MIDDLE SOUTH SERVICES, INC./BOX 61000/NEW ORLEANS, LA. 70161/(504) 529-5262

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January 5, 1983

Mr. Cecil O. Thomas, Chief
Standardization and Special
Projects Branch
Division of Licensing
U. S. Nuclear Regulatory
Commission
Washington D. C. 20555

SUBJECT: Request Number 2 for Additional Information on RETRAN-.01

Dear Mr. Thomas:

Attached are the responses to the questions transmitted via your letter of October 15, 1982. You should be aware that although your letter referenced EPRI NP-1850-CCM (RETRAN-02 Manual), the questions themselves referenced, through the equation numbers, EPRI CCM-5 (RETRAN-01 Manual). The responses to the questions, therefore, are based on EPRI CCM-5 and not on EPRI NP-1850-CCM.

Should you have any questions, please give me or Mr. Tom Temple a call at (504) 569-4568.

Sincerely,

Thomas W. Schnatz

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TWS/TLT/rjm

cc: Mr. J. Carter
Mr. P Abramson
Mr. G. Perry
Mr. P. Bergeron
Mr. R. Cross

File: 041-01
066-31

Y601

CHAPTER VIII. Numerical Solution Methods

(1) Explain the order of the operators on the right hand side of eq. (VIII.1-7).

(1) This question addresses the same item as Question VIII-1 of the NRC Request Number 1. See the response for that question.

(2) (a) How is the F_j^n term in the momentum equation, eq. (VIII.1-9) derived?

(b) Why are there no cosine factors for the gravity term?

(c) Justify the second term. Define S_{gn}?

(2a) This question addresses the same item as Question VIII-2 of the NRC Request Number 1. See the response for that question.

(2b) This question addresses the same item as Question VIII-2 of the NRC Request Number 1. See the response for that question.

(2c) This term represents the junction form losses. $Sgn(W_j)$ signifies the sign attached to W_j.

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RETRAN-01 REVIEW

At the request of the Electric Power Research Institute, Energy Incorporated has reviewed the questions submitted by the U. S. Nuclear Regulatory Commission[1] to the Utility Group for Regulatory Application. The information requested in Reference 1 is associated with the RETRAN-01 Theory Manual[2].

Many questions in Reference 1 are the same as had been posed previously[3] for the RETRAN-02 Theory Manual[4], except that the references (e.g., equation numbers) are for the RETRAN-01 Manual[2] instead of the RETRAN-02 Manual[4]. Since questions of this type have been answered previously[5], the response presented in this enclosure indicates the response to the corresponding question given in Reference 5. In these cases, reference is made to ".... Question I-A of the NRC Request Number 1."

REFERENCES

(1) Miller, J. R., "Request Number 2 for Additional Information on EPRI NP-1850-CCM", USNRC letter to T. W. Schnatz, UGRA, October 15, 1982.

(2) Moore, K. V. et al., "RETRAN - A Program for One-Dimensional Transient Thermal-Hydraulic Analysis of Complex Fluid Flow Systems", Vol. I, EPRI CCM-5, December 1978.

(3) Miller, J. R., "Request Number 1 for Additional Information on EPRI NP-1850-CCM", USNRC letter to T. W. Schnatz, UGRA, March 8, 1982.

(4) McFadden, J. H. et al., "RETRAN-02 - A Program for Transient Thermal-Hydraulic Analysis of Complex Fluid Flow Systems", Vol. I, EPRI NP-1850-CCM, May 1981.

(5) hantz, T. W., "Request Number 1 for Additional Information on EPRI NP-1850-CCM", UGRA letter to J. R. Miller, USNRC, July 30, 1982.

CHAPTER II. Fluid Differential and State Equation

(1) Is the sign of the stress term $(\bar{\bar{T}} \cdot \tilde{v})$ of equation (II.1-20) correct?

(1) This question addresses the same item as Questions II-1 and II-2 of of the NRC Request Number 1. See the response for those questions.

(2) Are there errors in equation (II.1-25) and equation (II.2-30)?

(2) Equations II.1-25 and II.2-30 are correct. There is an error in Eq. II.1-20 as noted in the response to Question 1.

