + 1 + 4 + 1)                                  | PTOTS     | 255 |
|    |     | CALL CONVRT (1510IX.XMN.XMX.IXL.IXR)                                 | PIOTS     | 256 |
|    |     | CALI DICH (IX + IY + 1 + 1H3 + 1)                                    | PLOTS     | 257 |
|    |     | CALL CONVET (1630. TX XMN XMX IXI IXE)                               | PIOTS     | 258 |
|    |     | CALI DICH (IX, IY, 1, 1H2, 1)  | PLOTS     | 259 |
|    |     | CALL CONVRT (1760IX.XMN.XMX.IXL.IXR)                                 | PINTS     | 260 |
|    |     | $CALI DICH (IX \cdot IY \cdot I \cdot IH \cdot I)$                   | PIOTS     | 261 |
|    |     | GO TU 100  | PIOTS     | 262 |
|    | 90  | CALL CONVET (1800.,TX,XMN,XMX,IXL,IXR)                               | PIOTS     | 263 |
|    |     | CALI CONVPT (-1.9 + IY + YMN + YMX + IYB + IYT)                      | PLOTS     | 264 |
|    |     | CALI DICH (IX + IY + 1 + 1H4 + I)                                    | PLOTS     | 265 |
|    |     | CALI CONVRT (=2.15, IY, YMN, YMX, IYB, IYT)                          | PLOTS     | 266 |
|    |     | CALL DLCH (IX+IY+1+1H3+1)  | PLOTS     | 267 |
|    |     | CALL CONVRT (-2.3.1Y.YMN.YMX.IYH.IYH)                                | PLOTS     | 26A |
|    |     | CALL DLCH (IX+IY+1+1H2+1)  | PLOTS     | 269 |
|    |     | CALL CONVRT (-2.7.IY.YMN.YMX.IYR.IYT)                                | PLOTS     | 270 |
|    |     | $CAL_{1} D_{1}CH (IX \bullet IY \bullet 1 \bullet 1H1 \bullet 1)$    | PLOTS     | 271 |
|    | 100 | CONTINUE   | PLOTS     | 272 |
|    |     | ENCOUE (43,180, TITLE) MFUEL, AGF, LAGE                              | PLOTS     | 273 |
|    |     | CAL! DLCH (100+I005+43+TITLE+1)                                      | PLOTS     | 274 |
|    |     | CALL ADV (1)   | PLOTS     | 275 |
|    | 110 | CONTINUE   | PLOIS     | 276 |
|    |     | XMIN=1200.   | PLOTS     | 277 |
|    |     | XMAX=5500 °  | ΡLΟΤS     | 278 |
|    |     | 1NTVALX=5  | PLOTS     | 279 |
|    |     | Kx=0 -   | PLOTS     | 280 |
|    |     | YMIN=0.0   | PLOTS     | 281 |
|    |     | YMAY=3.0   | PLOTS     | 285 |
|    |     | INTVALY=3  | PLOTS     | 283 |
| -  |     |  | PLOTS     | 284 |
| C  |     | FIRS FOR BISU  | PLOTS     | <85 |
| C  |     | USE FRARKAT FOR LOWER TEMPS FI FOR HIGHER TEMPS IT FOR TIME          | PLOIS     | 296 |
|    |     |  | PLOTS     | 201 |
|    |     | · D(1/=)000,10<br>Fr/A)=000015                                       |           | 200 |
|    |     | F   (   / =   770 + 19<br>TT ( = ) = / 3.                            |           | 204 |
|    |     | FR (-) - (ASR 15   |           | 290 |
|    |     | FT (a) - 1926 15   | PLOTS     | 293 |
|    |     |  |           | 291 |
| С  |     | $1000 \cdot 0AYS = 1000 \cdot /365 \cdot 25 YEARS$                   | PLOTS     | 294 |
|    |     | FB(3) = (876, 17*EXP(-80, 4098/365, 25))                             | PLOTS     | 295 |
|    |     | FT(3) = 2011.97 + EXP(-57.4098/365.25)                               | PIOTS     | 296 |
|    |     | CALL PLOPH (FB+TT+3+=1+0+NCHAR+0++8++8++30HFT+ ST. VRAIN FIFT MODE   | PLOTS     | 297 |
|    |     | 1LBISO, 30, 28HFUEL TEMPERATURE (DEGREES K) -28, 23HTPRADIATION TIME | PLOTS     | 298 |
|    | ;   | 2 ([[AYS] + 23+0+0+2+2])   | PLOTS     | 299 |
|    |     | CALL PLOPE (FT+TT,3+-1+0+-NCHAR+0++8++8++0+0+0+-28+0+0+0+0+0+2+2)    | PINTS     | 300 |
|    |     | CALL CONVRT (1400.+IX.XMN+XMX+IXL+IXR)                               | PIOTS     | 301 |
|    |     | CALL CONVRT (1.2.11, YMN, YMX, IYB, IYT)                             | PLOTS     | 302 |
|    |     | CALL WLCH (1×,IY,19,10HNO COATING FAILURES,1)                        | PLOTS     | 307 |
|    |     | CALL CONVRT (1250., IX, XMN · XMX, IXL, IXR)                         | PLOTS     | 304 |
|    |     | CALI CONVRT (2.2.4IY,YMN,YMX,IYB,IYT)                                | PLOTS     | 305 |
|    |     | CALL WICH (1×+1Y+22+22HPARTIAL FAILURE PEGION+11                     | ΡΓΟΤΖ     | 306 |
|    |     | CALL CONVRT (1800.,IX,XMM;,XMX,IXL,IXR)                              | PLOTS     | 307 |
|    |     | CALL CONVRT (2.7.IY, YMN, YMX, IYB, IYT)                             | PLOTS     | 308 |
|    |     | CALL WICH (IX+IY+28+28H100 PERCENT COATING FAILHDES+1)               | PLOTS     | 309 |
|    |     | CALL ANV (1)   | PLOTS     | 310 |
| С  |     | FOR IRTSO DO THE SAME.   | PLOTS     | 311 |
|    |     | FR(3)=1880,10EXP(-97,4459/365,25)                                    | PLOTS     | 312 |
| ~  |     | TT(3/ =2009.53°EXP(=47.2964/365.25)                                  | PLOTS     | 313 |
| C  |     | THESE NUMBERS ARE THE SAME AS THOSE IN THE FRACE AND FRACE SUBROUT   | PLOTS     | 314 |
| L. |     |  | PI ()   3 | 315 |

|  | -        |       |
|--|----------|-------|
| CALL PLOPO. (PDIIII3)=1.0 INCHARIO. B. B. B. B. BIHFT. ST. VRAIN FIFI MODE   | PLOTS    | 316   |
| LTHISO+31+28HFUEL TEMPERATURE (DEGREES K)+-28+234IRRADIATION TIM   | PLOTS    | 317   |
| 2E (DAYS):23.0.0.2.2)  | DL OTS   | 210   |
|  | PLOID    | 314   |
| CALL - LOPE (FITIITS = 1 + 0 = NCHAR + 0 + 8 + 8 + 9 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 7 + 2   | P1 0 T S | 319   |
| CALL CONVRT (1400.,IX,XMN,XMX,1XL,1XR)   | PLOTS    | 320   |
| CALL CONVRT (1-2+TY-YMN-YMY-TYR-TYT-   |          | 331   |
|  | PL013    | 321   |
| CALL WICH (IN ITTIG + IGHNO FOATING FAILURES+1)  | PLOTS    | 322   |
| CALL CONVRT (1250.,IX.XMN.XMX,IXL,IXR)   | PLOTS    | 323   |
| CALL CONVRT (2.2.4 TY $\gamma$ YMN | OL OTS   | 22/   |
|  | P[.010   | 324   |
| CALL ALGO (INTICZZZZARARTIAL PAJLORE REGIONAL)   | PLOTS    | 325   |
| CALL CONVRT (1800.,IX.XMN,XMX,IXL.)  | PLOTS    | 326   |
| CALI CONVRT (2.7) IY YMN YMX TYB TYT   | DINTS    | 325   |
| CALL WICH (TXATYARA SALION REDCENT COATANA FAT HERA AN   | F[ 013   | 521   |
| OAL ALM THE PROPERTY (VALUE PALLIDEST)   | PLOIS    | 326   |
|  | PLOTS    | 320   |
| NOW WE USE FIB, F2B, F3B TO REPRESENT J. FOLEY. AVER AND SODE  | PLATS    | 330   |
| MODELS FIRST HALFA FIT AND FOT TO HERRESONT IN THE AND SHAR  | PLOTS    | 550   |
| MODEL OF FEEDER AND ATER   | PLUIS    | 331   |
| MODELS SECOND HALF   | PIOTS    | 332   |
| INITIALIZE SPLINE FUNCTIONS  | PINTS    | 222   |
|  |          |       |
|  | PLOIS    | .5.54 |
| 2=AYER(0.0)  | PLOTS    |       |
| Z=S^KSn(0.0)   | PIOTS    | 334   |
| Z = U + M P = 0 (0, 0)   | 0.075    | 33-   |
|  | P[ 015   |       |
|  | PLOTS    | 330   |
| NN=) 01  | PLOTS    | 339   |
| $DT = 20 \cdot (NN-1)$   | DUATE    | 340   |
|  | -1,013   | 340   |
|  | PLOTS    | 341   |
| TT(T'=1)*DT  | PLOTS    | 342   |
|  | DIOTE    | 343   |
|  | PLOIS    | 343   |
|  | PLOTS    | 344   |
| FIB(I) <sup>2</sup> 01MP(I)  | PLOTS    | 345   |
| F2B(I)=AYER(T)   | DINTS    | 344   |
| $F^{3}B(1)$ -SORS(T)   | P1 015   | 347   |
|  | PLOIS    | 37/   |
|  | PLOTS    | 34 A  |
| F21(1)=AYERC(1)  | PLOTS    | 349   |
| GO TO 130  | PLATS    | 350   |
| 120 F18/T1-0.0   |          | 550   |
|  | PLOTS    | 351   |
|  | PLOTS    | 352   |
| $F_{3B}(1) = 0 \cdot 0$  | PIOTS    | 35 3  |
| F1T(I)=0.0   | 1.075    | 35.   |
|  | PLOIS    | 374   |
|  | PLOTS    | 355   |
| 130 CONTINUE   | PIOTS    | 356   |
|  | 0.075    | 35-   |
|  | PLUIS    | 357   |
|  | PLOTS    | 328   |
| INTAVEATO  | PLOTS    | 359   |
| 6X=0   | 01015    | 360   |
|  | F1 015   | 341   |
|  | PLOIS    | 361   |
|  | PLOTS    | 362   |
| INTVALYED  | PLOTS    | 363   |
| KY=1   | DIOTS    | 364   |
| CALL PLUPS (TT+F1RANNA) ADANCHARAD ARAE AZHUNTEORY TENO-RAEURE   | PE013    | 24-   |
| TYEN AND SODE DESULTE TO JUNTANT ANTEN ATTACH AND AND AND AND AND AND AND AND AND AND  | PLOIS    | 365   |
| THE AND SURS RESULTS 42 SOM TIME AFTER ONSET OF ACCTDENT (HOURS) -3  | PLOTS    | 366   |
| 25,19 <sup>M</sup> FRACTION IN COOLANT,19,0,0,2,2)   | PLOTS    | 367   |
| GALL PLOPE (TT+F2B+66+1+0+-NCHAR+0++B++5-+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+-24+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0  | DIATE    | 307   |
| $CA(1) = P(0PB) (TT = F3B = B_{1,1}, 0) = NO(100, 0) = F_{1,1} = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = $   | -1013    | 308   |
|  | PLOTS    | 369   |
| UALI CONVRI (2.0.)IX,AMN,AMX,IXL,IXR)  | PLOTS    | 370   |
| CALL CONVRT (0.8+IY+YMN+YMX+IY8+IY1)   | DI OTE   | 27.   |
|  | PL013    | 311   |
|  | PLOTS    | 3/2   |
| UALI, CONVEL (4.0.IX.AMN.AMX.IXL.IXR)  | PLOTS    | 373   |
| CALL CONVRT (0,4,1Y,YMN,YMX,IYB,1YT)   | PIOTS    | 374   |
|  |          | -7-   |
|  | PLOTS    | 3/5   |
| CALL UNIVEL (0.U.IX.AMN.AMX.IXL.IXE)   | PLOTS    | 376   |
| CALL CONVRT (0.5+IY,YMN+YMX+IYB,IYT)   | PLOTS    | 377   |
| CALL WICH (IX+IY+4+4HSORS+1)   | 0.070    | 377   |
| m  | PLOIS    | 378   |

с с с с

|   | CALL ADV (1)  | PLOTS              | 379  |
|---|---|--------------------|------|
|   | YMAx=4900.  | PLOTS              | 380  |
|   | INTVALý=4   | PLOTS              | 381  |
|   | KY=0  | PLOTS              | 382  |
|   | CALL PLOPB (TT+FIT+NN+1+0+NCHAR+0++8++5++36HUNTFORM TEMPERATURE   | AN PLOTS           | 383  |
|   | 1D AYER RESULTS.36.36HTIME AFTER ONSET OF ACCIDENT (HOURS).=36.3  | JUT PLOTS          | 384  |
|   | 2-131 CHMULATIVE RELEASE (CHRIES)+33+0+0+2+2)   | PLOTS              | 385  |
|   | CALI PI, UPB (TT+F2T+NN+1+0+-NCHAR+0++8++5++0+n+n+-36+0+0+n++7+2  | ) PLOTS            | 386  |
|   | CALL CONVRT (4.0+IX+XMN+XMX+IXL+1XR)  | ΡΕΟΤΣ              | 387  |
|   | CAL: CONVRT (3000.,IY.YMN,YMX,IYH,IYT)  | PLOTS              | 38A  |
|   | CALI WICH (IX+IY+18+18HUNIFORM TEMP MODEL+I)  | PLOTS              | 389  |
|   | CALL CONVRT (10.+IX+XMN+XMX+IXL+IXR)  | PLOTS              | 390  |
|   | CALL CONVRT (2400., IY, YMN, YMX, IYB, IYT)   | PLOTS              | 391  |
|   | $(a_1)  w_1 \subset H  (I \land \bullet I \uparrow \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet$   | PLOTS              | 392  |
|   |   | PLOTS              | 393  |
| ~ | RETURN  | PLOTS              | 394  |
| C |   | PLOTS              | 395  |
|   | 140 FORMAT (180)<br>150 FORMAT (8 NEUE) - A TI EXCARGE - A EA LEY MARE (1997) - A FORMAT  | PLOTS              | 396  |
|   | 150 + 0.000 | ) PLOIS            | 37/  |
|   | 105 FURNET (7 TATENTTATIN 19 1 13 ATCH 11 13 ATCH 2013 X 72H 30 13 A 72H 40 14 A  | +14 P <u>1</u> 015 | 370  |
|   | 170 FORMAT (15-6F15-5)  | PLOIS              | 399  |
|   |   |                    | 401  |
|   |   |                    | 407  |
|   |   | PLOTS              | 402  |
|   |   | PLOTS              | 40.3 |
|   | UIMENSTON FRAC(241) + BERAC(241) + TERAC(241) + A(241)  | PLOTS              | 405  |
|   | DIMENSION FUEL (21  | PLOTS              | 406  |
|   | COMMUN /LA/ LAGE.AGE.MFUEL.ISO.BISO   | PIDTS              | 407  |
| С | LAGE IS A LOGICAL VARIABLE SET TRUE IF ALL FOUR ARES OF FUEL AR   | F PLOTS            | 408  |
| С | TO BE USED. IF LAGE IS TRUE, AGE IS SET EQUAL TO THE TIME SINC  | E PLOTS            | 409  |
| С | THE REACTOR WAS TURNED ON.  | PLOTS              | 410  |
| С | IF LAGE IS FALSE, AGE IS SET EQUAL TO THE AGE OF ALL OF THE FUE   | L. PLOTS           | 411  |
| С | MFUFL = 1 FT. ST. VRATN FIEL MODEL  | - PLOTS            | 412  |
| С | MFUEL = 2 GASSAR FUEL MODEL   | PLOTS              | 413  |
|   | NCHAR=27  | ΡΙ, ΟΤ Ş           | 414  |
| C | INITIA, IZE PLOTS   | PLOTS              | 415  |
| С | INITIALIZE SPLINE   | PI_0TS             | 416  |
|   | $DO_{30}$ TL=1,2  | PLOTS              | 417  |
|   | IF (IL E0.1) LAGE=.T.   | PLOTS              | 418  |
|   | IF (IL_EU.2) LAGET.F.   | PLOTS              | 419  |
|   |   | PLOTS              | 420  |
|   |   | P[013              | 421  |
|   |   | PLOIS              | 422  |
|   |   | PLOTS              | 423  |
|   |   |                    | 424  |
|   | $A(1_{A}GF) = AGF$  |                    | 426  |
|   | HFPAC(TAGE) = 0.0   | PLOTS              | 427  |
|   | TFRAC(TAGE) = 0.0   | PLOTS              | 429  |
|   | NN=100  | PLOTS              | 420  |
|   | DO = 10 T = 1 • NN  | PLOTS              | 430  |
|   | PER=1./NN   | PLOTS              | 431  |
|   | BIN=PER/2   | PIOTS              | 432  |
|   | T=TFMP(RIN)   | PLOTS              | 433  |
|   | FB=FHACH(T)   | PLOTS              | 434  |
|   | BFRAC(TAGE)=BFRAC(IAGE)+FR  | PLOTS              | 435  |
|   | FT=FRAcT(T)   | PLOTS              | 436  |
|   | TFRAC (TAGE) = TFRAC (IAGE) + FT.   | PLOTS              | 437  |
|   | 10 CONTINUE   | PLOTS              | 43R  |
|   | BFRAU(TAGE)=BFRAC(IAGF)*PER   | PLOTS              | 439  |
|   | IFRAU(TAGE)=TFRAU(IAGE) *PER  | PLOTS              | 440  |
|   | rMAC(IAGE)=0.688FMAC(TAGE)+0.48TFRAC(IAGE)  | PLOTS              | 441  |