(3) In RETRAN is cos α of equation (II.2-11) always ±1?

(3) This question addresses the same item as Question II-4 of the NRC Request Number 1. See the response for that question.

(4) Summarize the layout of the two geometrical meshes, the momentum cell mesh and the energy/mass mesh and illustrate how the junciton angle for the vector momentum is defined in the generalized geometry.

(4) The vector model is not in RETRAN-01.

(5) How is $\tilde{A}$ oriented with respect to the channel walls in the macroscopic momentum equation? Reference should be made to equation #(3) which poses the problem of the mass balance equation.

(5) This question addresses the same item as Question II-13b of the NRC Request Number 1. See the response for that question.

(6) The term F_{loc} is missing from equation (II.3-5). Why?

(6) Equation II.3-5 is a mass balance equation.

(7) Is there a typographical error in equation (II.3-17)?

(7) Yes, the equation should be

$$\frac{1}{A_k}\frac{d}{dt}\int_{1/2\ V_k} \rho v\ dV + \frac{1}{A_{k+1}}\frac{d}{dt}\int_{1/2\ V_{k+1}} \rho v\ dV = \bar{\rho}_k v_k^2 - \bar{\rho}_{k+1} v_{k+1}^2 + p_k - p_{k+1}$$

$$- \frac{1}{A_k} F_{w,i} - \frac{1}{A_{k+1}} F_{w,i+1} - \frac{1}{A_k} \bar{M}_{1/2\ V_k}\left(g_{z,k}\right) - \frac{1}{A_{k+1}} \bar{M}_{1/2\ V_{k+1}}\left(g_{z,k+1}\right)$$

$$+ \rho_i^+(v_i^+)^2 - \rho_i^-(v_i^-)^2 + p_i^+ - p_i^- \ . \qquad \text{(II.3-17)}$$

(8) Is the sign of the next to the last term in the right-hand side of equation (II.3-18) correct?

(8) Yes, it is correct.

(9) (a) In the variable channel area momentum balance equation, equation (II.3-23), the $F_{w,\,i+1}$ term needs to be corrected.

(b) Is there a typographical error in the last term of the right hand side.

(9) a) Yes, this term should be preceded by a "-" sign.

b) Yes, the equation should be

$$\left(\frac{1}{2}\frac{L_k}{A_k} + \frac{1}{2}\frac{L_{k+1}}{A_{k+1}}\right)\frac{dW_i}{dt} = \frac{\bar{W}_k^2}{\bar{\rho}_k A_k^2} - \frac{\bar{W}_{k+1}^2}{\bar{\rho}_{k+1} A_{k+1}^2} + P_k - P_{k+1} - \frac{1}{A_k} F_{w,i}$$

$$- \frac{1}{A_k} F_{w,i+1} - \frac{1}{A_k} \bar{M}_{1/2} V_k \left(g_{z,k}\right) - \frac{1}{A_{k+1}} \bar{M}_{1/2} V_{k+1} \left(g_{z,k+1}\right)$$

$$- \frac{1}{2}\frac{W_i^2}{\rho_i}\left[\frac{1}{A_{k+1}^2} - \frac{1}{A_k^2}\right] - \frac{1}{2} |W_i| W_i \quad \frac{e_v^*}{\rho_i A_i^2} \quad . \qquad \text{(II.3-23)}$$

(10) Show how equation (II.3-29b) is derived. Why is it correct to assume that the flow is isentropic? How is it reincorporated into the final flow equation? There are typographical errors in §3.3.2. Correct.

(10) The compressible flow with area change model discussed in Section III.3.2 of Volume 1 is used only when the sonic choking model is allowed. This model was a carryover from the RELAP4 codes. The option was seldom specified, and when the model was used, it frequently caused difficulties (see Section III.3.1 of the RETRAN-01 Application Manual, EPRI NP-2175). This model was not included in RETRAN-02.

(11) Are there typographical errors in equation (II.3-30)?

(11) Yes, the equation should be

$$\frac{d}{dt}\int_{V_k} \rho(e+\phi)\, dV = -\sum_i \left[\rho u v + \frac{1}{2}\rho v^3 + \rho\phi v + p v\right]_i A_i \cos\alpha_i + Q_{w,k} - \dot{W}_{p,k} \qquad \text{(II.3-30)}$$

(12) In equation (II.3-36), is there a typographical error in the second term of the right hand side?

(12) Yes, the equation should be

$$\frac{dU_k}{dt} = -\frac{1}{2}\frac{L_k}{A_k}\frac{d}{dt}\left(\frac{\bar{W}_k^2}{\bar{\rho}_k}\right) - \sum_i W_i\left[h_i + \frac{1}{2}v_i^2 + g(Z_i - \bar{Z}_k)\right] \qquad \text{(II.3-36)}$$

$$+ Q_{w,k} - \dot{W}_p \; .$$

CHAPTER III. Constitutive Models

(1) The derivation of the mass balance, eq. (III.1-62) as presented in eqs. (III.1-56) - (III.1-61) is incorrect as the 1-D equations used cannot describe a 3-D situation with transverse junctions. A similar comment applies to the derivation for eq. (III.1-67). Discuss.

(1) This question addresses the same item as Question III-2 of the NRC Request Number 1. See the response for that question.

(2) Why do the production terms in eqs. (III.1-66) and (III.1-67) involve m's?

(2) This question addresses the same item as Question III-3 of the NRC Request Number 1. See the response for that question.

(3) The meaning of ϕ, in eq. (III.1-67) is inconsistent with its meaning in eq. (III.1-69). Why is it that in eq. (III.1-67) it is used as an area fraction while in eq. (III.1-69) it is used as a mass fraction?

(3) This question addresses the same item as Question III-4 of the NRC Request Number 1. See the response for that question.

(4) How and where is $\dot{M}_g$ in eq. (III.1-65) for the total steam mass balance determined?

(4) This question addresses the same item as Question III-5 of the NRC Request Number 1. See the response for that question.

(5) How are the inlet junction qualities in eq. (III.1-73) determined?

(5) This question addresses the same item as Question III-6 of the NRC Request Number 1. See the response for that question.

(6) There are errors in eqs. (III.1-79) to (III.1-80), eqs. (III.1-82) to (III.1-85), eq. (III.1-87) and eq. (III.1-89). Correct.

(6) This question addresses the same item as Question III-7 of the NRC Request Number 1. See the response for that question.

(7) Will RETRAN automatically switch between homogeneous and separated models during a transient?

(7) This question addresses the same item as Question III-8 of the NRC Request Number 1. See the response for that question.

(8) How are the control volume momentum and energy balance equations derived in Chapter 2 used in conjunction with the phase separation model?

(8) This question addresses the same item as Question III-9 of the NRC Request Number 1. See the response for that question.

(9) Equation (III.2-37) of the junction enthalpy model assumes that volume average properties are equal to volume center properties. Is the same assumption made for all the thermal/hydraulic macroscopic balance equations?

(9) This question addresses the same item as Question III-10 of the NRC Request Number 1. See the response for that question.

(10) Why does the W_i term in eqs. (III.2-37) and (III.2-38) use A_k instead of A_i?

(10) This question addresses the same item as Question III-11 of the NRC Request Number 1. See the response for that question.

(11) Is not the sign of the Z_i term in eq. (III.2-51) incorrect?

(11) This question addresses the same item as Question III-12 of the NRC Request Number 1. See the response for that question.

(12) Does eq. (III.2-42) imply constant pressure?

(a) Why is eq. (III.2-51) used for junction enthalpy instead of eq. (III.2-49)?

(b) What is the physical interpretation of $\Delta h_{S_{ik}}$ in the steady state Bernoulli equation, eq. (III.2-38), when no heat or work is added?

(c) Can the enthalpy transport model be used with pump volumes? If so, justify.

(12) This question addresses the same item as Question III-13 of the NRC Request Number 1. See the response for that question.

a), b), c) This question addresses the same item as Question III-14 of the NRC Request Number 1. See the response for that question.

(13) (a) Can RETRAN-01 be used as a blowdown and refill code?

(b) Can its heat transfer model be extended to the reflood analysis?

(13) This question addresses the same item as Question III-15 of the NRC Request Number 1. See the response for that question.