| 20 CONTINUE   | PLOTS    | 442  |
|---|----------|------|
| PRINT 60  | PLOTS    | 443  |
| PRINT 70% (I+A(I)+BFRAC(I)+TFRAC(I)+FRAC(I)+T#1+NTL)  | PLOTS    | 444  |
| CALL PLOPB (A+BFRAC+NTL+1+0+NCHAR+0++8++8++0+0+1)HAGE (YFARS)+11-2  | PLOTS    | 445  |
| 10HFAILED FRACTION BISO, 20,0,0,2,2)  | PLOTS    | 446  |
| CALL DLCH (100+1005+18+FUEL+1)  | PLOTS    | 447  |
| IF (MFHEL.EQ.1) CALL DLCH (325+5+24+24HFT. ST. VPAIN FUEL MODEL.2)  | PLOTS    | 448  |
| 1F (MFHEL.EQ.2) CALL DLCH (325.5.24,24HLATEST GASSAR FUEL MODEL.2)  | PLOTS    | 449  |
| CALL ADV (1)  | PIOTS    | 450  |
| CALI PLOPY (A+TFRAC+NTL+1+0+NCHAR+0++8++0+0+11HAGE (YFAP5)+11+2   | PLOTS    | 451  |
| 11HFAILFD FRACTION TRISO,21,0,0,2,2)  | PLOTS    | 452  |
| CALL D: CH (100+1005+18+FUEL+1)   | PIOTS    | 457  |
| IF (MFUEL.EQ.1) CALL DLCH (325,5,24,24HET, ST. VRATH FUET MODEL,2)  | PLOTS    | 454  |
| IF (MFHEL, EQ. 2) CALL DLCH (325+5+24+24HLATEST BASSAR FUEL MODEL+2)  | PLOTS    | 455  |
| CALL ADV (1)  | PIOTS    | 456  |
| CALL PLOPB (A+FRAC+NTL+1+0+NCHAR+0++8++8++0+0+11HAGE (YEAPS)+11+21  | PIOTS    | 457  |
| 1HFATLED FRACTION TUTAL +21+0+0+2+2)  | PIOTS    | 458  |
| CALI DICH (100+1005+18+FUEL+1)  | PLOTS    | 459  |
| IF (MFHEL+EQ-1) CALL DLCH (325+5+24+24HFT, ST. VPATN FUEL MODEL+2)  | PLOTS    | 460  |
| IF (MFHEL, EQ.2) CALL DLCH (325,5,24,24HLATEST GASSAR FUEL MODEL.2)   | PLOTS    | 461  |
| CALL ADV (1)  | PLOTS    | 462  |
| 30 CONTINUE   | PIOTS    | 463  |
| RETURN  | PLOTS    | 464  |
|   | PIOTS    | 46=  |
| 40 FORMAT (*MFUEL=**I1.5X.**LAGE=**L1)  | PIOTS    | 466  |
| 50 FORHAT (*0MFUEL =*,11,5X,*1,AGE =*,11)   | PINTS    | 467  |
| 60 FORMAT (///4X,1HI,17X,3HAGE,15X,5HFRACB,15X,SHFPACT,16X,AHFPAC/)   | PIOTS    | 46P  |
| 70 FORMAT (15+4F20-5)   | PLOTS    | 469  |
| END   | PLOTS    | 47 0 |
| SURPOUTINE PLOT3  | PIOTS    | 471  |
| LOGT <sup>C</sup> A( LAGE+BISO  | PIOTS    | 472  |
| DIMENSION RINTAC(151), REATLD(151), TT(151), TT4(151), RTLOG(151),  | PLOTS    | 473  |
| $1 \text{ RF}_{1} ^{0}\text{G}_{(151)}$   | PLOTS    | 474  |
| COMMUN /CJE07/ ΙΧL+ΙΧR+ΙΥΤ+ΙΥΒ+ΧΜΝ+ΧΜΧ+ΥΜΧ+ΥΜΝ  | PLOTS    | 475  |
| COMM <sup>g</sup> n /Cjeob/ xmin,xmax,intvalx,kx,ymin,ymax,intvaly,ky   | PLOTS    | 476  |
| COMM <sup>U</sup> N /LA/ LAGE+AGE+MFUEL+ISO+HISO  | PLOTS    | 477  |
| COMM <sup>U</sup> N /LJNE#/ IXSAVE,IYSAVE,IX2,IY2   | PLOTS    | 478  |
| NCHAK=>7  | PLOTS    | 479  |
| HN=K1   | PLOTS    | 4B ( |
|   | PLOTS    | 481  |
| $TT4(1)=9\cdot0-(I-1)*0\cdot1$  | PLOTS    | 482  |
| 10 TT(T)=1•0E4/TT4(1)   | PLOTS    | 483  |
| MFUFL=1   | PLOTS    | 484  |
| XMIN=3.0  | ρίοις    | 485  |
| KMAX=9.0  | PLOTS    | 486  |
| 1NTVALX=6   | PLOTS    | 487  |
| BISOT.F.  | P1 0 T S | 488  |
| KX=1  | PLOTS    | 489  |
| YMIN <sup>I</sup> -K.   | P1.0TS   | 490  |
| YMAY=1.   | PLOTS    | 491  |
| INTV <sup>A</sup> LY=7  | PLOTS    | 492  |
| KY=0  | PLOTS    | 493  |
| CALL PLOPB (TT4+RFAILD+NN+-1+0+NCHAR+0++5++7++244FT+ ST+ VRAIN FIF  | PLOTS    | 494  |
| IL MOVEL +-24+19H1+0E4/T (DEGREES K)+-19+36HPARTTCLE COATING PELEASE  | P1.0TS   | 495  |
| 2 RATE / HOUR+36+0+0+2,2)   | PLOTS    | 496  |
| CALL CONVRT (3-5+IX+XMN+XMX+IXL+IXR)  | PLOTS    | 497  |
| CALL CONVRT (-4.75.IY, YNN, YMX, IYB, IYT)  | ΡΙ ΟΤΟ   | 498  |
| CALI WLCH (IX+IY+12+12+12+1,3+4+5+4+10+1)   | PLOIS    | 499  |
| CALL CONVRT (-3.5.1Y.) YMN, YMX, TYB.IYT)   | PLOTS    | 500  |
| CALI WLCH (IX+IY+1+1HA+1)   | PLOTS    | 501  |
| CALL CONVET (3.6+IX+XM+XM+XXX+IXL+IXR)  | PIOTS    | 502  |
| $ \begin{array}{c} Lali  ConvRT  (=2\cdot^{2} \cdot I Y \cdot YMN \cdot YMX \cdot I YH \cdot I YT ) \end{array} $ | P1 OTS   | 503  |
| CALL W1CH (IX+1Y+1+1H7+1)   | PLOTS    | 504  |

|            | CALL CONVRT (3.9,IX,XMN,XMX,IXL,IXR)   | PI OTS   | 505 |
|------------|--|----------|-----|
|            | CALL CONVRT (-2.0.IY.YMN.YMX.IYB.IYT)  | PLOTS    | 506 |
|            | CALL WICH (IX+IY+1+1H9+1)  | PLOTS    | 507 |
|            | CALL CONVRT (4-5+TX+XMN+XMX+TXL+TXR)   | PLATS    | 507 |
|            | CALL CONVET (-1-5-TY-YMN-YMX-TYB-TYT)  |          | 500 |
|            | $CAL = W(CH) (TX_{A}TY_{A}) (Hz_{A}TY_{A})$  |          | 504 |
|            | $\begin{bmatrix} A_{1} & A_{2} & A_$ | PLOIS    | 510 |
|            |  | PLOIS    | 511 |
|            |  | PLOTS    | 215 |
|            | CALI =                  | P1 013   | 513 |
|            |  | PLOTS    | 514 |
|            | CALL CONVRITEICOJIYOYMNOYMXOTTNOICT)   | PLOTS    | 515 |
|            | $CALI = W_1 CR (IA) IY + 0 + 6H3 + 5 + 10 + 1)$  | PLOTS    | 516 |
|            | CALL CONVRT (4-D-TX + ANN + XMX + TXL + TXR)   | P1 0 T S | 517 |
|            | CALL CONVRI (U-0-17+TMN+TMX+IYB+IYI)   | PLOTS    | 518 |
|            |  | PLOTS    | 519 |
|            | CALL CONVRT (4+75+1X+XMN+XMX+TX)++IAR)   | PLOTS    | 520 |
|            |  | P1_0TS   | 521 |
|            | $CA[1] W[CH] (IX \bullet IY \bullet I \bullet IH6 \bullet I)$  | PLOTS    | 522 |
|            |  | PLOTS    | 523 |
|            |  | PLOTS    | 524 |
|            |  | PLOTS    | 525 |
|            | $R[N] \wedge C(I) \Rightarrow R[(I)]$  | PLOTS    | 526 |
|            | RFATLO(I) = RF(T)  | PLOTS    | 527 |
|            | RILOG(T) = ALOGIO(RINTAC(T))   | PLOTS    | 528 |
| <b>n</b> - | RFLOG(T) = ALOG10(RFAILD(I))   | PLGTS    | 529 |
| 20         | CONTINUE   | PLOTS    | 530 |
|            | FRINI AD, ISD, MFUEL   | PLOTS    | 531 |
|            | PRINE 90+ (I+TT(I)+TT4(I)+RINTAC(I)+RILOG(I)+REATLD(I)+RELOG(I)+TE   | PLOTS    | 532 |
|            | 11 • NN )  | PLOTS    | 533 |
|            |  | PLOTS    | 534 |
|            | 1 • 2)   | PLOTS    | 535 |
|            | UALI_ PLOPB (TT4,RINTAC,NN,-1,0,-NCHAR,0,.5,,7,,0,0,0,-19,0.0,0,0,-2   | PLOTS    | 536 |
|            | 1,2)   | PLOTS    | 537 |
| 30         | CONTINIE   | PLOTS    | 538 |
|            | MFUFL=2  | PLOTS    | 539 |
|            | CALL ANV (1)   | PLOTS    | 540 |
|            | XMIN=3_0   | PLOTS    | 541 |
|            |  | Ρίοτς    | 542 |
|            | INTVAL x=4   | PLOTS    | 543 |
|            |  | PLOTS    | 544 |
|            |  | PLOTS    | 545 |
|            |  | PLOTS    | 546 |
|            | INTVALV=6  | PLOTS    | 547 |
|            |  | PLOTS    | 549 |
|            | CALL PLOPE (TT4, RFAILD, NN, -1,0, NCHAR, 2, 5, 17, 1364GASSAR FUEL MODEL  | PLOTS    | 549 |
| 1          | I - FAILED PARTICLES, -36,1941.0E4/T (DEGREES K), -T9,364PARTICLE COA  | PLOTS    | 550 |
| 4          | ZVING RELEASE RATE / HOUR+36+0+0+2+2)  | PLOTS    | 551 |
|            | CALL CONVET (4.0, IX, XMN, XMX, IXL, IXE)  | PLOTS    | 552 |
|            | CALL CONVEL (-1.4.IY, YMN, YMX, TYH, IYT)  | PLOTS    | 553 |
|            | CALI WICH (IX+IY+8+8H)0 TRISO+1)   | PLOTS    | 554 |
|            | CAL1 CONVRT (-0.4.IY.YMN.YMX,IYB,IYT)  | P1 OTS   | 555 |
|            | CALL WLCH (IX,IY,1,1H5,1)  | PLOTS    | 556 |
|            | CALL CONVRT (6.0+IX+XMN+XMX+IXL+IXH)   | PLOTS    | 557 |
|            | LALI CONVET (-1.0, IY, YMN, YMX, IYH, IYT)   | PLOTS    | 558 |
|            | GAL1 WLCH (IX+IY+1+1H3+1)  | PLOTS    | 559 |
|            | CALL CONVET (3.9.IX.XHN.XMX.IXL.IXR)   | PLOTS    | 560 |
|            | CALL CONVRT (0.4+IY,YMN,YMX+IYB,IYT)   | PLOTS    | 561 |
|            | CALL WICH (IX+IY+1+1H6+1)  | PLOTS    | 562 |
|            | CALL CONVET (3.6+IX.XMN.XMX.+IXL.+IXR)   | PLOTS    | 563 |
|            | CALL CONVET (0.0+IY+YMN+YMX+IY8+1YT)   | PLOTS    | 564 |
|            | CALL WLCH (IA, IY, 7, 7H10 BISO, 1)  | PLOTS    | 565 |
|            | CALL CONVER (6+B+IX+XMN+XMX+IXL+IXR)   | PLOTS    | 566 |
|            | UALL CONVRT (=1.3,IY,YMN,YMX,IYB,IYT)  | PLOTS    | 567 |

|        | GALL WLCH (IX+IY+1+1+1+1)  | PIOTS  | 568        |
|--------|--|--------|------------|
|        | CALL CONVRT (3.6'IX'XMN'XMX'IXL'IXR)   | PLOTS  | 569        |
|        | CALL CONVRT (1.0+IY,YMN,YMX+IYB,IYT)   | PIOTS  | 570        |
|        | CAL1 WLCH (IX+IY+7+7H4+7+8+9+1)  | PLOTS  | 571        |
|        | CALI CONVRT (4.25.JX.XMN.XMX.JXL.JXR)  | PLOTS  | 572        |
|        | CALL CONVRT (1.5+IY+YMN+YMX+IYB+IYT)   | PLOTS  | 573        |
|        | $GALI W_1 CH (IX \cdot IY \cdot 1 \cdot 1H2 \cdot 1)$  | PIOTS  | 574        |
|        | DO 50 7S01=1+11  | PLOTS  | 575        |
|        | ISO=ISOI   | PLOTS  | 576        |
|        | IF (1S0.EQ.11) BISO=.T.  | POTS   | 577        |
|        | IF (ISA.EQ.11) ISA=10  | PLOTS  | 578        |
|        | DO 4 <sup>U</sup> T=1•NN   | PLOTS  | 579        |
|        | Τ=Ττ(ξ)  | PLOTS  | 580        |
|        | RFATLO(I)=RF(T)  | PLOTS  | 581        |
|        | RFLnG(T)=ALUG10(RFAILD(I))   | PLOTS  | 582        |
| 40     | CONTINUE   | PLOTS  | 583        |
|        | PRINT RO. ISD.MFUEL  | PLOTS  | 584        |
|        | PRINT 100+ (1+TT(I)+TT4(I)+RFAILD(I)+RFLOG(I)+T=T+NN)  | PIOTS  | 585        |
|        | CAL1 PLOPB (TT4, FAILD, NN, =1,0, =NCHAR, 0, 5, ,7,,0,0,0, =1,0,0,0,0, ,, ,  | PLOTS  | 586        |
| 1      | 2)   | PLOTS  | 587        |
| 50     | CONTINIE   | PLOTS  | 588        |
|        | CALI ANV (1)   | PLOTS  | 589        |
|        | XMIN=4.0   | PLOTS  | 590        |
|        | XMA x=9.0  | PLOTS  | 591        |
|        | YMIN=7.  | PLOTS  | 592        |
|        | YMAX=0.  | PLOTS  | 593        |
|        | INTVALx=5  | PLOTS  | 594        |
|        | κx= <sup>n</sup>   | PLOTS  | 595        |
|        | 1NTV <sup>A</sup> LY=7   | PLOTS  | 596        |
|        |  | P1.0TS | 597        |
|        | CALL PLOPE (114+RINTAC, NN, -1, 0, NCHAR) 2., 5., 7., 36HGASSAR FUEL MODEL   | PLOTS  | 598        |
| د<br>م | TIME DE FRANCIELES, -30, 1941.024/1 (DEOREES K) -19, 30 HPARTICLE CAA  | PLOIS  | 199        |
|        | - ING RELEASE RA'E / HOUR, 3640, U,242)  | PLOIS  | 600        |
|        | $CAL = CONVET (7 \cdot 0 \cdot 1 X \cdot X M N \cdot X M X \cdot 1 X \cdot 1 X \cdot 1 X X)$   | PLOTS  | 601        |
|        | CALL UN CHI ( $T_{1}^{*}$ CALL UN CHI ( $T_{1}^$ |        | 602        |
|        | CAL = CANUT (A - A + Y + A + A + A + A + A + A + A + A +   |        | 604        |
|        | CAL = CONVAL (= 0 TV (MN) VM (TAL TIAL)  |        | 600        |
|        | CALL UNVERT $(4, 4, 6, 6, 1, 1, 5, 1, 1, 6, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,$  | P1 015 | 605<br>602 |
|        | CALL = CONVET (5.0 at x. x. w. x. w. y. t. y. t. x.  | PLOTS  | 607        |
|        |  |        | 6007       |
|        | CA(t) = (I + (T + 1) + (T + 1))  | PLOTS  | 600        |
|        | CALL CONVRT (-3.7.1Y,YMN,YMX,TYB,TYT)  | PLOTS  | 610        |
|        | CALL WICH (1X+TY+12+12H6+(8+9'BISO)+1)   | PLOTS  | 611        |
|        | $CALL CONVRT (-3.1 \cdot IY \cdot YMN \cdot YMX \cdot IYB \cdot IYT)$  | PLOTS  | 612        |
|        | CALI WICH (IX+IY+2+2HIN+1)   | PLOTS  | 613        |
|        | CALL CONVRT (=2.1.IY.YMN,YMX,IYB,IYT)  | PLOTS  | 614        |
|        | $CALI  w_1 CH  (IX + IY + 1 + 1HP + 1)$  | PLOTS  | 615        |
|        | CALL CONVRT (8.0.1X.XMN.XMX.1XL.1XR)   | PLOTS  | 616        |
|        | CALI CONVRT (-4.0.IY.YMN.YMX.IYB.IYT)  | PLOTS  | 617        |
|        | $CALI = W_1 CH (I^{\lambda} + I^{\gamma} + 6 + 6H^{\gamma} BISO + 1)$  | PLOTS  | 618        |
|        | CALL CONVRT (-2.4.1Y.YMN.YMX.TYR.IYT)  | PLOTS  | 619        |
|        | CALL WLCH (IX+IY+6,6H1 BISO+1)   | PLOTS  | 620        |
|        | CALL CONVRT (4.6.IX.XMN.XMX.IXL.IXR)   | PLOTS  | 621        |
|        | CALL CONVRT (-0.4.IY.YMN.YMX.IYB.IYT)  | Ρίοτς  | 622        |
|        | CALL WLCH (IX+IY+6,6H4 BISC+1)   | PLOTS  | 623        |
|        | DO 70 TSO=1+10   | PIOTS  | 624        |
|        | D0 70 THISD=1+2  | PLOTS  | 625        |
|        | IF (18,50,EQ.1) BISO=,F.   | PLOTS  | 626        |
|        | IF (18750.EQ.2) HISO=.T.   | PLOTS  | 627        |
|        |  | PLOTS  | 62A        |
|        |  | PLOTS  | 629        |
|        | KINTAC(I)=RI(T)  | PLOTS  | 630        |

¥

,

|     | $RILn^{G}(T) = ALOG10(RINTAC(T))$   | PI OTS   | 631                                     |
|-----|---|----------|---|
| 60  | CONTINUE  | PLOTS    | 632                                     |
|     | PRINT BO + ISO +MFUEL   | PLOTS    | 633                                     |
|     | CALL PLOPB (TT4+FINTAC-NN+-1+0+-NCHAR+0+-5++7++0+0+0+0+-1+0+0+0+0+0+0+0+0+0+0+0+0+0+0   | PLOTS    | 634                                     |
|     | 12)   | DLOTS    | 635                                     |
| 70  | CONTINUE  |          | 634                                     |
| ••• |   |          | 637                                     |
|     |   | PLOIA    | 031                                     |
|     | RETHEN  | PLOTS    | 638                                     |
| -   |   | PLOTS    | 639                                     |
| 80  | FORMAT (6HOISO =+I2+3X+7HMFUEL =+I1+10X+741+0E4/T+18X+2HRT+15X+5HR  | ΡĹΟΤS    | 64n                                     |
|     | LLOG+1AX+2HRF+15X+5HRFLOG/)   | P1 0 T S | 641                                     |
| 90  | FORMAT (14,15,F12,1,5F20,5)   | PIOTS    | 642                                     |
| 100 | FORMAT (1X+15+F12+1+E20+5+40X+2E20+5)   | PLOTS    | 643                                     |
|     | END   | PLOTS    | 644                                     |
|     | SUAPOUTINE PLOT4  | PL OTS   | 645                                     |
|     | INTEGER DATE  | PLATS    | 646                                     |
|     | DIMENSION T(41) + FF(41) + TX(41+50) + 8(50) + VECP(250) + TTITIC(26)   | PLOTS    | 647                                     |
|     | DIMENSTON TEMP1 (41.50), TEMP2 (41.50)  | PL013    | 640                                     |
|     | COMMON ATMODEL A MODEL  |          | 04n                                     |
|     |   | P1.015   | 649                                     |
| 10  |   | PLOTS    | 050                                     |
| 10  |   | PLOTS    | 021                                     |
|     | CALL GFT (4ENJHN,JUBNAME)   | PLOIS    | 652                                     |
|     | CALL DATE! (DATE)   | PLOTS    | 653                                     |
|     | ITITLE(1)=JOHNAME   | PLOTS    | 654                                     |
|     | ITITLE (2) = DATE   | PLOTS    | 655                                     |
|     | ITITLE (14)=10HTEMPERATUR   | PLOTS    | 656                                     |
|     | ITITLE()3)=10HE MODEL =   | PLOTS    | 657                                     |
|     | Z=SPLINE(0.0,0.0)   | PLOTS    | 658                                     |
|     | Z=T=MPQ(0.0)  | PLOTS    | 659                                     |
|     | CALL ADV (1)  | PLOTS    | 660                                     |
|     | NTOT=4n   | PLOTS    | 661                                     |
|     | IVFMAX=50   | DUDTS    | 662                                     |
|     |   | PLOTS    | 663                                     |
|     |   |          | 603                                     |
|     | $DO 2^{\circ} = 1 \cdot NTOT1$  | PL015    | 665                                     |
| 20  |   | PLOIS    | - CO - CO - CO - CO - CO - CO - CO - CO |
| 20  |   | PLOIS    | 666                                     |
|     |   | PLOTS    | 00/                                     |
|     |   | PLOTS    | 668                                     |
|     |   | PLOIS    | 669                                     |
|     |   | PLOTS    | 67 n                                    |
|     |   | PLOTS    | 671                                     |
|     |   | PLOTS    | 672                                     |
|     | 10E1 = TEMP (0.01 = 1174.4  | PLOTS    | 673                                     |
|     | DO 30 T=1+NTOT1   | PLOTS    | 674                                     |
|     | TIMFET(I)   | PLOTS    | 675                                     |
| 30  | FF(T) = (TMAX(TIME) - TAVE(TIME))/TDELT   | PIOTS    | 676                                     |
| 40  | CONTINUE  | PLOTS    | 677                                     |
|     | PER=1./IVFMAX   | PLOTS    | 679                                     |
|     | DO SU TVF=1. IVFMAX   |          | 670                                     |
|     | BIN=PEP*(IVF=0.5)   |          | 680                                     |
|     | B(TVE)_BIN  |          | 000                                     |
|     |   | PLOIS    | 681                                     |
|     |   | PLOTS    | 682                                     |
|     |   | PLOTS    | 683                                     |
|     | IF ("OTEL.NE.4") (E=FF([)*(TEMP(BIN)=11/4.4)+TAVE(TIME)   | PLOTS    | 684                                     |
|     | IF ("UDEL+RU+4) (E=SPL(IIMF+RIN)  | PLOTS    | 685                                     |
| -   |   | PLOTS    | 686                                     |
| 50  |   | PLOTS    | 687                                     |
|     | ITITLE(9)=10HTIME(HRS)  | PLOTS    | 688                                     |
|     | ITITLE (101=10HCORE FRACT   | PLOTS    | 689                                     |
|     | IT [ TLE ( 11 ) = I UH TEMP (K)   | PLOTS    | 690                                     |
|     | PRINT DO MODEL  | PLOTS    | 691                                     |
|     | PPINT q0+ (J+(TX(I+J)+T=1+NTOT1+2)+J=1+TVFMAX)  | PLOTS    | 692                                     |
|     | CALL PINOW (TX+NTOT)+TVFMAX+T+B+VFCP+250-TTTTIEY  | PLOTS    | 403                                     |
|     | and the second | -1,013   | 073                                     |