(14) (a) Why was the Baroczy model implemented as

$$\phi^2_{tp} = 1.0 + [\phi^2_{tp,G=10^6} - 1.0]\, F_G$$

when the original Baroczy model is

$$\phi^2_{tp} = \phi^2_{tp,\, G=10^6}\, F_G\ ?$$

(b) Has the value of the function F_G already been corrected in the Tables III.1-1 to III.1-5 to account for the change in the Baroczy model?

(14) This question addresses the same item as Question III-16 of the NRC Request Number 1. See the response for that question.

(15) The Berenson heat transfer coefficient and heat flux at the minimum film boiling are

$$h_{c,min} = 0.425 \left[\frac{K^3_{gf}\, \rho_{gf}\, (\rho_{ls} - \rho_{gs})\, g\Delta h_f}{\mu_{gf}\, (T_{w,min} - T_{sat}) \sqrt{\dfrac{g_c \sigma}{g\, (\rho_{ls} - \rho_{gs})}}} \right]^{1/4}$$

where the subscript gf denotes the value of the vapor properties at the vapor film evaluated at the average temperature of the hot surface and the saturated liquid. Why are all vapor properties in eqs. (III.2-16), the equivalent RETRAN equations for the Bereson heat transfer coefficient and heat flux, evaluated at the saturated condition?

(15) This question addresses the same item as Question III-17 of the NRC Request Number 1. See the response for that question.

(15) (a) Justify the use of the Berenson minimum temperature correlation in the case of turbulent boiling on oxidized surfaces under high pressure conditions.

(b) Is the Berenson minimum temperature correlation limited to pool boiling situations? If not, elaborate.

(c) According to Table III.3-1, the Berenson film correlation is utilized as one of the heat transfer modes in the forced convection option. Explain why this application in the forced convection zone is an appropriate one.

(16) This question addresses the same item as Question III-18 of the NRC Request Number 1. See the response for that question.

(17) The Groeneveld correlation as described by eq. (III.2-28) is used without Slaughterbeck's modifications.* Discuss the accuracy of the correlation without these modifications.

(17) This question addresses the same item as Question III-19 of the NRC Request Number 1. See the response for that question.

(18) The Bromley correlation is

$$h_c = 0.62 \; K_{gf}^3 \left[\frac{\Delta h_f \, \rho_{gf} \, g \, (\rho_l - \rho_v)}{\mu_{gf} \, (T_w - T_{sat}) \, D_r} \right]^{1/4}$$

where the subscript gf indicates evaluation of vapor properties at the average temperature of the hot surface and the saturated liquid. Why are all vapor properties in eq. (III.2-31), the RETRAN equation for the Bromley correlation, evaluated at the saturated conditions?

(18) The Bromley correlation is not used in RETRAN-01.

(19) Explain why heat transfer correlations such as Dengler and Addams [cf eq. (III.2-12a)], Guerrier and Tatty [cf eq. (III.2-13a)] and Shrock and Grossman [cf eq. (III.2-14)] should be used in preference to Chen's correlation.**

(19) This question addresses the same item as Question III-21 of the NRC Request Number 1. See the response for that question.

(20) (a) Can the use of the Dougall and Rohsenow correlation be extended to the pressure range of interest to LWR safety analysis? Justify.

(b) Can the correlation be applied in the dry wall mist flow regime where the flow is not in thermodynamic equilibrium?

(20) This question addresses the same item as Question III-22 of the NRC Request Number 1. See the response for that question.

(21) Discuss the adequacy of the Bennet flow regime map, presented in Fig. III.2-2, to calculate void fractions using the RETRAN dynamic slip model. In particular elaborate on the boundaries between the various flow regimes.

(21) There is no slip model in RETRAN-01. The Bennett flow regime map is used in conjunction with Beattie two-phase friction multipliers. The adequacy of the map is discussed in the response for Question III-23 of NRC Request Number 1.

(22) Justify the statement made on pp. III-30 that the Bennet map is believed to be more independent of pressure if the thermodynamic quality is converted to the homogeneous volume fraction when the relationship between quality, x and the homogeneous volume fraction α is

$$\alpha = \frac{x/\rho_{gs}}{(1-x)/\rho_{ls} + x/\rho_{gs}}$$

and ρ_{ls}, ρ_{gs} are functions of pressure.