|   | CALL PTCTURE (TX+TEMP1+TEMP2+NTOT1+TVEMAX+NTOT1+1-0+1-0+2-0+2-0+2   | DIATS  | 404         |
|---|---|--------|-------------|
|   | 10.909.3700.0.0.=2.3.01.)   | PLUIS  | 60=         |
| С | WRITE 108 IDENTIFICATION  | PLOTS  | 695         |
|   | CALL DICH $(154 + 992 + 4 + 4H, 10B = +1)$  | PLUIS  | 607         |
|   | CALI DICH (206+992+10.TTITE+1)  | PLOTS  | 690         |
| С | WRITE DATE  | PLOTS  | 690         |
|   | CALI DICH (400.992.5.5HDATE=.1)   | PLOTS  | 700         |
|   | CALL DICH (464-992-10-TTTTE(2)-1)   |        | 701         |
| С | WRITE ID  | PLOTS  | 701         |
|   | CALL DICH (154,972,60,TTITE(12),1)  | PLOTS  | 702         |
| С | WRITE FUNCTION RANGE  | PLOTS  | 703         |
|   | CALI DLCH (696,952,7,7+7HRANGE=-,1)   |        | 70=         |
|   | CALI DICH (780,952,20.TTITIE(3).1)  |        | 706         |
| С | WRITE & RANGE   |        | 707         |
|   | CALI DICH (780,972,20,1717) E (5),1)  |        | 700         |
| С | WRITE Y RANGE   | PLOTS  | 700         |
|   | CALI DLCH (780,992,20,ITITE(7),1)   | PLOTS  | 710         |
|   | $CA_{L1} = A_D V (1)$   | PLOTS  | 711         |
|   | CALL ADV (1)  |        | 715         |
|   | 60 CONTINUE   | PLOTS  | 715         |
|   | CALLEXH   | PLOTS  | 714         |
| С |   | PLOTS  | 716         |
|   | RETURN  |        | 714         |
| С |   | PLOTS  | 717         |
|   | 70 FORMAT (12,8X)   |        | 716         |
|   | 80 FORMAT (//* TEMPERATURE MODEL =*+11/)  | PLOTS  | 710         |
|   | 90 FORMAT $(1X, I3, 21F6, 0/)$  | PLOTS  | 720         |
|   | END   | PLOTS  | 721         |
|   | FUNCTION UTMPO (T)  | PLOTS  | 725         |
| С | THESE NUMBERS FROM TABILAR DATA IN REPORT BY J. FOLEY   | PLOTS  | 723         |
|   | UIMENSTUN IOF (2) + TAB (3)   | PLOTS  | 724         |
|   | DIMENSTON X(16) - F(16) + W(16) + A(16) + B(16) + C(16)   | PLOTS  | 725         |
|   | DATA X/2++3++4++5++6++7++8++9++10++11++12++13++14++16++18++20+/   | PLOTS  | 726         |
|   | DATA F/0++0157++0658++1774++3355++5280++7147++8470++9177++9473++9   | PI.OTS | 727         |
|   | 1550953/953/946939933/  | PLOTS  | 728         |
| С | SPLINE BOUNDARY CONDITIONS ETC.   | PLOTS  | 729         |
|   | I J=1   | PLOTS  | 730         |
|   | IOP (1)=5   | PLOTS  | 731         |
|   |   | PLOTS  | 732         |
|   | N1=10   | PLOTS  | 733         |
|   | CALL SPLIDI (N1+X+F+W+IOP+TJ+A+B+C)   | PIOTS  | 734         |
|   | RETURN  | PLOTS  | 735         |
|   |   | PLOTS  | 736         |
|   | CALL SPLIDZ (N1+X+F+W,IJ+T+TAR)   | PLOTS  | 737         |
|   |   | PLOTS  | 738         |
|   | RETURN  | PI.OTS | 739         |
|   |   | P1.0TS | 740         |
| ~ | FUNCTION AYERO (T)  | PLOTS  | 741         |
| C | THESE NUMBERS FROM GRAPHICAL DATA IN REPORT BY J. FOLEY   | PLOTS  | 742         |
|   | DIMENSION IOP(2) TAB(3)   | PLOTS  | <u>7</u> 43 |
|   | $\begin{array}{c} \text{DIMENSTON } \chi(r) + r(r) + \chi(r) + \chi($ | PLOTS  | 744         |
|   |   | PLOTS  | 745         |
| c | VATA F/U++113++435+.545+.75+.827.8457   | P1.0TS | 746         |
| C | SELINE BOUNDARY CONDITIONS ETC.   | PLOTS  | 747         |
|   |   | PLOTS  | 74B         |
|   | 107 (*/33)  | ΡΙΟΤΣ  | 749         |
|   |   | PLOTS  | 750         |
|   |   | PLOTS  | 751         |
|   | VALT SVLIDI (NIIAVILIMI) (NIIAVILIMI)<br>VALT SVLIDI (NIIAVILIMI) (NIIAVILIMI)  | PLOTS  | 752         |
|   |   | PLOTS  | 753         |
|   |   | PLOTS  | 754         |
|   | AVECTATAH(1)  | PIOTS  | 755         |
|   | A CONTRACT A  | MINTS  | 136         |

|   | RETURN   | PLOTS  | 757  |
|---|--|--------|------|
|   | END  | PLOTS  | 758  |
|   | FUNCTION SORSO (T)   | PIOTS  | 759  |
| С | THESE NUMBERS FROM GRAPHICAL DATA IN REPORT BY J. FOLEY                        | PLOTS  | 760  |
|   | UIMFNSTON IOP(2) + TAB(3)  | PLOTS  | 761  |
|   | DIMF <sup>N</sup> STON X(8) + F(8) + W(8) + A(8) + B(8) + C(8)                 | PIOTS  | 762  |
|   | DATA X/2.,4.,6.,6.,6.,12.,14.,16./   | PLOTS  | 763  |
|   | DATA F/0.,,085,.340,.560,.70,.79,.845,.88/                                     | PLOTS  | 764  |
| С | SPLINE BUUNDARY CONDITIONS ETC.  | PLOTS  | 765  |
|   | I J≖1  | PLOTS  | 766  |
|   | I () =5  | PLOTS  | 767  |
|   | I (P ( <sup>2</sup> ) =5   | PLOTS  | 76 A |
|   | N1=R   | ΡĹΟΤS  | 769  |
|   | CALL SPLIDI (N1,X,F,W,IOP,TJ,A,B,C)  | PLOTS  | 770  |
|   |  | PLOTS  | 771  |
|   | ENTPY SORS   | PIOTS  | 772  |
|   | CALL SPLIUZ (N1+X+F+W+TJ+T+TAR)  | PIOTS  | 773  |
|   | SORS=TAB(1)  | PLOTS  | 774  |
|   |  | PLOTS  | 775  |
|   | END  | PLOTS  | 776  |
|   | FUNCTION UTMPC0 (T)  | PLOTS  | 777  |
| С | THESE NUMBERS FROM TABULAR DATA IN REPORT BY J. FOLEY                          | PLOTS  | 77A  |
|   | OIMENSTON TOP (2) + TAB (3)  | PLOTS  | 779  |
|   | DIMENSTON $X(16)$ , $F(16)$ , $W(16)$ , $A(16)$ , $B(16)$ , $C(16)$            | PLOTS  | 780  |
|   | UATA X/2+33+94+55+66+77+8-99+10+11+12+13+14+16+18+20+/                         | PLOTS  | 781  |
|   | UATA F/0.17.2,102.8,319.4,702.7,1240.,1866.2456.2909.3200,336                  | PLOTS  | 782  |
| ~ | 11++3439++34/3++3493++3496++3496+/   | PIOTS  | 783  |
| L | SPETTE BUONDART CONDITIONS ETC.  | PI OTS | 784  |
|   |  | PLOIS  | 785  |
|   |  | PLOTS  | 786  |
|   |  | PLOTS  | 787  |
|   |  | PIOTS  | 786  |
|   | SET SPEED (NEWAYFW, IOF II) AABAC/   | PLOIS  | 789  |
|   |  | PLOIS  | 790  |
|   |  |        | 70   |
|   |  |        | 707  |
|   | KETURN   |        | 79.3 |
|   | END  | PLOTS  | 765  |
|   | FUNCTION AVERCO (T)  | PLOTS  | 794  |
| С | THESE NUMBERS FROM GRAPHICAL DATA IN REPORT BY 1. FOLFY                        | PLOTS  | 797  |
|   | DIMENSION 10P(2) + TAB(3)  | PLOTS  | 799  |
|   | DIMENSION X(8) • $F(8)$ • $W(8)$ • A(8) • B(8) • C(8)                          | PLOTS  | 799  |
|   | DATA X/2.,4.,6.,8.,10.,12.,14.,10,/  | PLOTS  | 800  |
|   | DATA F/0.,250.,1020.,1930.,2480.,2800.,3000.,3110./                            | PLOTS  | 801  |
| С | SPLINE ROUNDARY CONDITIONS ETC.  | PINTS  | 802  |
|   | (=)  | PIOTS  | 807  |
|   | IOP(1)=5   | PLOTS  | 804  |
|   | 10P (21=5  | PIOTS  | B0=  |
|   | N1=8   | PLOTS  | 804  |
|   | CALL SPLIDI (N1+X+F+W+IOP+TJ+A+B+C)  | PLOTS  | 807  |
|   | RETURN   | PLOTS  | 80 F |
|   | ENTRY AYERC  | PLOTS  | 809  |
|   | CALL SPLIDZ (N1+X+F+W+IJ+T+TAB)  | PLOTS  | 810  |
|   | AYERC=TAB(1)   | PLOTS  | 811  |
|   | RETURN   | PLOTS  | 812  |
|   |  | PLOTS  | 817  |
|   | SURDUITINE PLOPH (X, Y, NPTS, INC, LNN, NSYM, C, XAA, YAA, LABELZ, N71, LABELX | PLOTS  | 814  |
|   | 1+NXI *LABELY+NYL+LABELP+NRL+LSTZE+ISIZE)                                      | PLOTS  | 81=  |
| C | PLODE PRODUCES A STANDARD 2-DIMENSIONAL PLOT STMTLAR TO PLOJE                  | PLOTS  | 814  |
| C | WHILE TS SUITABLE FOR PUBLICATION.   | PLOTS  | 817  |
|   | LARSES MAT BE WHITTEN ON 4 SIDES OF PLUT                                       | PLOTS  | 81 A |
| U | LDIVE TO THE DIAL OF THE LABELS. 1STABS/ISIZE) 46                              | PLOTS  | 810  |

| С  |            | IF LSIZE > 0. DEPENDENT VARIABLES ARE PLOTTED ON LEFT-HAND SCALE  | PLOTS    | 820 |
|----|------------|---|----------|-----|
| С  |            | IF I SIZE < 0. DEPENDENT VARIABLES ARE PLOTTED ON RIGHT-HAND SCALE  | PLOTS    | 821 |
| С  |            | ISI7E IS THE SIZE OF THE SCALES. 1SIABS(ISIZE) <4   | PLOTS    | 822 |
| С  |            | LINFAR PLUTS FOR DEPENDENT VARIABLES MAY HAVE 2 SCALES ON   | PIOTS    | 823 |
| С  |            | MULTIPLE PLOIS.   | PLOTS    | 824 |
| C  |            | IF ISIZE - 0. ONLY LEFT SIDE OF PLUT HAS SCALE  | PLOTS    | 825 |
| С  |            | IF ISIZE > 0 AND ISIZE < 0. ALLOWANCE IS MADE TO DOAW SCALE ON  | PLOTS    | 826 |
| С  |            | RIGHT SIDE WITH A LATER CALL TO PLOPH   | PLOTS    | 827 |
| С  |            | IF I STZE < 0 AND ISTZE < 0. SCALE IS DRAWN ON PTANT STDE   | PLOTS    | 828 |
| С  |            | SCALES PRINT 4 FIGURES. DATA MUST BE AU UISTED REFORE CALL PLOPE.   | PLOTS    | 829 |
| С  |            | IF 1 ABEL OTHER THAN TOP DOES NOT FIT ON ONE LINE.  | PLOTS    | 830 |
| С  |            | LSI7E WILL BE REDUCED BY 1  | PLOTS    | 831 |
| С  |            | ALSO THE LOG AXES WILL BE FULL CYCLES.  | PIOTS    | 832 |
| С  |            | IF XXA AND/OH YYA ARE NON-ZERO THE LENGTHS  | PIOTS    | 837 |
| С  |            | WILL BE CONSIDERED AS RATIOS WHERE THE LONGEST  | PLOTS    | 834 |
| С  |            | SIDE IS FITTED ON A 860 POINT LINE.   | PIOTS    | 835 |
| C٠ |            | AXES LENGTHS WILL BE REDUCED IN ORDER TO ALLOW POOM FOR   | PLOTS    | 834 |
| С  |            | LAHFLS AND SCALES IF NECESSARY.   | PLOTS    | 837 |
|    |            | COMM <sup>U</sup> N /CJF07/ IXL+IXR+IYT+IYB+XMN+XMX+YMX+YMN   | PLOTS    | 838 |
|    |            | COMMUN /CJE08/ XMIN+XMAX+MAJDRX+KX+YMIN+YMAX+MAJORY+KY  | PIOTS    | 839 |
|    |            | DIMFNSTON X(1) + Y(1)   | PLOTS    | 840 |
|    |            | DIMENSTON IS'(6) + IVS7(6)  | PLOTS    | 841 |
|    |            | DATA 15//12+18+24+30+36+42/   | PLOTS    | 842 |
|    |            | DATA IVSZ/16+24,32,40,48,56/  | PLOTS    | 843 |
|    |            | INTFGER GRIDF   | PLOTS    | 844 |
|    |            | $B = \Delta u A \chi j (A M A \chi 1 (C + 0 + )) + (1 N N + 1) + 0 + )$   | PIOTS    | 845 |
|    |            |   | PIOTS    | 846 |
|    |            | KSY11=TEHS (NSYM)   | PLOTS    | 847 |
|    |            | $KINC = NAXO(IAbS(INC) \cdot 1)$  | PLOTS    | 848 |
|    |            | MPTS=1AHS (NPTS)  | PLOTS    | 849 |
|    |            | $M^{2}L = M^{2}M = IABS(N^{2}L)$  | PLOTS    | 850 |
|    |            | $X \times A = ABS (XAA)$  | PLOTS    | 851 |
|    |            | $YA = AB \subset (YAA)$   | PLOTS    | 852 |
|    |            | $N \times N = N \times v = 1 \text{ ABS}(N \times L)$   | PLOTS    | 853 |
|    |            | NYN=NYH=IARS(NYL)   | ΡΪΟΤΣ    | 854 |
|    |            | NRN=NRM=IABS(NRL)   | PLOTS    | 855 |
|    |            | LSZ=IAPS(LSIZE)   | PLOTS    | 856 |
|    |            | 1517=1AHS(IS12E)  | PLOTS    | 857 |
|    |            | GR1nF = AMAX1(1 • + ABS(C))   | PLOTS    | 858 |
|    |            | IF (NSYM.GT.0) CALL ANV (1)   | PLOTS    | 859 |
|    |            | IF $(N_1, 0, 1, 0)$ GO TO 50  | PLOTS    | 860 |
|    |            | IF ('NSYM-LT-0).A. (ISTZE-GT-0)) GO TO 100  | PLOTS    | 861 |
|    |            | $ \begin{array}{c} Call & MAAV & (AVKINC_{MP} S_{S}(S) MAX) \\ Call & MAV & (AVKINC_{MP} S_{S}(S) MAX) \\ \end{array} $ | P1 015   | 807 |
|    |            | CALL MAAV (TERINCEMPISEISURETMA)  | PLOIS    | 001 |
|    |            | CALL MINY (AGAINCGMPISGISUGAMN)   | PLOIS    | 804 |
|    |            | CALL MINV (YANJNCAMPIS,ISUHAYMN)  | PLOTS    | 865 |
|    |            | $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | P1.015   | 866 |
|    |            | $\Gamma = \{ (TA \in U, U) \mid TA = 10 \}$   | PLOIS    | 007 |
|    |            |   | PLOIS    | 008 |
|    |            |   | PLUIS    | 074 |
|    |            |   | PLOTS    | 870 |
|    |            |   | PLOIS    | 071 |
|    |            |   | PLOIS    | 872 |
|    | 10         |   | PLOIS    | 074 |
|    |            | CALL ANDE CUTORNYAMAYMAJAYMINAYKKA/   | PL015    | 8/9 |
|    | <b>2</b> 0 |   | PLOTS    | 8/5 |
|    | 20         |   | PLUIS    | 876 |
|    | 30         | $\Delta^{T}A = -LOGIU(A^{T}A)$  | PLOTS    | 877 |
|    | - 0        |   | PLUIS    | 014 |
|    |            | 17 ("MMTENZETMA) 00 10 40<br>()YMMTENZETMA) 00 10 40  |          | 879 |
|    |            | TF (0YM_EQ.0) DYM=.0001   | PLOTS    | 881 |
|    |            | YMN=YMN-DYM   | PIOTS    | 883 |
|    |            | •   | 1,1,0,10 |     |

|     | AWX≓AWX + DAN  | PLOTS  | 883  |
|-----|--|--------|------|
| 40  | CALL ASCL (5+YMN+YMX+MAJY+MINY+KKY)  | PLOTS  | 884  |
|     | GO T <sup>U</sup> 70   | PLOTS  | 885  |
| 50  | AMN=AMTN   | PLOTS  | 886  |
|     | XMX <sup>m</sup> XMΔX  | PLOTS  | 887  |
|     | MAJY=MAKXEMAJORX   | PLOTS  | 888  |
|     | κκχ= <sup>κ</sup> χ  | PLOTS  | 889  |
|     | YMN=YMIN   | PLOTS  | 890  |
|     | YMX=YM&X   | PLOTS  | 891  |
|     | MAJY=MAKY=MAJORY   | PLOTS  | 892  |
|     | KKY=KY   | PLOTS  | 893  |
|     |  | PLOTS  | 894  |
| 60  |  | PLOTS  | 895  |
| 70  |  | PLOTS  | 896  |
| 10  |  | PLOIS  | 897  |
|     |  |        | 800  |
|     | 1 = -1 = -1 = -1 = -1 = -1 = -1 = -1 =   | PLOTS  | 004  |
|     | H = T V S Z (ISIZ)   |        | 901  |
|     | IF (INC.GE.0) IH=IH/2  | PLOTS  | 902  |
|     | $IYT = \frac{2}{3} WAXO(IVSZ(LSZ) + IH)$   | PLOTS  | 903  |
|     | 1F ((M7L+1)*1SZ(LSZ).GT.1023-IXL/2) IYT=IYT+IVSZ(LSZ)  | PLOTS  | 904  |
|     | FACT=860./AMAX1(XXA.YYA)   | PLOTS  | 905  |
|     | IXH=MINO(IXL+IFIX(FACT+XXA)+1023-MAX0(3+TVSZ(LSZ)/2+ISZ(TST7)+5+TS   | PLOTS  | 906  |
| 3   | 12(15121/2))   | PLOTS  | 907  |
|     | $IF (15TZE \cdot 1T \cdot 0) IXR = TXR - 4*TSZ(ISIZ)$  | PLOTS  | 908  |
|     | 1YB="IND(1YT+1FIX(FACT+YYA)+1023-5*IVSZ(TSIZ)/3-3*TVSZ(1S7)/2)   | PLOTS  | 909  |
|     | LALI FRAME (IALITARITYTITA)  | PLOTS  | 910  |
|     | TE TETRITIE FAMALEGI GI GU TU HU   | PLOTS  | 911  |
|     |  | PLOTS  | 917  |
|     |  | PLUIS  | 71.5 |
| 80  | IF (SICN(1, YAA), GT, 0) GO TO 90  |        | 010  |
| -   | SWAD=YMN   | PLOTS  |      |
|     | YwN=YM¥  | PLOTS  | 917  |
| _   | YMX=SWAP   | PLOTS  | 918  |
| 90  | CALL DCA (IXL + IXH + IYH + IYB + XMN + XMX + YMN )  | PLOTS  | 919  |
| 100 | IF (LSTZE+LT+0) NAKY=-MAKY   | PLOTS  | 921  |
|     | $IF ((NeYM \cdot LT \cdot U) \cdot A \cdot (LSTZE \cdot GT \cdot U)) GO TO < 30$   | PLOTS  | 941  |
|     | $\frac{1}{1} = \frac{1}{1} $ | PLOTS  | 922  |
|     | IF (MPTS-LI-0-AND-INC-LI-0) CALL DIGLOI  | PLOTS  | 923  |
|     | IF (NPTS-GF-0-AND-INC IT-0) CALL DINIGT (MARVATSTE)  | PLOIS  | 924  |
|     | IF (NPTS-GE-0-AND-TNC-GE-0) CALL DINI NT (MAKY+NAKY-TSTZE)   | PLOTS  | 924  |
|     | IF (NPTS+LT+0) GO TO 110   |        | 927  |
|     | IF (NSVM+GT+0) CALL SPLN (MAJX+KKX+TSIZ)   |        | 92   |
|     | GO T <sup>O</sup> 120  | PLOTS  | 920  |
| 110 | IF (NSYM.GT.0) CALL SRLG (ISIZ)  | PLOTS  | 93(  |
| 120 | IF ( <sup>1</sup> NC.LT.0) GO TO 130   | PLOTS  | 931  |
|     | IF ((LSIZF.GT.0).A.(NSYM.GT.0)) CALL SLLN (MAJY.KKY.ISI7)  | PLOTS  | 932  |
|     | IF ((LSIZE.LT.0).A. (ISIZE.1.T.D)) CALL SRLN (MA.JY.KKY.IST7)  | PLOTS  | 93:  |
|     |  | PLOTS  | 934  |
| 130 | CALL SILG (ISIZ)   | PLOTS  | 935  |
|     | IF (ISTZE.LT.U) CALL SRLG (ISTZ)   | PLOTS  | 936  |
| 140 | LALI EXL   | PLOTS  | 9 17 |
|     | IF ("AT™0L1007 00 10 230<br>KC7_1 C3   | PI 015 | 938  |
|     | 154 = -57<br>15 + (Ny) = 65 = 01 + 60 = 70 + 220   | PLOTS  | 930  |
|     | KS7==Kc2   | PLUIS  | 04   |
|     | IF (MZN.EQ.0) GO TO 160  | PLOTS  | 941  |
|     | U0 100 K=1.MZM   | PLOTS  | 94   |
|     | CALL FFTCH (K+LABELZ+KK)   | PLOTS  | 944  |
|     | IF ( <sup>K</sup> K.GE.608) MZM=MZM+1  | PLOTS  | 94   |
|     |  | -      |      |

|   | 150 | CÓNTINIE  | PLOTS  | 946  |
|---|-----|---|--------|------|
|   | 160 | IF (NXM.EQ.0) GO TO 180   | PLOTS  | 947  |
|   |     | UO 170 K=1.NXM  | PLOTS  | 940  |
|   |     | CALL FETCH (K+1 ABELX+VK)   |        | 940  |
|   |     |   |        | 944  |
|   | 170 |   | P1015  | 950  |
|   | 100 |   | PLUIS  | 951  |
|   | 100 |   | PLOID  | 952  |
|   |     |   | PLOTS  | 953  |
|   |     | CALL FFICH (K+LABELY+KK)  | ρίυις  | 954  |
|   |     | IF (^K.GE.60B) NYM=NYM+1  | PLOTS  | 955  |
|   | 190 | CONTINUE  | P1.0TS | 956  |
|   | 200 | IF (NR44.EQ,0) 60 TO 220  | PLOTS  | 957  |
|   |     | UO 210 K=1,NRM  | PLOTS  | 958  |
|   |     | CALL FFTCH (K+LABELR+KK)  | PINTS  | 950  |
|   |     | IF $(^{K}K, GE_{\bullet}60B)$ NRM=NRM+1   | DI OTS | 96.0 |
|   | 210 | CONTINUE  | PLOTS  | 961  |
|   | 220 | CONTINUE  |        | 901  |
|   |     | TE (NYN-NE-A) CALL DION (MAYA (TYL/DATYL (TYD TYL FOZ/A SZERAMA) / )  |        | 30%  |
|   |     | 1 1 2 3 4 - V S / 1 5 1 / 2 4 V S 7 / 1 6 5 1 / 2 4 / | PLOIS  | 963  |
|   |     |   | PLOIS  | 904  |
|   |     | 1 - ("THE RE U) CALL DECV (0, MINU((1TH+1023)/2, IVR_(IVB-IVT_TS7(LS7)  | PLOIS  | 965  |
|   |     | I WNYN 1/2) INYM I LABELY I KSZI  | PLOTS  | 966  |
|   |     | IF (NZI +NE+0) CALL DICH (MAX0(IXL/2+IXL+(IXR=IXI=ISZ(LSZ)+471)/2)+   | PLOTS  | 967  |
|   |     | 10•M7M•LABELZ•KSZ)  | PLOTS  | 968  |
|   |     |   | PIOTS  | 969  |
|   |     | IF ( <sup>I</sup> STZE·LT· <sup>U</sup> ) IXX=IXX+4+TSZ(ISIZ)   | PIOTS  | 970  |
|   |     | IF (NRNI+NE+0) CALL DLCV (IXX+IVS7(LSZ)/2+IS7(IST7)/2+MINO((TYB+102)  | PIOTS  | 971  |
|   |     | 13)/2+IYB-(IYB-IYT-ISZ(1SZ)+NRN)/2)+NRM+1ABELP+KS7)   | PLOTS  | 972  |
|   |     | CALL EXH  | DLOTE  | 972  |
|   | 230 |   |        | 7/1  |
| С | 200 |   |        | 9/4  |
| - |     |   |        | 770  |
|   |     |   | PLUIS  | 976  |
|   |     | AT 440 MATELYMTIS #RINC   | PLOTS  | 977  |
|   |     |   | PLOTS  | 978  |
|   |     |   | PLOTS  | 979  |
|   |     | IF (NPTS-LI,U) XIWOEALOGIO(XTWO)  | PLOTS  | 980  |
|   |     | IF (INC.LT.U) YTWO=ALOGIU(YTWO)   | PIOTS  | 981  |
|   |     | CALL CONVRT (XTWO,NXTWO,XMN,XMX,IXL,IXR)  | PLOTS  | 982  |
|   |     | CALL CONVRT (YTWO+NYTWO+YMN+YMX+IYB+IYT)  | PLOTS  | 983  |
|   |     | IF $(Nxp \cdot EQ \cdot 1)$ go tu 290   | PIOTS  | 984  |
|   |     | IF (LIN+GE+0) GO TO 280   | PLOTS  | 985  |
|   | 240 | IF (MOD(((NXP-1)/KINC), IABS(LIN)), NF.0) GO TO 253   | PLOTS  | 986  |
|   |     | CALL FYL  | DI OTS | 987  |
|   |     | CALL DICH (NXTWO+NYTWO+0+KSYM-1)  |        | 000  |
|   |     |   |        | 908  |
|   |     |   |        | 709  |
|   | 250 |   | PLOIS  | 340  |
|   | 240 |   | PLOIS  | 991  |
|   | 270 |   | PLOTS  | 996  |
|   | 210 | CA = (1 - 2)  | PLOTS  | 993  |
|   |     |   | PLOTS  | 994  |
|   | 280 | IF (B.FN.0.) CALL DRV (NXONE,NYONE,NXTWO.NYTWO)   | PLOTS  | 995  |
|   | 290 | $IF (LIN \cdot NE \cdot 0) GO TO 240$   | P1_0TS | 996  |
|   |     | IF (B.NE.0.) GO TO 260  | PLOTS  | 997  |
|   | 300 | NYONE=NYTWO   | PLOTS  | 998  |
|   |     | NXONE=NXTWO   | PLOTS  | 999  |
|   | 310 | CONTINUE  | PLOTS  | 1000 |
|   | 320 | RETURN  | DIATS  | 1001 |
|   |     | END   | P[013  | 1001 |
|   |     |   | PLUIS  | 1005 |
|   |     |   | PLOTS  | 1003 |
|   |     | ₩₩₩₩₩ 200000000000000000000000000000000   | PLOTS  | 1004 |
|   |     | D(MT, 1) = 100 + 1007(4) = 1007(4)  | PLOIS  | 1005 |
|   |     |   | PLOTS  | 1006 |
|   |     | UATA 1954/16:24:32:40/  | PLOTS  | 1007 |
|   |     | DATA MASK1/7:000000000000000B/  | PLOTS  | 1008 |

.....

|   |     | DATA'MASK2/007777777777777778/  | PLOTS  | 1009 |
|---|-----|---|--------|------|
|   |     | NNK = NK  | PLOTS  | ĩ010 |
|   |     | NC=MAXA(INT(ALOG10(AMAX1(ARS(YT)+AUS(YB)))++00001)+1+1)   | PLOTS  | 1011 |
|   |     | IF $(MINO(YT+YB)+LT+0)$ NC=NC+1   | PLOTS  | 1012 |
|   |     | IF (NNK.GT.O) NC=NC+1   | PIOTS  | 1013 |
|   | 10  | IF (IS7(ISIZE)*(NC+NNK+.5).LT.IXL) GO TO 20   | PIOTS  | 1014 |
|   |     | IF (NNK.GT.0) NNK=NNK-1   | PIOTS  | 1015 |
|   |     | IF (NNK-GT-0) GO TO 10  | PLOTS  | 1016 |
|   | 20  | NC = 4I Ha (NC + NNK + 4)   | PLOTS  | 1017 |
|   |     | IE (YT.GE005) GO TO 30  | PLOTS  | 1018 |
|   |     | 1F (NNY-LE-51 GQ TQ 30  | PLOTS  | 1019 |
|   |     |   | PLOTS  | 1020 |
|   |     | NNK - NNK + 1   | PLOTS  | 1021 |
|   | 30  | CONTINUE  | PLOTS  | 1022 |
|   | ••  |   | PLOTS  | 1023 |
|   |     |   | PLOTS  | 1024 |
|   |     | IF ( (OUT + AND + MASK1) - FO - 11 *) OUT = (OUT + AND - MASK2) - OF 11 -   | PLOTS  | 1025 |
| c |     | THIS CHANGE SHOULD REPLACE + BY . AT LEFT OF FILE   | PLOTS  | 1026 |
| č |     | WE COULD HAVE USED CALL PUT (1-OUT-1R-1)  | PLOTS  | 1027 |
| - |     |   |        | 1020 |
|   |     |   |        | 1020 |
|   |     |   | PLOTS  | 1030 |
|   |     |   | PLOTS  | 1031 |
|   |     | CALL IS' (IACTIONITIAN)   | PL013  | 1031 |
|   |     | $Ir  [INV_{0} L L_{0} U]  RC   URA   N = 1 $  | PLUIS  | 1032 |
|   |     | NT = M T N ( (TT B - TT ) ) T V = V ( T T Z Z ) + NNT )   |        | 1024 |
|   |     | UT-(' ='D/N'+T''LE=12<br>NOV-E', -AT/YT-TVOYAND   | P1.015 | 1034 |
|   |     |   | PLOTS  | 1031 |
|   |     |   |        | 1035 |
|   |     |   |        | 1037 |
|   |     |   | PLOTS  | 1030 |
|   |     |   |        | 1040 |
|   | 40  |   |        | 1040 |
|   | 40  | GREEN (INCVITCVITCVITCVITCVITCVITCVITCVITCVITCVIT   |        | 1041 |
| c |     | BE HIPN   |        | 1042 |
| C | E 0 |   |        | 1043 |
|   | 50  | FURMER (CH(FVIIVIN-VII-IN))   |        | 1044 |
|   |     | END<br>SUBSOULÉTNE SELENTING NYS  |        | 1047 |
|   |     | SUBROUTINE SELIN(NNY NK)  | PLUIS  | 1045 |
|   |     | COMMON / CJEU// IALVIARVITIVITRVALVARVITVT  |        | 1047 |
|   |     | DIMENSION FMILLED COTTES  | PLUIS  | 1040 |
|   | ,   | $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 $ |        | 1044 |
|   |     | 2.9 W (1951) (W (1951) 5.0 (1951) (1951) (1953) (1951) (19  |        | 1050 |
|   | 6   |   | PLOIS  | 1051 |
|   |     |   | PLOIS  | 1052 |
|   |     | K=MTN0(6+MAX0(0+NK))+1  | PLOTS  | 1053 |
|   |     |   | PLOTS  | 1054 |
|   |     |   | PLOTS  | 1055 |
|   | 10  | K = M T N O (16 + MAX O (10 + NK)) = 2  | PIOTS  | 1056 |
|   | _   | NC=r=1  | PLOTS  | 1057 |
|   | 50  |   | PLOTS  | 1058 |
|   |     | ENCODE (20+A+OUT) YB  | PLOTS  | 1059 |
|   |     | IXT=1X  -12#NC-6  | PLOTS  | 1000 |
|   |     | CALL WLCH (IXI+IYB+NC+OUT+1)  | PLOTS  | 1061 |
|   |     | CALL TSP (IXL+IYB+1+1H+)  | PLOTS  | 1062 |
|   |     | IF (NNY+LE+0) RETURN  | PLOTS  | 1063 |
|   |     | NY=MINA(128+NNY)  | PLOTS  | 1064 |
|   |     | IYC=IYR   | P1_0TS | 1065 |
|   |     |   | PLOTS  | 1066 |
|   |     | DDY=FLOAT(1YT-IYB)/NY   | PLOTS  | j067 |
|   |     | DO JU T=1 NA  | PLOTS  | 1068 |
|   |     | YC=∀B+1 ⊗DY   | PLOTS  | 1069 |
|   |     | IYC=IYR+I*DDY   | PLOIS  | 1070 |
|   |     | ENCAPE (20+A+OUT)YC   | PLOTS  | 1071 |

---

|       | CALL WLCH (IXT+IYC+NC+OUT+1)   | PLOTS  | 1072 |
|-------|--|--------|------|
| - 30  | CALL TSP (IXL+IYC+1+1++)   | PLOTS  | 1073 |
|       | RETURN   | PLOTS  | 1074 |
|       | END  | DIATS  | 1074 |
|       | SUBROUTINE SRLIN(NNY+NK)   | PLOTS  | 1077 |
|       | COMMUN /CJE07/ IXI + IXD + IYI + IYB + XI + XD + YI - YB   |        | 1076 |
|       | DIMENSION ENT(12). OUT(2)  | PLOIS  | 1077 |
|       | DATA (FMT (K) + K=1+12) (2) (F+1H +1H +1H +1H +1H + 1H - 1H + 1) (FMT (K) + K=1+12) (2) (F+1H +1H +1H +1H +1H +1H +1H +1H +1H +1H  | PLOIS  | 1078 |
|       | 1 (1PE9, 3) • 9W(1PE10, 3) • 0U(1PE1) • 61 • 910 | P[013  | 1079 |
|       | TE // / / 9 0 10 10  | PLOTS  | 1080 |
|       |  | PLOTS  | 1081 |
|       | MC = MAXA(INT(ALUGIU(AMAXI(ARS(YI), AUS(YB))) + 1 + 1)   | PLOTS  | 1082 |
|       | 1F ("IND(T1+TB)+LT+0) NC=NC+1  | PLOTS  | 1083 |
|       | $IF (NK_GT_0) NC=NC+1$   | ΡΙΟΤΣ  | 1084 |
|       |  | PLOTS  | 1085 |
|       | ENCODE (10+40+FMT(2))NC  | PLOTS  | 1086 |
|       | ENCODE (10,40,FMT(4))NK  | PLOTS  | 1087 |
|       | κ=1  | PLOTS  | 1088 |
|       | GO TU 20   | PLOTS  | 1089 |
| 10    | $K \pm M \uparrow N \cap (16 \bullet MAX \cap (0 \bullet NK)) = 4$   | PLOTS  | 1090 |
|       | NC=×+1   | PLOTS  | 1091 |
| 20    | ENCODE (20+FMT(K)+OUT)YB   |        | 1091 |
|       | CALI TSP (IXR+IYB+1+1H+)   |        | 1092 |
|       | CALL TOP (NG+OUT)  |        | 1044 |
|       |  |        | 1094 |
|       |  | PLOTS  | 1095 |
|       |  | PLOTS  | 1096 |
|       |  | PLOTS  | 1097 |
|       | DDY=FLOAT(ITT=IYB)/NY  | PLOTS  | 109A |
|       |  | PLOTS  | 1099 |
|       | DO AU TET NA   | PLOTS  | 1100 |
|       | YC=YB+T+DY   | PIOTS  | 1101 |
|       | IYC=IYR+I*DDY  | PLOTS  | 1102 |
|       | ENCODE (20+FMT(K)+OUT)YC   | PIOTS  | 1103 |
| •     | CALI TSP (IXR + IYC + 1 + 1H +)  | PIOTS  | 1104 |
| - 3 0 | CALL TCP (NC+OUT)  | PLOTS  | 1105 |
|       | RETINN   | PIOTS  | 1106 |
|       |  | PIOTS  | 1107 |
| 40    | FORMAT (I2)  | PLOTS  | 1108 |
|       | END  | PLOTS  | 1100 |
|       | SURPOUTINE SBLIN(NNX+NK)   | PLOTS  | 1110 |
|       | COMMON /CJE07/ IXL+IXR+IYT+IYR+XL+XR+YT+YR   | PLOTS  | 1111 |
|       | DIMENSTON EMT(12) OUT(2)   |        | 1111 |
|       | DATA (FMT(K) +K=1+12)/2+(F+1H++1H++1H++1H)+8H(1PE7,0)+8H(TPER 1)+84  | PLOTS  | 1112 |
| 1     | (1PF9,2)+9H(1PE10+3)+9H(1PF11,4)+9H(1PE12,5)+9H(1PE13,6)   | DIOTS  | 1114 |
|       | IY=TYB   |        | 1114 |
|       | I YOFL #12   |        | 1117 |
|       | GO TV 10   | P1 015 | 1116 |
|       |  | PLOTS  | 1117 |
|       |  | PLOTS  | 1118 |
|       |  | P1.015 | 1119 |
| • •   |  | P1 0TS | 1120 |
| 10    |  | PLOTS  | 1121 |
|       | NC=MAXA (INI (ALOGIO (AMAX1 (ARS(XL)+ABS(XR)))+•00001)+1+1)  | PLOTS  | 1155 |
|       | IF ("TNU(XL+XR)+L+0) NC=NC+1   | PLOTS  | 1123 |
|       | $IF (NK_{\bullet}GI_{\bullet}O) NC=NC+1$   | PLOTS  | 1124 |
|       |  | PLOTS  | 1125 |
|       | ENCOVE (10+50+FMT(2))NC  | PLOTS  | 1126 |
|       | ENCODE (10,50,FMT(4))NK  | PLOTS  | 1127 |
|       | κ=1  | PLATS  | 1120 |
|       | 00 F UT 00   | PLOTS  | 1120 |
| 20    | K = MTNO(16 + MAXO(10 + NK)) = 4   | PLOTS  | 1124 |
|       | NC=K+1   | DIATE  | 112+ |
| 30    | ÉNCODE (20,FMT(K),OUT)XL   | DIATE  | 1130 |
| -     | CALL TSP (IXL+IY+1+1H+1  |        | 1132 |
|       |  | P1,015 | 1133 |
|       |  | PLOTS  | 1134 |

4

.