(22) The statement appears on page III-13 of the RETRAN-01 manual. This question addresses the same item as Question II-24 of the NRC Request Number 1. See the response for that question.

CHAPTER V. Power Generation

(1) Eqs. (V.1-1) and (V.1-2) are missing factors of π and ν. Correct.

(i) Yes, the equations should be

$$\frac{1}{v(u)} \frac{\partial\phi(\bar{r},u,\bar{\Omega},t)}{\partial t} = S(\bar{r},u,\bar{\Omega},t)$$

$$+ \int_{u'} du' \int_{\bar{\Omega}'} d\bar{\Omega}' \; \Sigma_s(\bar{r},u',t) \frac{h_s}{2\pi}(u,\mu_o|u',\bar{\Omega}')\phi(\bar{r},u',\bar{\Omega}',t) \qquad (V.1\text{-}1)$$

$$+ \int_{u'} du' \int_{\bar{\Omega}'} d\bar{\Omega}' \; \frac{h_p(u)}{4\pi} \nu(u')(1-\beta) \Sigma_f(\bar{r},u',t)\phi(\bar{r},u',\bar{\Omega},t)$$

$$+ \Sigma_i \lambda_i \frac{h_i(u)}{4\pi} C_i(\bar{r},t) - \Sigma_t(\bar{r},u,t)\phi(\bar{r},u,\bar{\Omega},t) - \bar{\Omega}\cdot\bar{\nabla}\phi(\bar{r},u,\bar{\Omega},t)$$

$$\frac{\partial C_i(\bar{r},t)}{\partial t} = \int_{u'} du' \int_{\bar{\Omega}'} d\bar{\Omega}' \; \Sigma_f(\bar{r},u',t)\nu(u')\beta_i\phi(\bar{r},u',\bar{\Omega}t) - \lambda_i C_i(\bar{r},t) \qquad (V.1\text{-}2)$$

(2) Why are there no π's in the adjoint equation, eq. (V.1-4)?

(2) Yes, the equation should be

$$\int_{u'} du' \int_{\bar{\Omega}'} d\bar{\Omega}' \, \Sigma_{sc}(\bar{r},u) \frac{h_{sc}}{2\pi}(u',\mu_0|u,\bar{\Omega})\phi_c^*(\bar{r},u',\bar{\Omega}')$$

$$+\int_{u'} du' \int_{\bar{\Omega}'} d\bar{\Omega}' \, \frac{h_t(u')}{4\pi} \nu_c(u) \, \Sigma_{fc}(\bar{r},u)\phi_c^*(\bar{r},u',\bar{\Omega}') \qquad \text{(V.1-4)}$$

$$- \Sigma_{tc}(\bar{r},u)\phi_c^*(\bar{r},u,\bar{\Omega}) + \bar{\Omega}\cdot\bar{\nabla}\phi_c^*(\bar{r},u,\bar{\Omega}) = 0$$

(3) There are ν's and "'" missing in eqs. (V.1-6), (V.1-8) and (V.1-10). Correct.

(3) Yes, the equations should be

$$\bar{\beta}_i(t) = \frac{1}{F(t)} \int du \int d\bar{\Omega} \int d^3r \int du' \int d\bar{\Omega}' \, \nu(u')\beta_i \frac{h_i(u)}{4\pi} \Sigma_f(\bar{r},u',t)\phi_c^*(\bar{r},u,\Omega)\phi(\bar{r},u',\bar{\Omega}',t) \qquad \text{(V.1-8)}$$

$$\bar{\beta}(t) = \Sigma_i\overline{\beta_i(t)} = \frac{1}{F(t)}\int du \int d\bar{\Omega} \int d^3r \int du' \int d\bar{\Omega}' \, [h_t(u) - (1-\beta)h_p(u)]^* \nu(u')\Sigma_f(\bar{r},u',t)\phi_c^*(\bar{r},u,\bar{\Omega})\phi(\bar{r},u,\bar{\Omega},t) \qquad \text{(V.1-10)}$$

(4) Define v used in eq. (V.1-12).