.

с

|    | IYC≠IY + IYOEL   | PLOTS        | 1135  |
|----|--|--------------|-------|
|    | CALI WICH (IXTT+IYC+NC+OUT+1)  | PLOTS        | 1136  |
|    | TE (NNY-LE-0) RETURN   | PLOTS        | 1137  |
|    |  | 0.075        | 130   |
|    | N (341N) (NNX+1-0)   | PLUIS        | 1100  |
|    |  | PLOIS        | 1139  |
|    | UDX=FLOAT(IXR=IXL)/NX  | PLOTS        | 1140  |
|    |  | <b>BLOTS</b> | 1141  |
|    |  | P[013        | 1141  |
|    | DO 40 = 1.9  KX  | PLOTS        | 1142  |
|    | XC=xL+T+DX   | PI OTS       | 1143  |
|    |  | PLOTS        | 1144  |
|    |  |              | 1145  |
|    |  | PLOIS        | 1145  |
|    | ENCODE (20+FMT(K)+DUT)XC   | PLOTS        | 1146  |
|    | CALL TSP (IXC+IY+1+1H+)  | PLOTS        | 1147  |
| ۵۵ | CALL WICH (IXT+TYC+NC+OUT+1)   | PIOTS        | 1149  |
| -0 |  |              | 1140  |
|    | RETIEN   | PLOTS        | 1149  |
|    |  | PLOTS        | 1150  |
| 50 | FORMAT (I2)  | PLOTS        | 1151  |
|    | END  | PL OTS       | 1152  |
|    |  |              | 1150  |
|    | SOUCH THE SELUC  | PLUIS        | 112.5 |
|    | COMMON /CJE0// IXL, IXP, IYT, IYR, XL, XR, YT, YR                    | PLOTS        | 1154  |
|    | DIMENSION XY(4), IXY(4)  | PLOTS        | j 155 |
|    | FOUT VALENCE (XY-XL) + (TXY-TXL)                                     | PLOTS        | 1156  |
|    |  |              | 1157  |
|    |  | PLUIS        | 1157  |
|    | IY=TTB   | PLOTS        | 1159  |
|    |  | PLOTS        | )159  |
| 10 |  | PLOTS        | 1160  |
|    |  | D. OTE       | 1141  |
|    |  | PLUIS        | 1101  |
|    |  | PLOTS        | 1107  |
|    | 12=2   | PLOTS        | 1163  |
|    | GO TO 30   | PLOTS        | 1164  |
|    | ENTRY STIOG  | PLOTS        | 1165  |
|    |  | FE015        | 1104  |
|    |  | PLOIS        | 1106  |
|    | 1YDFL=_12  | PLOTS        | 1167  |
|    |  | PLOTS        | 1168  |
|    | ENTRY SRIDG  | PLOTS        | 1160  |
|    |  | F[015        | 1170  |
|    | TXELOR   | PLUIS        | 1170  |
|    | IXDFL=R  | PLOTS        | 1171  |
|    | G0 70 20   | PLOTS        | 1172  |
|    | ENTRY CLIDG  | PLOTS        | 1172  |
|    |  |              | 117/  |
|    |  | P[015        | 1174  |
|    | 1X0FL=_48  | PLOTS        | 11/5  |
| 50 |  | PLOTS        | 1176  |
|    | IYDEL="  | PLOTS        | 1177  |
|    | 11=4   | PLOTS        | 1170  |
|    |  | FLOTS        | 1170  |
|    |  | PLOIS        | 1179  |
| 30 | ×1=×* (T1)   | P1, 0TS      | 1189  |
|    | X2=xY([S])   | PLOTS        | 1181  |
|    |  | PLOTS        | 1182  |
|    |  |              | 1185  |
|    |  | PLOIS        | 1103  |
|    | $x^{4}$ IN-A $x^{1}$ IN1(AIN)(XMIN),SIGN(AIN)(A8-(XMIN)+.9991.4MTN)) | PLOTS        | 1184  |
|    | XMAY = AMAX1 (AINT (XMAX) + SIGN (AINT (ABS (XMAX) + 999) + YMAX))   | PLOTS        | )185  |
|    | XI = VMTAL   | PLATS        | 1186  |
|    |  | PL 015       | . 10- |
|    |  | PLUIS        | 1107  |
|    |  | PLOTS        | 1188  |
|    | IF (NY_NE_0) GO TO 40  | PI OTS       | 1189  |
|    | YTT=X1.1.  | PLOTS        | 1190  |
|    |  | 0.075        | 1101  |
|    |  | PLUIS        | 1171  |
|    |  | PLOTS        | 1192  |
|    | X1=Y <sup>T</sup> T  | PLOTS        | 1193  |
| 40 | XY (T <sup>1</sup> ) - X1  | PLOTS        | 1194  |
| 40 | V 1 2 V 7 2  | D OTE        | 1105  |
|    |  | PLUIS        | 1477  |
|    | 1417-14(11)  | PLOIS        | 1196  |
|    | NH=44X1 (ABS(XY(I1)) + ARS(XY(I2)))                                  | P1.0TS       | 1197  |

|   |     | νμ=υ1νī(XY(I1)•XY(I2))  | PI OTS | 1198 |
|---|-----|---|--------|------|
|   |     | NC#MIND(1NT(ALOG10(FLOAT(NH))+.00001)+2.41  | PLOTS  | 1199 |
|   |     | IF (NL GE.C) GO TO 60   | PLOTS  | 1200 |
|   |     | IF $(^{1}ABS(NL) \cdot EQ \cdot NH)$ GO TO 50   | PLOTS  | 1201 |
|   |     | IF (1NT (ALOG10 (ABS (FLOAT (NL)))) -1 T-INT (ALOG10 (FLOAT (NH)))) GO TO 6   | PLOTS  | 1202 |
|   |     |   | PLOTS  | 1203 |
|   | 50  |   | PLOTS  | 1204 |
|   | 60  |   |        | 1205 |
|   | 0.7 |   |        | 1204 |
|   |     |   | PLOTS  | 1200 |
|   |     |   | PLUIS  | 1207 |
|   |     | $ \begin{array}{c} CALL  I_{A} & (I_{A}) \\ I_{A} & I_{A} & I_{A} \\ \end{array} $  |        | 1208 |
|   |     | IX ( I ) = [ 4 - N] ( I × = ( |        | 1204 |
|   |     |   | PLUIS  | 1210 |
|   |     |   | PLOIS  | 1211 |
|   |     |   | PLOIS  | 1212 |
|   |     |   | PLOTS  | 1213 |
|   |     | $[CAL[ 1 \leq P ([A \cup F] + C \leq F] = P)]$  | PLOIS  | 1214 |
|   |     |   | PLOTS  | 1217 |
|   |     | IF (NX_F.W.D) RETURN  | PIOTS  | 1216 |
|   |     | IDXYV = TSIGN(1 + IFIX(XY(T2) - XY(I1)))  | PLOTS  | 1217 |
|   |     |   | PLOTS  | 1218 |
|   |     |   | P1 0TS | 1219 |
|   |     | ENCODE $(10 + FMT + OUT) IXYV$  | ΡΓΟΙΖ  | 1550 |
|   |     | IF (11.EQ.1) GO TO 70   | ΡLΟΤS  | 1551 |
|   |     | IYC=1Y+IYDEL+(I*(IXY(I?)-IXY(I1)))/NX   | PLOTS  | 1222 |
|   |     | IYX=IYC-8   | PLOTS  | 1223 |
|   |     | CALI = TSP = (IX + IYC + 1 + 1H +)  | PLOTS  | 1224 |
|   |     | 60 TO PD  | PLOTS  | 1225 |
|   | 70  | IXC=IX+IXDEL+(I+(IXY(I2)-IXY(I1)))/NX   | PLOTS  | 1226 |
|   |     | IXX=IXC+8   | PLOTS  | 1227 |
|   |     | CALL TSH (IXX+IY+1+1++)   | PLOTS  | 1228 |
|   | 80  | CALL TSP (IXC+IYC+2+TEN)  | PLOTS  | 1229 |
|   |     | CALI = WICH (IXX-B, IYX-12, 4, 0UT, 1)  | ΡΪΟΤΣ  | 1230 |
|   | 90  | CONTINUE  | PIOTS  | 1231 |
|   |     | RETURN  | PLOTS  | 1232 |
| С |     |   | PLOTS  | 1233 |
|   | 100 | FORMAT (2H(I+I1+1H);  | PLOTS  | 1234 |
|   |     | ENO   | PLOTS  | 1235 |
|   |     | SUBROUTINE PLNOW (FLUX.IX.JY.XPLT.YPLT.YPLT.VFCP.ILVFCP.ITITLE)   | PLOTS  | 1236 |
|   |     | LOGTCAL ITOP+JTOP+NFOIND+TPR  | ΡÜΟΤS  | 1237 |
|   |     | CONMON /CNTRCOM/ ISYM (50) SCFAC  | PINTS  | 1238 |
|   |     | COMM <sup>O</sup> N /CJE07/ IXL,IXR,IYT,IYR,XNM,XMX,YMX,YMN   | PLOTS  | 1239 |
|   |     | DIMF <sup>N</sup> STON FLUX(1), XPLT(1), YPLT(1), VECP(1), TTTTE(1)   | PLOTS  | 1240 |
|   |     | DATA TIGER/SLLARC1/   | PIOTS  | 1241 |
| С |     | LCP LT 0 WE COMPUTE CONTOUR INTERVALS   | PIOTS  | 1242 |
| С |     |   | PIOTS  | 1243 |
| С |     | LCP GT & CONTOUR ROUTINE COMPUTES INTERVALS   | PIOTS  | 1244 |
| С |     | PARAMETERS FOR COMPUTING REGIONS TO BE CONTOURED  | PLOTS  | 1245 |
| - |     | NCL=I0  | PLOTS  | 1246 |
|   |     | LABFLX = ITITLE(9)  | PLOTS  | 1247 |
|   |     | LABFLY = ITITLE(10)   | PLOTS  | 1242 |
|   |     | LARFLZ=ITITLE(11)   | PLOTS  | 1249 |
|   |     |   | PLOTS  | 1250 |
|   |     | FF=_04  | PLOTS  | 1251 |
|   |     | CINT=-j.0   | PLOTS  | 1252 |
|   |     | IGR TD=5  | PLOTS  | 1253 |
|   |     |   |        | 1254 |
|   |     |   | PLOTS  | 1255 |
|   |     |   | PLOTS  | 1254 |
|   |     | SCALE=20.0  | PLOTS  | 1257 |
|   |     | ANGT=1.0471976  | PLOTS  | 1250 |
|   |     |   |        | 1250 |
|   |     | AMIN X=1_0  |        | 1240 |
|   |     |   |        | 1-07 |

|   |     | AMU(X=YPLT(JY)/XPLT(IX)  | PI OTS | 1261   |
|---|-----|--|--------|--------|
| С |     | THIS SHOULD PRODUCE A SQUAPE BASE FOR THE 3-D PLOT                           | PLOTS  | 1262   |
|   |     | AMULY=1.0  | PLOTS  | 1263   |
|   |     |  | PL015  | 1264   |
|   |     | $DX_1 = HAXO(TMT_{\bullet,1}MT_{\bullet,2})$                                 | PLOTS  | 1946   |
|   |     |  |        | 1205   |
|   |     |  | PLOIS  | 1206   |
|   |     |  | PLOTS  | 1267   |
|   |     |  | PLOTS  | 1<68   |
|   |     |  | PLOTS  | 1269   |
|   |     | IF (IDVL+LE-ILVECP) GO TO 10   | PLOTS  | 1270   |
|   |     | PRINI 190+ IDXL+ILVECP   | PLOTS  | 1271   |
|   |     | RETURN   | PLOTS  | )272   |
| С | -   | COMPUTE ZERO ORIGIN.   | PLOTS  | 1273   |
|   | 10  | CONTINUE   | PLOTS  | 1274   |
|   |     | XMIN=XPLT(1)   | PLOTS  | 1275   |
|   |     | XMAx=XpLT(IMT)   | PIOTS  | 1276   |
|   |     | YMIN=YPLT(1)   | PLOTS  | 1277   |
|   |     | YMAX=YpLT (JMT)  | PLOTS  | 1270   |
|   |     |  | PLOTS  | 1270   |
|   |     |  | PLOTS  | 1280   |
|   |     |  |        | 1201   |
|   |     |  |        | 1201   |
|   |     |  | PLOIS  | 1505   |
|   |     |  | PLOTS  | 1283   |
| ~ |     |  | PLOTS  | 1284   |
| C |     | END OF THY LOOP.   | PLOTS  | 1285   |
|   | 20  | CONTINUE   | PLOTS  | 1286   |
|   |     |  | PLOTS  | 1287   |
|   |     | IF (TEMX.GT.TEMPM) TEMP=SCALE/(TEMX-TEMPM)                                   | PLOTS  | 1288   |
|   |     | IF $(1 \text{EMP} \cdot \text{EQ} \cdot 0 \cdot 0)$ GO TO 40                 | PLOTS  | 1289   |
| С |     | SCALE VALUES TO BE PLOTTED   | PLOTS  | 1290   |
|   |     | DO 30 TDY=1+IMJMT  | PLOTS  | 1291   |
|   |     | FLUX (INY)=TEMP*FLUX (INY)   | PLOTS  | 1292   |
|   | 30  | CONTINIE   | PLOTS  | 1293   |
|   | 40  | CONTINIE   | PIOTS  | 1294   |
|   |     | ENCO <sup>D</sup> E 120,230,ITITLE(5))XMIN,XMAX                              | PIOTS  | 1295   |
|   |     | ENCODE (20+240+ITITLE(7))YMIN+YMAX   | PIOTS  | 1296   |
|   |     | СМАХЕТЕМХ  | PLOTS  | 1297   |
|   |     | CMIN≃T∉ <sup>I</sup> IPM   | PLOTS  | 1298   |
|   |     | IF (TENP.NE.0,0) CMAX=CMAX+TEMP  | PLOTS  | 1299   |
|   |     | IF (TE44P+NE+0+0) CMIN=CMIN+TEMP   | PLOTS  | 1300   |
|   |     | SCMAX=TEMX   |        | 1301   |
|   |     | SCMIN=TEMPM  |        | 1301   |
|   |     | IF (CMAX+LF-CMIN) GO TO 160  |        | 1302   |
| С |     | RELATE & AND Z VALUES TO OBLETN  | PLOTS  | 1304   |
| • |     |  | PLOTS  | 1304   |
|   |     |  | PL013  | 1305   |
|   | E 0 |  | P1.015 | 1306   |
|   | 20  |  | PLOTS  | 1307   |
|   |     |  | PLOTS  | 130A   |
|   |     |  | PLOTS  | 1309   |
|   | 60  | CONTAINTE DATA A AGE 7   | PLOIS  | 1310   |
|   |     | PRIN' 2009 LABELZ  | PLOTS  | 1311   |
|   |     | CALL PLTXYZ (FLUX, XPLT, YPLT, IMT, JMT, ANGT, ANGF, ANILX, AMULY, VECP (INX | PLOTS  | 1312   |
| - | 1   | LA), VECP(IDXB), VECP(IDXC), VECP(IDXD), IRA, IRB, ICB, ICC)                 | PIOTS  | j 31 3 |
| Ç |     | RESTORF R AND Z VALUES   | PLOTS  | 1314   |
|   |     | DO 70 †DY=1+IMT  | PLOTS  | 1315   |
|   |     | XPLT(TNY)=XPLT(IDY)+XMTN   | PLOTS  | 1316   |
|   | 70  | CONTINUE   | PLOTS  | 1317   |
|   |     | DO 80 TIT=1+JMT  | PIOTS  | 131A   |
|   |     | YPLT(INY)=YPLT(IUY)+YMIN   | PLOTS  | 1310   |
|   | 80  | CONTINUE   | PLOTS  | 1320   |
| С |     | WRITE IOB IDENTIFICATION   | PLOTS  | 1321   |
|   |     | CALL DLCH (154,992,4.4HJOB=+1)   | PLOTS  | 1322   |
|   |     | CALI DI CH (206,992,10,ITITLE,1)   | PLOTS  | 1321   |
|   |     | · -•   |        |        |

| С |     | WRITE NATE   | PI OTS       | j 324   |
|---|-----|--|--------------|---------|
|   |     | CALL 01 CH (400+992+5++HDATE=1)  | <b>BLOTS</b> | 1325    |
|   |     |  | PL015        | 1334    |
| ~ |     |  | PLOIS        | 1325    |
| C |     |  | PLOTS        | 1327    |
|   |     | CALI DICH (154+952+60+ITITLE(31)+1)                                      | PLOTS        | 1328    |
| С |     | WRITE FUNCTION RANGE   | PLOTS        | 1350    |
|   |     | ENCODE (20,220,ITITLE(3))SCMIN,SCMAX                                     | PLOTS        | 1330    |
|   |     | CALL DLCH (696+952+7+7HRANGE+1)  | PLOTS        | 1331    |
|   |     | CALL DICH (780.952.20. TTITIE(3).1)                                      | DI OTS       | 1335    |
| С |     | WRITE V RANGE  |              | 1332    |
| - |     |  |              | 1333    |
| ~ |     |  | PLOIS        | 13.54   |
| L |     | WRITE V RANGE  | PLOTS        | 1335    |
|   |     | CALI DLCH (780,992,20,1111,E(7),1)                                       | PLOIS        | 1336    |
|   |     | CALI_ DLCH (154,972,60,JTITLE(12),1)                                     | PLOTS        | 1337    |
| С |     | LABEL THE AXES   | PLOTS        | 1338    |
|   |     | IRA72=1RA-72   | PLOTS        | 1330    |
|   |     | IRA72 = MAXO(IRA72 + O)  | DIOTS        | 1340    |
|   |     | CALL OF CH. (ICC-TRA72-NCL +LABELX-L)                                    |              | 1341    |
|   |     |  |              | 1341    |
|   |     |  | P1.015       | 1342    |
|   |     | CALL DICH (270,000,NCL+LABP1,2,2)  | PLOTS        | 1343    |
|   |     | CALI NLCH (200+4+5+TIGER+2)  | PLOTS        | 1344    |
|   |     | CALI, AnV (1)  | PLOTS        | 1345    |
|   |     | DIVTS=AHS (CMAX)   | PLOTS        | 1346    |
|   |     | IF (UTVIS-FG.0.0) DIVIS=ABS(CMIN)  | PLOTS        | 1347    |
|   |     |  | DIOTS        | 340     |
|   |     |  | PLUIS        | 1040    |
|   |     |  | PLOTS        | 1349    |
|   |     | IF ( $\Box C P \cdot G T \cdot 0$ ) GO TO 100                            | PLOTS        | 1 2 2 0 |
| С |     |  | PLOTS        | 1351    |
| С |     | COMPUTE PLOT INTERVALS GIVEN FF AND NC                                   | PLOTS        | 1352    |
|   |     | NC=I <sup>A</sup> BS(LCP)  | PIOTS        | 1353    |
|   |     | ANCENC   | PLOTS        | 1354    |
|   |     |  | PLOTS        | 1356    |
|   |     |  | PL015        | 354     |
|   |     |  |              | 1005    |
|   |     |  | P[ 013       | 137/    |
|   |     |  | PLOTS        | 1358    |
|   |     | BEIA-ANCWVNCMW(EONE-EXP(FF))   | PLOTS        | 1379    |
|   |     | CD1F <sup>m</sup> CMAX-CMIN  | PLOTS        | 1360    |
|   |     | DO QU N=1+NC   | PLOTS        | 1361    |
|   |     | VECP(N)=C <sup>V</sup> IF <sup>#</sup> ALOG(ALPH+FLOAT(N)&VNC&BETA)+CMTN | PIOTS        | 1362    |
|   | 90  | CONTINIE   | PIOTS        | 1363    |
|   |     | $CMIN=(1, 0-FE) \oplus VECP(1)$  | DIGTS        | 1364    |
|   | 100 |  |              | 1365    |
|   | 100 |  |              | 1367    |
|   |     |  | PLUIS        | 1306    |
|   |     |  | PLOTS        | 1367    |
|   |     |  | PLOTS        | 1358    |
|   |     | TMC=IMC  | PLOTS        | ) 369   |
|   |     | JMX= <sup>1</sup>  | PLOTS        | 1370    |
|   |     | JTOP <sup>I</sup> .F.  | PINTS        | 1371    |
|   |     | DO 140 J=1.JMT   | PLOTS        | 1372    |
|   |     | NEQUNDEST  | DUDTS        | 1375    |
|   |     |  |              | 1373    |
|   |     |  | PLOIS        | 1374    |
|   |     |  | PLOTS        | 1375    |
|   |     |  | PLOTS        | 13/5    |
|   |     | IF (FLux(II)+LT+CMIN) GO TO 120  | PLOTS        | 1377    |
|   |     | NFOLIND = • F •  | PIOTS        | 137A    |
|   |     | IF $(1T_0P)$ GO TO 110   | PIOTS        | 1379    |
|   |     | IT0p=. †.  | PLOTS        | 1380    |
|   |     | 1M1 = MTANO(TM1 + T)   | DIOTS        | 1381    |
|   |     |  |              | 1300    |
|   |     |  | FT013        | 1007    |
|   | 110 |  | PLOTS        | 1383    |
|   | 110 |  | PLOTS        | 1384    |
|   | 150 |  | P1 OTS       | 1385    |
|   |     | 1F ("FO"NU) 60 '0 140  | PLOTS        | 1386    |

|   |     | IF' (JTAP) GO TO 130   | PLOTS  | 1387      |
|---|-----|--|--------|-----------|
|   |     | • Ŧ• = = 0 T L   | PLOTS  | 1388      |
|   |     | (L+1NL) 0/1I = 1NL   | PLOTS  | 1389      |
|   |     | GO τ <sup>O</sup> 140  | PLOTS  | 1.390     |
|   | 130 | (LeXML)0XA <sup>M</sup> =XML   | PLOTS  | 1391      |
|   | 140 | CONTINUE   | PLOTS  | 1392      |
| С |     | IF N <sup>U</sup> REGION FOUND GO TO ERROR PRINT AND SKIP CONTOUR PLAT   | PLOTS  | 1393      |
|   |     | IPR=+FALSE.  | PLOTS  | 1394      |
|   |     | IF (1M1.GE.IMX) IPR#.TRUE.   | PLOTS  | 1395      |
|   |     | IF (JMĴ•GE•JMX) IPR=•TRUE,   | PLOTS  | 1396      |
|   |     | IF ( <u>•</u> NoT•IP <sup>R</sup> ) GO TO 150  | PLOTS  | 1397      |
|   |     | PRINT >10, IM1, IMX, JN1, JMX, SCMIN, SCMAX  | PLOTS  | 1398      |
|   |     | <u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>   | PLOTS  | 1399      |
|   | 150 | TOPX=XPL <sup>T</sup> (IMX)-XPLT(IM1)  | PLOTS  | 1400      |
|   |     | TOPY=YpLT(JMX)-YPLT(JM1)   | PLOTS  | 1401      |
|   |     | I J= { J= { J= { [M] + IM] }   | PLOTS  | 1402      |
|   |     | I+IML-XML=YUN  | PLOTS  | 1403      |
|   |     | NIX=LMX-JM1+1  | P1.0TS | 1404      |
| С |     | TO PASS SCALE FACTOR VIA CNTRCOM TO CNTRUE FOR CONTOUR LABELS  | PLOTS  | 140c      |
|   |     | SCFAC=TEMP   | PIOTS  | 1406      |
|   |     | $CAL_{1}$ AnV (1)  | PLOTS  | 1407      |
|   | _   | CALI CNITHUB (XPLT (IM1) +NIX +YPLT (JM1) +NJY +FLUX (TJ) +IX +JY + CP +CMIN' C  | Ριητς  | 1406      |
|   | 1   | 1MAX.CINT.VECP.TOPX.TOPY.IGPID.IDRW.LAULX.10.LARFLY.10)  | PLOTS  | 1409      |
|   |     | KX=T <sup>X</sup> R+10   | P1 OTS | 1410      |
|   |     | KX=MAXA (KX+IXL+480)   | PI.OTS | 1411      |
|   |     | KX=HINA (KX+780)   | PLOTS  | 1412      |
| С |     | WRITE JOB IDENTIFICATION   | PLOTS  | 1413      |
|   |     | CALI DICH $(KX=165+30+4+4H, JOB=+1)$   | PLOTS  | 1414      |
| • |     | $CaL_1 D_1 CH (RX - 120 + 30 + 10 + 17 T_1 E + 1)$   | PLOTS  | 1415      |
| С |     | WRITE DATE   | PLOTS  | 1416      |
|   |     | $CAL( D) CH (KX+36+30+5+5HDATE \pm 1)$   | PLOTS  | 1417      |
| ~ |     | CALI DI CH (KX+96+30+10+ITITLE(2)+1)   | PLOTS  | 1415      |
| C |     | WRITE FUNCTION RANGE   | PLOTS  | 1410      |
|   |     |  | PLOTS  | 1420      |
|   |     | ENLINE (EU)/CEU)/IIIE(3)/SCMIN/SCMAX   | PLOTS  | 1421      |
|   |     | $\frac{G_{R_{1}}}{10} \frac{f_{1}(0)}{100} \frac{G_{R_{2}}}{100} \frac{G_{R_{2}}}$ | PLOIS  | 1442      |
| С |     | WRITE DAND / RANGE   | PLUIS  | 146       |
| - |     |  | P1.013 | 1424      |
|   |     |  | PLUIS  | 424       |
|   |     |  |        | 1425      |
|   |     |  |        | 1420      |
|   |     |  |        | 1 - 6 - 6 |
|   |     |  | PLOTS  | 1421      |
|   |     | YMAYC=VPLT (JMX)   | PLOTS  | 1431      |
|   |     | ENCODE (20.240.ITITLE (29)) YMINC. YMAXC   | PLOTS  | 143:      |
|   |     | CALL OLCH (KX+IDPW2+20+ITITLE(29)+1)   | PLOTS  | 1437      |
| С |     | WRITE ID   | PLOTS  | 1434      |
|   |     | CALL DICH $(IXL, IDRW1, 60, ITTTLE(31), 1)$  | PLOTS  | 1439      |
|   |     | IDRW3=7DRW2+20   | PLOTS  | 1434      |
|   |     | CALL DLCH (IXL+IDRW3+60+ITTTLE(12)+1)  | PLOTS  | 1437      |
| С |     | LABEL THE FUNCTION AXIS  | PLOTS  | ) 438     |
|   |     | CAL1 D1 CH (110,30,10,LABEL7,1)  | PLOTS  | 1430      |
|   |     | CALL DICH (50+4+5+TIGFR+2)   | PLOTS  | 1440      |
|   |     | CALI ADV (1)   | PLOTS  | 1441      |
| С |     | END OF INX LOOP.   | PLOTS  | 144:      |
|   | 160 | CONTINUE   | PLOTS  | 144       |
| С |     | RESTORE FUNCTION VALUES  | PLOTS  | 1444      |
|   |     | IF (TEMP.EQ.0.0) GO TO 180   | PLOTS  | 1440      |
|   |     | TEMPI=1.0/TEPP   | PLOTS  | 1444      |
|   |     | DO 1 <sup>7</sup> 0 IDY=1+1MJMT  | PLOTS  | 1447      |
|   | 170 | FLUx(Iny)=FLUX(IDy)*TEMPI  | PLOTS  | 1445      |
|   | 180 | RETURN   | PLOTS  | 1449      |
| С |     |   | PLOTS          | 1450  |
|---|-----|---|----------------|-------|
|   | 190 | FORMAT ( #0 NOT ENOUGH STORAGE AVAILABLE FOR PLOTTING#/2014 # PEQUID          | PLOTS          | T451  |
|   |     | 1ED strate 44. + AVAILAH F stra   | PLOTS          | 1452  |
|   | 200 | FORMAT (# PLOT MADE OF #A10)  |                | 1457  |
|   | 210 | FORMAT (*0 ERROR TN CONTOUR VALUES-PLOTS CANNOT BE MADE# /*                   | PLOTS          | 1454  |
|   |     | 1 IMI. IMA. JMI. JMX. SCMIN. SCMAX #+415-102514 41                            | PLOTS          | 1455  |
|   | 220 | FORMAT (1X+1PE9-2+++++1PE9-2)   |                | 1454  |
|   | 230 |   | PL013          | 1479  |
|   | 240 | FORMAT $(\Psi = \Psi = \Theta_{A} = 3, \Psi_{A} = \Theta_{A} = 3)$            | PLUIS          | 1450  |
|   | 240 |   | PLUIS          | 1458  |
|   |     | SURPOULTING ONTO HEY ANNY YANNY ZANZYANA YANA TAY NO ZANA TAY DI Z TOTAN DADA |                | 14.54 |
|   | ,   | INDEXTADD TOP TOP TARE A DET VINT SERVICE VINT SERVICE                        | P1.015         | 1400  |
|   |     | CONVENTIONS LABELA NALULI LABELINILOL)  | P1 015         | 1461  |
|   |     |   | PLOTS          | 1402  |
|   |     | COMMON /CNIRCON/ ISYM (50) SCFAC  | PLOIS          | 1463  |
|   |     | DIMENSION XSCALE (2) SCALF (2)  | PLOTS          | 1464  |
|   |     | EQUITVALENCE (XMIN,XSCALE(1)), (XMAX,XSCALF(2))                               | PLOTS          | 1465  |
|   |     | EQUIVALENCE $(TMIN, YSCALE(1))$ , $(YMAX, YSCALF(2))$                         | PLOTS          | 1466  |
|   |     | $D14F^{N}STON X(1) + Y(1) + Z(N2X+1) + ZPLAN(1)$                              | ΡĹΟΤΣ          | 1467  |
|   |     | DIMENSTON FMT(2)  | Ρίατς          | 1468  |
|   |     | LOGTCAI ESI   | $P1 O^TS$      | 1469  |
|   |     | NOC=MINO(IABS(NC)+50)   | PLOTS          | 1470  |
|   |     |   | PLOTS          | 1471  |
|   |     |   | PINTS          | 1472  |
|   |     | DEL7=DLZ  | PIOTS          | 1477  |
|   |     | UNAPX=nMPX  | PLOTS          | 1474  |
|   |     | ΟΜΔΡΥΞηΜΡΥ  | PLOTS          | 1475  |
|   |     | NOX=IAPS(NNX)   | PLOTS          | 1476  |
|   |     | NOY = IABS(NNY)   | PLOTS          | 1477  |
|   |     | $D_{0} = 1.50$  | PLOTS          | 1478  |
|   | 10. | ISY4(T1=0   | PIOTS          | 1479  |
| С |     | ESTABLISH SCALES  | PIOTS          | 1480  |
|   |     | XMIN#X(1)   | PIOTS          | 1481  |
|   |     | XMAY=X (NOX)  | PIOTS          | 1482  |
|   |     | YHIN=Y(])   | PIOTS          | 1483  |
|   |     | (101) Y=YAMY  | PLOTS          | 1484  |
|   |     | FGPn=0.   | PIOTS          | 1485  |
|   |     | IF (IGRU.GT.0) FGRD=-IARD   | PLOTS          | 1486  |
|   |     | CALL PLJB (XSCALE+YSCALE+2+1+1+1+FGRD+DMAPX+DMAPY+LABELX+NYLBL+LAB            | PLOTS          | 1487  |
|   | 1   | ELY.NYLBL+-1)   | PIOTS          | 1488  |
|   |     | IF (NC_LT.0) GO TO 50   | PLOTS          | 1489  |
|   |     | 1F (NNX+LE+0) CALL MINM (Z+NZX+NOX+NOY+T+1+ZMIN)                              | PLOTS          | 1491  |
|   |     | IF (NNY+LE+0) CALL MAXM (Z+NZX+NOX+NOY+T+J+ZMAX)                              | PINTS          | 1491  |
|   |     | IF (DE1 2.6T.0) GO TO 20  | POTS           | 1492  |
|   |     | DEL7=(7MAX-ZMIN)/(NOC-1.)   | PIOTS          | 1493  |
|   | 20  | IF (NZY-GT-0) GO TO 30  | PLOTS          | 1494  |
|   |     | ZMAX=7VAX-AMCD (ZMAX+DFLZ)  | PLOTS          | 1495  |
|   |     | ZNIN=7MIN-AMOD (ZMIN.OFL7)  | PLOTS          | 1496  |
|   |     | NOC = MIND (NOC + IFIX ((7MAX - ZMIN))/DE(7+1-01))                            | PLOTS          | 1497  |
|   | 30  | 2PLAN(1) = ZMIN   | PLOTS          | 1498  |
|   |     | D0 40 T=5*NOC   | PLOTS          | 1499  |
|   | 40  | ZPLAN(T) = ZPLAN(I-1) + DFLZ  | PLOTS          | 1500  |
|   | 50  | CONTINUE  | PLOTS          | 1501  |
|   | -   | D0 90 NA=5*NOA  | PLOTS          | 1502  |
|   |     | IX=+400 (NY+2)  | PLOTS          | 1503  |
|   |     | DY = Y(NY) - Y(NY-1)  | PLOTS          | 1504  |
|   |     | DO QU TNX=2+NOX   | PLATS          | 1504  |
|   |     | NX=TNX  |                | 1506  |
|   |     | IF $(1X, NE+0)$ NX=NOX=TNX+2  | PLUIS<br>DLATS | 1507  |
|   |     | $ZT_1 = \zeta (NX - 1 \circ NY - 1)$  |                | 1007  |
|   |     |   | P[013          | 1208  |
|   |     |   | PI 015         | 1509  |
|   |     |   | PLUIS          | 1-10  |
|   |     |   | PLUIS          | 1511  |
|   |     |   | PLOTS          | 1512  |

|   |     | IF (ABS(ZT3-ZT1)-ABS(ZT4-ZT2)) 70,60.60  | PLOTS  | 1513  |
|---|-----|--|--------|-------|
|   | 60  | CALL TRCJB (X(NX),Y(NY),-DX+-DY+NOC+ZPLAN,ZT4+ZT3+ZT2)   | PLOTS  | 1514  |
|   |     | CALL TRCJB (X(NX-))+Y(NY-1)+DX+UY+NOC+ZPLAN+ZT2+ZT1+ZT4)   | PLOTS  | 1515  |
|   |     |  | PLOTS  | 1516  |
|   | 70  | CAL1 THCJB (X(NX-1),Y(NY),PX,-DY,NOC,ZP1AN,ZT3,ZT4,ZT1)  | PLOTS  | 1517  |
|   | • • | CALI_TRCJB (X(NX)+Y(NY-1)+-DX+DY+NOC+4PLAN+ZT1+ZT2+ZT3)  | PLOTS  | 1518  |
|   | 80  | CONTINUE   | PLOTS  | 1219  |
|   | 90  | CONTINUE   | PLOTS  | 1520  |
|   |     |  | PLOTS  | 1521  |
| r |     | IDE DI AL TE SDACE DEDNITS   | P1 015 | 1522  |
| č |     | USE SLOP IN STALE PERMITS  | PLOTS  | 1524  |
| č |     | TSP USES BSP/H. CHAR = 12SP/V. CHAR  | PLOTS  | 1525  |
|   |     | TEST=.F.   | PLOTS  | 1526  |
|   |     | ITOP=5Å  | PLOTS  | 1527  |
| С |     | IXR = RIGHT BOUNDARY   | PLOTS  | 152A  |
| С |     | NOC = NUMBER OF CONTOURS   | PIOTS  | 1529  |
| С |     | ITOP = SPACES DOWN FROM TOP LEFT FOR LABEL   | PLOTS  | 1530  |
|   |     | ITST=IXR+142   | PLOTS  | 1531  |
|   |     | IF (1TST-GE-1024) TEST=.T,   | PLOTS  | 1532  |
|   |     | ITST=NnC+15+ITOP   | PLOTS  | 1533  |
|   |     | $IF (ITST_{6}GE_{\bullet}1024) TEST_{\pm}T_{\bullet}$  | PLOTS  | 1534  |
|   |     | K X = T A R + 10   | PLOTS  | 1535  |
|   |     |  | PLOTS  | 1536  |
|   |     | IF ('ES'/ KUSKA+80   | PLOIS  | 1537  |
|   |     |  | PLUIS  | 1530  |
|   |     |  | PLOTS  | 1540  |
|   |     | ENCOUF (19,120,FMT)ZTEM  | PLOTS  | 1541  |
|   |     | IF (TEST) GO TO 100  | PLOTS  | 1542  |
|   |     | CALI DI CH (KX+KY+10+FMT+1)  | PLOTS  | 1543  |
|   |     | CALL DLCH (KC+KY+0+I+1)  | PLOTS  | 1544  |
|   |     | KY=xY+22   | PLOTS  | 1545  |
|   | •   | GO + O + 10  | PLOTS  | 1546  |
|   | 100 | FMT(C) = SMIFT(1+54)   | PLOTS  | 1547  |
|   |     | CALL INT (NAVNIVILOFMI)  | PLOIS  | 1548  |
|   | 110 |  | PLOTS  | 1544  |
|   | ••• | RETIEN   | PLOTS  | 1551  |
| С |     |  | PLOTS  | 1552  |
|   | 120 | FORMAT (1PE9.2.1X)   | PLOTS  | 1553  |
|   |     | END  | PLOTS  | 1554  |
|   |     | SURROUTINE PLJ8(X,Y,NPTS,INC,LNN,NSYM,C,XAA,YAA,LABELX,NXL,LABELY.   | PLOTS  | 1555  |
|   | 1   | INYL •NZL)   | PLOTS  | 1556  |
|   |     | COMMON /CJED// IXL+IXR+IYT+IYB+XMN+XMX+YMX+YMN   | PLOTS  | 7 לכן |
|   |     | $DIMENSTDN \times (1) + Y(1)$  | PLOTS  | 1554  |
|   |     |  | PLOTS  | 1559  |
|   |     | D = A M A A (A M A A I (C + 0 + ) * (LNN* I) + 0 + )   | PLOIS  | 1560  |
|   |     | Kania tang ing Yan<br>Finarna  | PLOIS  | 1501  |
|   |     |  | PLOTS  | 1567  |
|   |     | MPTS=TARS(NPTS)  |        | 1564  |
|   |     |  | PLOTS  | 1569  |
|   |     | YYA=ABC(YAA)   | PLOTS  | 1566  |
|   |     | $N \times N = I A \cap S(N \times L)$  | PLOTS  | 1567  |
|   |     | NYN-1ARS (NYL)   | PIOTS  | 1564  |
|   |     | GRINT=AMAX)(1.+ABS(C))   | PLOIS  | 1569  |
|   |     | IF (NSYM.LT.0) GO TO 130   | PLOTS  | 157   |
|   |     | CALL MAXV (X+KINC+MPTS+ISUR+XNX)   | PLOTS  | 1571  |
|   |     | CALI = MAXY (Y + KINC + MPTS + ISUR + YMX)   | PLOTS  | 15/2  |
|   |     | CALL MINY (ASKINGAMPISSIDURSKAN)<br>CALL MINY (YSKINGAMPISIIDSYMN)   | PLOTS  | 15/3  |
|   |     | ALSO THE LOG AXES WITH RE ENTLY VOLES.   | PLOIS  | 1574  |
| • |     | ACOUNTED FOR AND A COUNTED FOR | "Luia  | 10.2  |

| С |     | IF XXA AND/OR YYA ARE NON-ZERO THE LENGTHS                         | PLOTS | i576 |
|---|-----|--|-------|------|
| С |     | WILL BE CONSIDERED AS RATIOS WHERE THE LONGEST                     | PLOTS | 1577 |
| Ĉ |     | SIDE IS FITTED ON A BAG POINT LINE.                                |       | 1578 |
|   |     | IF (XXA=EQ=0) XXA=6  |       | 1570 |
|   |     | IF $(Y_{A}, EQ, 0)$ $Y_{A}=10$                                     |       | 1580 |
|   |     | IF (NPTS.LT.0) GO TO 20  | PLOTS | 1581 |
|   |     | IF (AMALANE XMX) GO TO 10  |       | 1580 |
|   |     | DxH = +0.1 + AHS(XMX)  |       | 1583 |
|   |     | IF (PXM = EQ = 0) DXM = = 0001                                     | PLOTS | 1584 |
|   |     | XMN ± XMN + DXM  |       | 1585 |
|   |     | X4X=X4X+DXM  |       | 1586 |
|   | 10  | CALL ASCL (5+XMN+XMX+MALX+MTNX+KKX)                                |       | 1587 |
|   |     | GO TO 30   | PLOTS | 1580 |
|   | 20  | AMN=ALOGIO (XMN)   | PLOTS | 1580 |
|   |     | $XMX = A_1 \circ (310 (XMX))$                                      |       | 1590 |
|   | 30  | 1F (1NC+LT+0) GO TO 50   | PLOTS | 1591 |
|   |     | IF (YMN, NE, YMX) GO TO AN   | PLOTS | 1592 |
|   |     | DYM = 0.01 + ABS(YMX)  | PLOTS | 1593 |
|   |     | IF (UY++EQ+0) DYM=+0001  | PLOTS | 1594 |
|   |     | YMN=YMN-DYM  | PLOTS | 1595 |
|   |     | YMX=YMX+DYM  | PLOTS | 1596 |
|   | 40  | CALL ASCL (5+YMN+YMX+MALY+MINY+KKY)                                | PLOTS | 1507 |
|   | ••• | GO TU AO   | PLOTS | 1598 |
|   | 50  | YMN=AI OGIO (YMN)  | PLOTS | 1590 |
|   |     | YMX = ALOGIO(YMX)  |       | 1600 |
|   | 60  | IF (ISTON(I+NYL)+IT-0-AND+INC-GT-0) YYA=(YMX-YMN)/YYA              |       | 1601 |
|   |     | IF (ISTON(1+NXL)+1T-0-AND-NPTS-GT-0) XXA-(XMX-YMAL)(XXA            |       | 1602 |
|   |     | MAKX=GDIDF+MAJX  |       | 1602 |
|   |     | Mak y = Gp Ti) F + Ma IY   |       | 1003 |
|   |     | FACT=850./AMAX1 (XXA.YVA)  | PLOTS | 1004 |
|   |     | IXI = 66   |       | 1606 |
|   |     |  |       | 1607 |
|   |     | $I \times R = 1 \times 1 + 860$                                    | PLOTS | 1608 |
|   |     | IY8=1Y++860.   | PLOTS | 1609 |
|   |     | CALL FRAME (IXL+IXR+IYT+IYB)                                       | PLOTS | 1610 |
|   |     | IF (SIGN(1.+XAA)+GT.0) GO TO 70                                    | PLOTS | 1611 |
|   |     | SWAP=XNN   | PLOTS | 1612 |
|   |     | XMN=XMX  | PLOTS | 1613 |
|   |     | XMX=SWAP   | PIOTS | 1614 |
|   | 70  | IF (SIGN(1.,YAA).GT.0) GO TO 30                                    | PLOTS | 1615 |
|   |     | SWAP=ANN   | PLOTS | 1616 |
|   |     | λψυ <sup>22</sup> μX   | PLOTS | 1617 |
|   | •   | YMX=SWAP   | PLOTS | 1618 |
|   | 80  | CALL DGA (IXL+IXR+IYT+IYB+XMN+XMX+YMX+YMN)                         | PLOTS | 1619 |
|   |     | IF (NPTS-LT-0-AND-INC-LT-0) CALL DLGLG                             | PLOTS | 1620 |
|   |     | IF (NPTS.LT.0.AND.INC.GE.0) CALL DLGLN (MAKY)                      | PLOTS | 1621 |
|   |     | 1F (NPTS+GE+0+AND+INC+LT+0) CALL OLNLG (MAKX)                      | PLOTS | 1622 |
|   |     | IF (NPTS.GE.O.AND.INC.GE.O) CALL DLNLN (MAKX.MAKŸ)                 | PLOTS | 1623 |
|   |     | IF (NPTS+LT+0) GO TO 90  | PLOTS | 1624 |
|   |     | CALI Selîn (Majx,KKx)  | PLOTS | 1625 |
|   |     | Gn +0 100  | PIOTS | 1626 |
|   | 90  | CALL SALOG   | PLOTS | 1627 |
| 1 | 00  | IF (INC.LT.0) GO TO 110  | PIOTS | 1628 |
|   |     | CALL SLLIN (MAJY+KKY)  | PLOTS | 1629 |
|   |     | GO T <sup>U</sup> 120  | PLOTS | 1630 |
| 1 | 10  | CALI. SI LUG   | PLOTS | 1631 |
| 1 | 20  | CALL EXL   | PLOTS | 1632 |
|   |     | INXN#25  | PLOTS | 1637 |
|   |     | IF (NXN+NE+0) CALL DLCH (MAX0(54+IXL+(IXR-IX1-12+NXN)/2).TYR+INXN: | PIOTS | 1634 |
|   | 1   | NXN.LARELX.1)  | PLOTS | 1635 |
|   |     | INCx=1ñ  | PLOTS | 1636 |
|   |     | IF (NYN.NE.0) CALL DLCV (INCX.MINO(IY8+52.IYR-(IVR-IYT-12*NYN)/2). | PLOTS | 1637 |
|   | 1   | NYN.LARELY.1)  | PLOTS | 163A |
|   |     |  | -     |      |

w

.

.

|   |     | CALIEXH  | PIOTS  | 1639 |
|---|-----|--|--------|------|
|   |     | IF (NZL+LT+0) GO TO 220  | PLOTS  | 1640 |
| С |     | PLOT POINTS AND/OR LINE  | PLOTS  | 1641 |
|   | 130 | MPTS=MPTS*KINC   | PLOTS  | 1642 |
|   |     | UO 210 NXP=1+MPTS+KINC   | PLOTS  | 1643 |
|   |     | XTWO=X (NXP)   |        | 1045 |
|   |     | YTWO = Y (NXP)   | PLOIS  | 1044 |
|   |     | F (NPTS.17.0) XTWO-0.0610(XTWO)  | PLOTS  | 1045 |
|   |     |  | PLOTS  | 1646 |
|   |     | $\mathbf{T} = (\mathbf{T} \cdot \mathbf{N}_1 \cdot \mathbf{C} + \mathbf{N}_2 \cdot \mathbf{T} \cdot \mathbf{N}_2 \cdot \mathbf{N}_1 \cdot \mathbf{N}_2 \cdot$ | PLOTS  | 1647 |
|   |     |  | PLOTS  | 1648 |
|   |     | CALL CONVENT (TIWO, NY WO, YMN, YMX, IYE, IYT)   | PLOTS  | 1649 |
|   |     |  | ΡΙΟΤΟ  | 1650 |
|   |     |  | PLOTS  | 1651 |
|   | 140 | 12 (MODICI (NAP-1)/KINC)+IABS(LIN))+NE+0) GO TO 150  | PIOTS  | 1652 |
|   |     |  | PLOTS  | 1653 |
|   |     | CALL DECH (NAIWO,NYIWO,0+KSYM,1)   | PLOTS  | 1654 |
|   |     | CALL EVH   | PLOTS  | 1655 |
|   |     | GO TO 200  | PLOTS  | 1656 |
|   | 150 | IF (B.FD.0.) GO TO 200   | PLOTS  | 1657 |
|   | 160 | $D_{0} 1 = 1 + 4$  | PIOTS  | 165A |
|   | 170 | CALI PIT (NXTWO,NYTWO,42)  | PLOTS  | 1659 |
|   |     | GO T <sup>O</sup> 200  | PLOTS  | 1660 |
|   | 180 | IF (B.FD.O.) CALL DRV (NXONE+NYONE+NXTWO+NYTWO)  | PLOTS  | 1661 |
|   | 190 | IF (LIN.NE.0) GO TO 149  | PLOTS  | 1662 |
|   |     | IF ( <sup>H</sup> .NF.0.) GO TO 160  | PLOTS  | 1663 |
|   | 200 | NYONE=NYTWO  | PLOTS  | 1664 |
|   |     |  | PLOTS  | 1665 |
|   | 210 | CONTINUE   | PLOTS  | 1664 |
|   | 250 | RETHRN   |        | 1667 |
|   |     | ENO  |        | 1669 |
|   |     | SUBROUTINE TRCJB(X+Y+DX+DY+NOC+ZPLAN+ZX+ZV+ZY)   | PLOTS  | 1660 |
|   |     | COMMON /CNTRCOM/ ISYM (50) +SCFAC  | PLOTS  | 1670 |
|   |     | DIMENSTON XP (2,50) + YP (2,50) + ZT (4) + ZP (AN (1)  | PLOTS  | 1671 |
|   |     | 21(1)=7X   | P1,013 | 1071 |
|   |     | 21(2)=2  | PLOIS  | 1072 |
|   |     | Z f(a) = zY  | PLOIS  | 1073 |
|   |     | 27(4) = 7 ×  | PLUIS  | 10/4 |
|   |     | $Z_{TMT}N = AMIN1(ZT(1), ZT(2), ZT(3))$  | PLOTS  | 10/5 |
|   |     | 2 TMAX = AMAX1(2T(1)) + 2T(2) + 2T(3)  | PLOTS  | 10/6 |
|   |     |  | P[013  | 16/7 |
|   |     |  | PLOTS  | 1674 |
|   |     |  | PLOTS  | 16/9 |
|   |     |  | PLOTS  | 1689 |
|   |     | F (2P) AN(1) AF (2TMTN) TMTN = 1   | PLOTS  | 1681 |
|   |     |  | PLOTS  | 1692 |
|   | 10  |  | PLOTS  | 1683 |
|   | 10  |  | PLOTS  | 1684 |
|   |     | TE (INTAL TABOR ZIMIN EQ. ZIMAN) CO. TO DOG  | PLOTS  | 1685 |
|   |     | 12-1   | PLOTS  | 1686 |
|   |     |  | P1_0TS | 1687 |
|   |     |  | PLOTS  | 1688 |
|   |     |  | PLOTS  | 1689 |
|   |     | 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -  | PLOTS  | 1690 |
|   |     | MIN=NCC+1  | PLOTS  | 1691 |
|   |     |  | PLOTS  | 1692 |
|   |     |  | PLOTS  | I693 |
|   |     |  | PIOTS  | 1694 |
|   |     | IF (2PLAN(INZ).GT.ZPMIN.OR. (ZPLAN(INZ).ER.ZPMIN.AND.ZTMIN.FR.ZPMIN  | PLOTS  | 1695 |
|   | 1   | )) MIN=INZ   | PIOTS  | 1696 |
|   |     | IF (ZPLAN(J).LE.ZTMAX) MAX=J   | PLOTS  | 1697 |
|   | 20  | CONTINUE   | PLOTS  | 1699 |
|   |     | INZ=MAX-MIN_   | PLOTS  | 1690 |
|   |     | IF ( <sup>1</sup> N7+LT+ <sup>0</sup> +OR+ZTMAX+FQ+ZPMIN) GO TO 110  | PLOTS  | 1700 |
|   |     | IF $(IN_7 - IN_7) = 40 + 30 + 40$  | PLOTS  | 1701 |
|   |     |  |        |      |

-

.

•

•

| 30  | 60 T <sup>0</sup> (30,40), 12  | PLOTS        | 1702 |
|-----|--|--------------|------|
| 40  | I2=1   | PLOTS        | 1703 |
|     | GO TU KO   | PLOTS        | 1704 |
| 50  | I2=2   | PLOTS        | 1705 |
| 60  | DO 100 J=MIN+MAX   | PLOTS        | 1796 |
|     | GO T <sup>O</sup> (70,80,90), K  | PLOTS        | 1707 |
| 70  | XP(τ²+,)=X+DX+(ZPLAN(J)-ZT(2))/(ZT(1)-ZT(2))   | PLOTS        | 1708 |
|     | YP (T <sup>2</sup> +.))=Y  | PLOTS        | 1709 |
|     | GO τ <sup>U</sup> in0  | PLOTS        | 1710 |
| 80  | XP(T <sup>2</sup> , 1)=X   | PLOTS        | 1711 |
|     | YP(T <sup>2</sup> •.)=Y+OY#(ZPLAN(J)=ZT(2))/(ZT(3)=ZT(2))  | PLOTS        | 1712 |
|     | GO TU. jon   | PLOTS        | 1713 |
| 90  | XP(T2+1)=X+DX*(ZPLAN(J)-ZT(3))/(ZT(1)-ZT(3))   | ΡΙ.ΟΤΣ       | 1714 |
|     | YP(j <sup>2</sup> ,j)=Y+DY*(ZPLAN(,j)-ZT(1))/(ZT(3)-ZT(1))   | PLOTS        | 1715 |
| 100 | CONTINUE   | PLOTS        | 1716 |
| 110 | CONTINIE   | PLOTS        | 1717 |
|     | DO 120 J=IMIN+IMAX   | PLOTS        | 1718 |
|     | 1SYN(J)=ISYM(J)+I  | PLOTS        | 1719 |
|     | L=3  | PLOTS        | 1720 |
|     | IF $(MO_{D}(ISYM(J)+10) \cdot NF \cdot 1) L=0$   | PLOTS        | 1721 |
|     | CALI PIJB (XP(1+J)+YP(1+J)+2+1+L+=J+0+0+0+0+0+0+0+0)   | PLOTS        | 1/22 |
| 120 | CONTINIE   | P1 015       | 1/23 |
| 130 |  | PLOTS        | 1724 |
|     |  | PLOTS        | 1725 |
| ,   |  | PLOIS        | 1727 |
|     |  | PLOIS        | 1121 |
|     | DIMENSION F(1), X(1), Y(1), AA(1), AB(1), RA(1), RR(1)   | P1 015       | 1/28 |
|     | YT=SIN(ANGT) #AMULX  | PLOIS        | 17-4 |
|     |  |              | 1730 |
|     |  |              | 1731 |
|     | APECVS (ANGEL * AMOLIT<br>VTG VTLV/IV)   |              | 1732 |
|     |  |              | 1734 |
|     |  |              | 1735 |
|     |  | PLOTS        | 1736 |
|     |  | PLOTS        | 1737 |
|     | EA=?•  | PLOTS        | 173a |
|     | EB=I <sup>0</sup> 00   | PLOTS        | 1739 |
|     |  | PLOTS        | 1740 |
|     | L=I  | PLOTS        | 1741 |
|     |  | PIOTS        | 1742 |
|     | $E \simeq F(L_1 = X(I) * YT = Y(J) * YP$   | PLOTS        | 1743 |
|     | EA=AMAX1(EA+E)   | PLOTS        | 1744 |
|     | EB=^M1N1(EB+E)   | PLOTS        | 1745 |
| 10  | L=L+IX   | PLOTS        | 1746 |
|     | YC=YT8+YPB   | PLOTS        | 1747 |
|     | IF (EB) 20,40,40   | PLOTS        | 1748 |
| 20  | DIF=YC+EB  | P1 OTS       | 1/49 |
| -   | IF (U(F) 30+40+40  | PLOTS        | 1/50 |
| 30  |  | PLOTS        | 1/51 |
|     |  | PL013        | 1752 |
| 40  |  | P1 015       | 1753 |
| 24  | $\frac{1}{10} = \frac{1}{10} $ |              | 1756 |
|     | $CA_{1} = CA_{1} = C$   |              | 1756 |
|     | VN-VHANTH  | PLOTS        | 1757 |
|     | ΤΔ=τΧω   | PLOTS        | 1750 |
|     |  |              | 1750 |
|     |  | PLOTS        | 1760 |
|     | $\Delta \Delta (T) = \gamma T H - X T + X (T)$   | PLOTS        | 1761 |
|     | $AB(T) = \gamma PB + AA(T)$  | PLOTS        | 1762 |
|     | $R_{\rm H} (1) = V (1 + Y + X (1))$  | PLOTS        | 1763 |
| 60  | $H_{A(T)} = VP8 + RB(I)$   | PLOTS        | 1764 |
| 50  | ···· · · · · · · · · · · · · · · · · ·   | <b>1</b> . • |      |

\$

•

|   |     | CALL PLOT (IX+AA+1+RA-1+32+0)  |
|---|-----|--|
|   |     | CALI PLOT (IX+A8+1+R8+1+32+1)  |
|   |     | YE=yd+yPB  |
|   |     | 00 70 j=1,JY   |
|   |     | AA(j) = yP + Y(J)  |
|   |     | AB(J) = yTB + AA(J)  |
|   |     | RA(J) = yE = YP + Y(J)   |
|   | 70  | $R_{B}(J) = \gamma T B + R_{A}(J)$   |
|   |     | CALI PIOT (JY+AA+1+RA+1+32+1)  |
|   |     | CALI PLOT (JY+AB+1+RB+1+32+0)  |
|   |     | ZH=, US +EA  |
|   |     | YF=YC+yB   |
|   |     | DO RO   =1+21  |
|   |     | AA(i) = XTB  |
|   |     | $RA(I) = \gamma F + ZH + FLDAT(L-1)$   |
|   | 80  | CONTINUE   |
|   |     | CALI PLOT (21+AA+1+RA,1+32,1)  |
|   |     | 00 100 I=1+IX  |
|   |     |  |
|   |     | UO  9U  j=1, JY  |
|   |     |  |
|   | ~ ~ | RA())=YF=X(I)+YT=Y(J)+YP+F(L)  |
|   | 90  |  |
|   | 100 | CALL PLOI (JY+AA+1+RA+1+42+1)  |
|   | 100 |  |
|   |     | 00 120 J=1+JY  |
|   |     | $DO  1 = 0  C = 1 + C \times C$  |
|   |     | AA(T)=yT8=x(I)+xT+y(J)+xP  |
|   |     | RA(T) = vF = X(I) + YT = Y(J) + YP + F(L)  |
|   | 110 | L=L+I  |
|   |     | CALI PLOT (IX+AA+1+RA+1+42+1)  |
|   | 120 | CONTINUE   |
|   |     | CA=>2.+(XP8+.5#XTB)#113./XA  |
|   |     | $CA=A^{M}INI(CA-116.0)$  |
|   |     |  |
|   |     | UC=Y+H#113./XA   |
|   |     | $\frac{1}{1} \frac{1}{1} \frac{1}$ |
|   |     | TTY-Rph16_0+8_0  |
|   |     | IRB=IFTX(T1Y1  |
|   |     | $TIY = RA \neq 16 \cdot 0 = 8 \cdot 0$   |
|   |     | IRA=1FTX(TIY)  |
|   |     | TIX=CC+8.0-4.0   |
|   |     | ICC+IFTX(TIX)  |
|   |     | TIX=CB+8.0-4.0   |
|   |     | ICB=IFIX(T1X1  |
| С |     | RETURN WITHOUT ADVANCE OF THE FRAME.   |
|   |     | RETHRN   |
|   |     | END  |

| PIOTS  | 1765    |
|--------|---------|
| PLOTS  | 1766    |
| PLOTS  | 1767    |
| PLOTS  | 1768    |
| PLOTS  | 1769    |
| PLOTS  | 1770    |
|        | 1771    |
| PLOTS  | 1773    |
| PLOTS  | 1773    |
|        | 177     |
|        | 1775    |
|        | 1774    |
| PLOTS  | 1777    |
| PLOTS  | 1778    |
| PLOTS  | 1770    |
| PLOTS  | 1780    |
| PLOTS  | 1781    |
| PLOTS  | 1784    |
|        | 1782    |
|        | .70     |
|        | 1795    |
|        | 1705    |
| PLOTS  | 1700    |
| PL013  | 1707    |
| PLOTS  | 1786    |
| PLOIS  | 1770    |
| P1013  | 1/90    |
| PLOTS  | 1/91    |
| PLOIS  | 1792    |
| P[,015 | 1793    |
| PLOIS  | 1794    |
|        | 177     |
|        | 177     |
| PLOTS  | 177     |
|        | 1776    |
| PLUIS  | 1 9 9 9 |
|        | 1000    |
| PLOTS  | 1803    |
|        | 1002    |
| PLOTS  | 100     |
|        | 1805    |
| PLOTS  | 1804    |
|        | 1005    |
|        | 1800    |
|        | 1804    |
| PLOTS  | 1004    |
|        | 1010    |
| PLOTS  | 1812    |
| PLOTS  | 1815    |
| PLOTS  | 1812    |
| FLUIS  | 1014    |

COPYSE

. END OF FILE

#### APPENDIX E

#### COMPARISON OF FRACTION IN COOLANT AND CUMULATIVE RELEASE AT TWO HOURS

٢

•.

Calculations for  $^{131}$ I were made for the Ft. St. Vrain fuel model (MFUEL = 1) with an average age of 2.5 yr (AGE = 2.5) and the fuel was not aged (LAGE = F). A BISO-TRISO mixture (0.06, 0.04) was used (FRAC = 0.6). Six partitions of the core volume IC = 1, 5, 10, 25, 100, 200 and five partitions of the 20-h time period IT = 20, 40, 100, 300, 500 were used. The four temperature models SORS, CORCON, AYER, and AYER Fu-Cort (ITEMP = 1, 2, 3, 4) and the four equation models, Simplified Model Equation-Renormalized, Constant Release-Renormalized, Linear Release-Renormalized, Intact-Failed Self-Consistent fuel transition (NEQ = 1, 2, 3, 4) were used. The most sensitive test of these 320 calculations was the comparison of the fraction in the coolant and the cumulative release at 2-h time.

In Tables E.I through E.XXVIII we exhibit a summary of these results at 2 h. We note that the maximum variation between (IT, IC) of (100, 100) and 500,200) for the  $^{131}$ I fraction release in the coolant is 20% for any temperature model, whereas the various temperature models differ by as much as a factor of 3.73 (NEQ = 4; ITEMP = 1,3; IT = 500, IC = 200).

A similar remark holds for the cumulative release where the maximum variation between (IT, IC) of (100,100) and (500,200) for the  $^{131}$ I cumulative release is about 19%, whereas the various temperature models differ by as much as a factor of 3.03 (NEQ = 4, ITEMP = 1,3; IT = 100, IC = 100).

It should be noted that we are comparing the fraction at the  $10^{-4}$  level and the release at less than the 1 Ci level here.

| TABLE | E.I |
|-------|-----|
|-------|-----|

| IC  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 1.38 | 1.14 | 1.26 | 1.38 | 1.41 |
| 5   | 1.75 | 1.97 | 3.17 | 3.70 | 3.80 |
| 10  | 1.85 | 2.91 | 4.15 | 4.78 | 4.91 |
| 25  | 1.95 | 3.36 | 4.75 | 5.43 | 5.57 |
| 100 | 2.09 | 3.78 | 5.22 | 5.89 | 6.03 |
| 200 | 2.12 | 3.82 | 5.26 | 5.92 | 6.06 |

<sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 1, NEQ = 1, 2

TABLE E.II 131 I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 1, NEQ = 3

| IT  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 1.38 | 1.14 | 1.26 | 1.38 | 1.41 |
| 5   | 1.75 | 1.97 | 3.17 | 3.70 | 3.80 |
| 10  | 1.85 | 2.91 | 4.15 | 4.78 | 4.91 |
| 25  | 1.95 | 3.36 | 4.75 | 5.43 | 5.57 |
| 100 | 2.09 | 3.78 | 5.22 | 5.89 | 6.03 |
| 200 | 2.12 | 3.81 | 5.26 | 5.92 | 6.06 |

TABLE E.III 131 I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 1, NEQ = 4

| IC  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 2.24 | 1.67 | 1.50 | 1.46 | 1.45 |
| 5   | 5.49 | 4.11 | 4.01 | 3.98 | 3.97 |
| 10  | 6.59 | 5.39 | 5.14 | 5.11 | 5.11 |
| 25  | 7.14 | 5.99 | 5.79 | 5.78 | 5.78 |
| 100 | 7.48 | 6.44 | 6.26 | 6.24 | 6.24 |
| 200 | 7.51 | 6.47 | 6.30 | 6.27 | 6.27 |

| IT<br>IC | 20   | 40   | 100  | 300  | 500  |
|----------|------|------|------|------|------|
| 1        | 0.85 | 0.76 | 0.74 | 0.74 | 0.74 |
| 5        | 1.03 | 0.98 | 1.02 | 1.05 | 1.06 |
| 10       | 1.08 | 1.10 | 1.24 | 1.32 | 1.34 |
| 25       | 1.14 | 1.25 | 1.42 | 1.51 | 1.53 |
| 100      | 1.20 | 1.37 | 1.57 | 1.68 | 1.70 |
| 200      | 1.21 | 1.38 | 1.58 | 1.69 | 1.71 |

TABLE E.IV <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 2, NEQ = 1,2

۲

TABLE E.V 131 FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 2, NEQ = 3

| IT  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.85 | 0.76 | 0.74 | 0.74 | 0.74 |
| 5   | 1.03 | 0.98 | 1.02 | 1.05 | 1.06 |
| 10  | 1.08 | 1.10 | 1.24 | 1.32 | 1.34 |
| 25  | 1.14 | 1.25 | 1.42 | 1.51 | 1.53 |
| 100 | 1.20 | 1.37 | 1.57 | 1.68 | 1.70 |
| 200 | 1.21 | 1.38 | 1.58 | 1.69 | 1.71 |

TABLE E.VI <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2h ITEMP = 2, NEQ = 4

| IT  |      | • • • • • <u>u</u> |      |      |      |
|-----|------|--------------------|------|------|------|
| IC  | 20   | 40                 | 100  | 300  | 500  |
| 1   | 0.85 | 0.76               | 0.74 | 0.74 | 0.74 |
| 5   | 1.36 | 1.16               | 1.10 | 1.08 | 1.08 |
| 10  | 1.69 | 1.44               | 1.37 | 1.38 | 1.37 |
| 25  | 1.89 | 1.64               | 1.58 | 1.36 | 1.56 |
| 100 | 2.05 | 1.81               | 1.75 | 1.74 | 1.74 |
| 200 | 2.06 | 1.82               | 1.76 | 1.75 | 1.75 |

| IC  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.93 | 0.81 | 0.78 | 0.78 | 0.78 |
| 5   | 1.08 | 0.95 | 1.05 | 1.14 | 1.16 |
| 10  | 1.11 | 1.05 | 1.24 | 1.36 | 1.38 |
| 25  | 1.13 | 1.10 | 1.35 | 1.48 | 1.51 |
| 100 | 1.14 | 1.18 | 1.44 | 1.59 | 1.62 |
| 200 | 1.14 | 1.18 | 1.45 | 1.60 | 1.63 |

TABLE E.VII 131 FRACTION IN COOLANT  $\times 10^4$  at 2 h ITEMP = 3, NEQ = 1,2

٠

.

TABLE E.VIII <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 3, NEQ = .3

| IT  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.93 | 0.81 | 0.78 | 0.78 | 0.78 |
| 5   | 1.08 | 0.95 | 1.05 | 1.14 | 1.16 |
| 10  | 1.11 | 1.05 | 1.24 | 1.36 | 1.38 |
| 25  | 1.13 | 1.10 | 1.35 | 1.48 | 1.51 |
| 100 | 1.14 | 1.18 | 1.44 | 1.59 | 1.62 |
| 200 | 1.14 | 1.18 | 1.45 | 1.60 | 1.63 |

TABLE E.IX <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2h ITEMP = 3, NEQ = 4

| IT  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 1.02 | 0.87 | 0.81 | 0.79 | 0.79 |
| 5   | 1.69 | 1.33 | 1.21 | 1.20 | 1.20 |
| 10  | 1.95 | 1.55 | 1.44 | 1.43 | 1.42 |
| 25  | 2.09 | 1.66 | 1.58 | 1.56 | 1.56 |
| 100 | 2.20 | 1.78 | 1.69 | 1.67 | 1.67 |
| 200 | 2.21 | 1.79 | 1.69 | 1.68 | 1.68 |

| IT  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.94 | 0.84 | 0.81 | 0.81 | 0.81 |
| 5   | 1.25 | 1.41 | 1.94 | 2.20 | 2.26 |
| 10  | 1.26 | 1.48 | 2.07 | 2.36 | 2.42 |
| 25  | 1.27 | 1.55 | 2.15 | 2.45 | 2.51 |
| 100 | 1.28 | 1.59 | 2.20 | 2.51 | 2.57 |
| 200 | 1.28 | 1.59 | 2.20 | 2.51 | 2.57 |

TABLE E.X <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 4, NEQ = 1,2

.

4

بر

z

TABLE E.XI 131 I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 4, NEQ = 3

| IC  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.94 | 0.84 | 0.81 | 0.81 | 0.81 |
| 5   | 1.25 | 1.41 | 1.94 | 2.20 | 2.26 |
| 10  | 1.26 | 1.48 | 2.07 | 2.36 | 2.42 |
| 25  | 1.27 | 1.55 | 2.15 | 2.45 | 2.51 |
| 100 | 1.28 | 1.59 | 2.20 | 2.51 | 2.57 |
| 200 | 1.28 | 1.59 | 2.20 | 2.51 | 2.57 |

TABLE E.XII <sup>131</sup>I FRACTION IN COOLANT x  $10^4$  at 2 h ITEMP = 4, NEQ = 3

| IC  | 20   | 40   | 100  | 300  | 500  |
|-----|------|------|------|------|------|
| 1   | 0.97 | 0.86 | 0.82 | 0.81 | 0.81 |
| 5   | 3.12 | 2.46 | 2.37 | 2.35 | 2.34 |
| 10  | 3.30 | 2.62 | 2.53 | 2.51 | 2.51 |
| 25  | 3.40 | 2.73 | 2.63 | 2.61 | 2.61 |
| 100 | 3.47 | 2.79 | 2.69 | 2.67 | 2.67 |
| 200 | 3.47 | 2.80 | 2.69 | 2.67 | 2.67 |

# TABLE E.XIII

1

## 131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 1, NEQ = 1

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.187 | 0.125 | 0.114 | 0.114 | 0.115 |
| 5   | 0.238 | 0.195 | 0.220 | 0.238 | 0.244 |
| 10  | 0.251 | 0.264 | 0.284 | 0.309 | 0.316 |
| 25  | 0.265 | 0.299 | 0.325 | 0.355 | 0.363 |
| 100 | 0.282 | 0.332 | 0.362 | 0.393 | 0.401 |
| 200 | 0.286 | 0.335 | 0.364 | 0.395 | 0.403 |

#### TABLE E.XIV

# 131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 1, NEQ = 2

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.187 | 0.125 | 0.114 | 0.114 | 0.115 |
| 5   | 0.238 | 0.195 | 0.220 | 0.238 | 0.244 |
| 10  | 0.251 | 0.264 | 0.284 | 0.309 | 0.316 |
| 25  | 0.265 | 0.299 | 0.325 | 0.335 | 0.363 |
| 100 | 0.282 | 0.332 | 0.362 | 0.393 | 0.401 |
| 200 | 0.286 | 0.335 | 0.364 | 0.395 | 0.402 |

## TABLE E.XV

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.151 | 0.115 | 0.112 | 0.113 | 0.115 |
| 5   | 0.191 | 0.177 | 0.215 | 0.238 | 0.243 |
| 10  | 0.201 | 0.237 | 0.277 | 0.308 | 0.316 |
| 25  | 0.212 | 0.266 | 0.317 | 0.354 | 0.362 |
| 100 | 0.226 | 0.295 | 0.353 | 0.391 | 0.400 |
| 200 | 0.228 | 0.298 | 0.355 | 0.394 | 0.403 |

# 131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 1, NEQ = 3

# TABLE E.XVI

131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 1, NEQ = 4

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.263 | 0.151 | 0.122 | 0.117 | 0.116 |
| 5   | 0.566 | 0.309 | 0.265 | 0.254 | 0.253 |
| 10  | 0.677 | 0.411 | 0.341 | 0.329 | 0.328 |
| 25  | 0.720 | 0.461 | 0.389 | 0.378 | 0.377 |
| 100 | 0.756 | 0.501 | 0.429 | 0.416 | 0.415 |
| 200 | 0.760 | 0.505 | 0.432 | 0.419 | 0.418 |

## TABLE E.XVII

à

# <sup>131</sup>I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 2, NEQ = 1

| IC  | 20    | 40    | 100   | 300            | 500                     |
|-----|-------|-------|-------|----------------|-------------------------|
| 1   | 0.129 | 0.102 | 0.096 | 0.095          | 0.095                   |
| 5   | 0.157 | 0.127 | 0.121 | 0.121          | 0.122                   |
| 10  | 0.163 | 0.138 | 0.136 | 0.139<br>0.155 | 0.140<br>0.156<br>0.171 |
| 25  | 0.172 | 0.151 | 0.151 |                |                         |
| 100 | 0.179 | 0.161 | 0.164 | 0.169          |                         |
| 200 | 0.180 | 0.162 | 0.165 | 0.171          | 0.172                   |

## TABLE E.XVIII

<sup>131</sup>I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 2, NEQ = 2

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.129 | 0.102 | 0.096 | 0.095 | 0.095 |
| 5   | 0.157 | 0.127 | 0.121 | 0.121 | 0.122 |
| 10  | 0.163 | 0.138 | 0.136 | 0.139 | 0.140 |
| 25  | 0.172 | 0.151 | 0.151 | 0.155 | 0.156 |
| 100 | 0.179 | 0.161 | 0.164 | 0.169 | 0.171 |
| 200 | 0.180 | 0.162 | 0.165 | 0.171 | 0.172 |
| 4   |       |       |       |       |       |

## TABLE E.XIX

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.115 | 0.099 | 0.095 | 0.095 | 0.095 |
| 5   | 0.139 | 0.122 | 0.120 | 0.121 | 0.122 |
| 10  | 0.145 | 0.132 | 0.135 | 0.139 | 0.140 |
| 25  | 0.152 | 0.144 | 0.149 | 0.155 | 0.156 |
| 100 | 0.158 | 0.154 | 0.162 | 0.169 | 0.171 |
| 200 | 0.159 | 0.155 | 0.163 | 0.170 | 0.172 |

## 131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 2, NEQ = 3

\$

7

\*

#### TABLE E.XX

<sup>131</sup>I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 2, NEQ = 4

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.129 | 0.102 | 0.096 | 0.095 | 0.095 |
| 5   | 0.186 | 0.137 | 0.125 | 0.123 | 0.122 |
| 10  | 0.217 | 0.158 | 0.144 | 0.142 | 0.142 |
| 25  | 0.238 | 0.177 | 0.161 | 0.159 | 0.158 |
| 100 | 0.255 | 0.192 | 0.177 | 0.174 | 0.174 |
| 200 | 0.257 | 0.194 | 0.178 | 0.175 | 0.175 |
|     |       |       |       |       |       |

## TABLE E.XXI

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.132 | 0.099 | 0.089 | 0.088 | 0.087 |
| 5   | 0.152 | 0.113 | 0.107 | 0.108 | 0.108 |
| 10  | 0.157 | 0.121 | 0.116 | 0.119 | 0.120 |
| 25  | 0.159 | 0.125 | 0.123 | 0.127 | 0.128 |
| 100 | 0.160 | 0.131 | 0.129 | 0.133 | 0.135 |
| 200 | 0.161 | 0.131 | 0.129 | 0.134 | 0.135 |

## 131 I CUMULATIVE RELEASE (Ci) at 2 h ITEMP = 3, NEQ = 1

7

٢

3

TABLE E.XXII

131
I CUMULATIVE RELEASE (Ci) at 2 h
ITEMP = 3, NEQ = 2

| IT  | 20    | 40    | 100 300 |       | 500   |
|-----|-------|-------|---------|-------|-------|
| 1   | 0.132 | 0.099 | 0.089   | 0.088 | 0.087 |
| 5   | 0.153 | 0.113 | 0.107   | 0.108 | 0.108 |
| 10  | 0.157 | 0.121 | 0.116   | 0.119 | 0.120 |
| 25  | 0.159 | 0.125 | 0.123   | 0.127 | 0.128 |
| 100 | 0.161 | 0.131 | 0.129   | 0.133 | 0.135 |
| 200 | 0.161 | 0.131 | 0.129   | 0.134 | 0.135 |

# TABLE E.XXIII

| 131 |            |    |     |     |     |    |    |   |   |
|-----|------------|----|-----|-----|-----|----|----|---|---|
| I   | CUMULATIVE | RJ | ELE | ASE | (Ci | i) | at | 2 | h |
|     | ITEMP      | =  | 3,  | NEQ | =   | 3  |    |   |   |

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.111 | 0.093 | 0.088 | 0.087 | 0.087 |
| 5   | 0.127 | 0.106 | 0.106 | 0.108 | 0.108 |
| 10  | 0.131 | 0.114 | 0.115 | 0.119 | 0.120 |
| 25  | 0.132 | 0.116 | 0.121 | 0.127 | 0.128 |
| 100 | 0.134 | 0.122 | 0.127 | 0.133 | 0.135 |
| 200 | 0.134 | 0.122 | 0.127 | 0.134 | 0.135 |

TABLE E.XXIV

.

131 I CUMULATIVE RELEASE (Ci) at 2 h ITEMP = 3, NEQ = 4

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.140 | 0.102 | 0.090 | 0.088 | 0.088 |
| 5   | 0.207 | 0.132 | 0.113 | 0.110 | 0.110 |
| 10  | 0.231 | 0.147 | 0.126 | 0.122 | 0.122 |
| 25  | 0.244 | 0.155 | 0.135 | 0.131 | 0.131 |
| 100 | 0.254 | 0.164 | 0.142 | 0.138 | 0.138 |
| 200 | 0.255 | 0.165 | 0.142 | 0.138 | 0.138 |

2

## TABLE E.XXV

## 131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 4, NEQ = 1

| IT  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.139 | 0.110 | 0.102 | 0.100 | 0.100 |
| 5   | 0.182 | 0.162 | 0.170 | 0.181 | 0.183 |
| 10  | 0.184 | 0.167 | 0.178 | 0.189 | 0.192 |
| 25  | 0.185 | 0.172 | 0.183 | 0.195 | 0.198 |
| 100 | 0.186 | 0.175 | 0.186 | 0.198 | 0.202 |
| 200 | 0.186 | 0.175 | 0.186 | 0.198 | 0.202 |

## TABLE E.XXVI

<sup>131</sup>I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 4, NEQ = 2

| 0.100 |
|-------|
| 0.183 |
| 0.192 |
| 0.198 |
| 0.202 |
| 0.202 |
|       |

#### TABLE E.XXVII

|     | IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-----|-------|-------|-------|-------|-------|
|     | 1   | 0.120 | 0.105 | 0.101 | 0.100 | 0.100 |
|     | 5   | 0.156 | 0.152 | 0.168 | 0.180 | 0.183 |
|     | 10  | 0.157 | 0.156 | 0.176 | 0.189 | 0.192 |
|     | 25  | 0.158 | 0.161 | 0.180 | 0.195 | 0.198 |
|     | 100 | 0.159 | 0.163 | 0.183 | 0.198 | 0.201 |
| 1   | 200 | 0.159 | 0.163 | 0.183 | 0.198 | 0.202 |
| - 1 | 4   |       |       |       |       |       |

<sup>131</sup>I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 4, NEQ = 3

5

#### TABLE E.XXVIII

131 I CUMULATIVE RELEASE (Ci) AT 2 h ITEMP = 4, NEQ = 4

| IC  | 20    | 40    | 100   | 300   | 500   |
|-----|-------|-------|-------|-------|-------|
| 1   | 0.142 | 0.111 | 0.102 | 0.101 | 0.100 |
| 5   | 0.346 | 0.220 | 0.194 | 0.189 | 0.189 |
| 10  | 0.362 | 0.231 | 0.204 | 0.199 | 0.198 |
| 25  | 0.372 | 0.240 | 0.210 | 0.205 | 0.204 |
| 100 | 0.378 | 0.244 | 0.214 | 0.208 | 0.208 |
| 200 | 0.378 | 0.244 | 0.214 | 0.208 | 0.208 |

AU.S. GOVERNMENT PRINTING OFFICE: 1978-777-018/14