(4) The v terms used in Equation V.1-12 should be greek mu's, which have been defined.

(5) Where is G(t) used in eq. (V.1-14) defined?

(5) Equation V.1-14 does not contain G(t) but does contain $C_i(t)$ which is the delayed neutron precursor concentration. Equation V.1-14 is the defining differential equation for $C_i(t)$.

CHAPTER VI. System Component Models

(1) Is the statement N=W in the nomenclature of Page VI-1 a typographical error?

(1) No, it is not a typographical error, and $N = \omega$.

(2) Should the term $M(\bar{a})$ be $N(\bar{a})$ in the equation VI.1-4?

(2) Yes.

(3) Should ρ be replaced by $\bar{\rho}$ in equation VI.1-5?

(3) Yes.

(4) What is the accuracy of the difference curves/head multiplier procedure used for the two-phase pump model?

(4) This question addresses the same item as Question VI-1 of the NRC Request Number 1. See the response for that question.

The Semiscale test data are described in ANCR-1165, Aerojet Nuclear Company, 1974.

(5) What is the error involved in using "steady state" characteristics in the pump formulation presented during transient situations?

(5) This question addresses the same item as Question VI-2 of the NRC Request Number 1. See the response for that question.

The momentum effect associated with angular acceleration is neglected. For the flow conditions of operational transients, this effect is negligible.

(6) In the equation VI.1-8, how are the i^{th} coefficient of friction torque, $(T_{fr})_i$ obtained? Are they build-in values?

(6) These coefficients must be identified for the machine in question. One method is to obtain a fit to T_{fr} from pump coastdown data.

(7) Should the equation VI.1-10 be expressed as follows: $T = T_{hr} + T_{fr} - T_m$?

(7) No, it is correct as printed.

(8) Is there a typographical error in the first term on the right-hand side of equation VI.2-5? Should it be as follows:

$$\frac{A}{I} \int_{t_o}^{t} P(\tau)\, e^{\frac{K}{I}\tau}\, d\tau?$$

(8) Yes.

(9) Is there a typographical error in the second term in the right-hand side of equation VI.2-6? Should it be as follows:

$$\frac{AP(t)}{K}\left(1 - e^{-\frac{K}{I}t}\right)?$$

(9) Yes.

(10) Should the first term on the right hand side of equation VI.2-7 be θ_0 instead of θ?

(10) Yes.

(11) Discuss how valves are included in the momentum balance equations with emphasis on the numberical scheme involved.

(11) This question addresses the same item as Question VI-14 of the NRC Request Number 1. See the response for that question.

(12) What is the physical interpretation of eq. VI.3-4?

(12) This question addresses the same item as Question VI-15 of the NRC Request Number 1. See the response for that question.

CHAPTER VII. Operational Transient Models

(1) Is the lag compensation formula for y_1 in Table VII.1-1 correct? Justify.

(1) This question addresses the same item as Question VII-1 of the NRC Request Number 1. See the response for that question.

(2) Illustrate the use of the transport delay model with a Y and all possible combination of flow directions.

(2) This question addresses the same item as Question VII-2 of the NRC Request Number 1. See the response for that question.

(3) Why are there no condensate terms in the energy equations, eq. (VII.3-3) and eq. (VII.3-4)?

(3) This question addresses the same item as Question VI-16a of the NRC Request Number 1. See the response for that question.

(4) Show how $(\dot{M}_g)$ of eq. (III.1-65) used in the determination of the flashing mass flux, eq. (VII.3-8) is related to the primary variable $[P, M_1, M_2, U_1, U_2]^T$ of the pressurizer model?

(4) This question addresses the same item as Question VI-17 of the NRC Request Number 1. See the response for that question.

(5) How are the momentum balance equations of Chapter 2 coupled to the pressurizer mass/energy equations?

(5) This question addresses the same item as Question VI-18 of the NRC Request Number 1. See the response for that question.

(6) Present the mass and energy balance equation when the first spray option is chosen; spray in the vapor region.

(6) This question addresses the same item as Question VI-19 of the NRC Request Number 1. See the response for that question.

(7) Discuss the numerical behavior of the pressurizer model solution when the pressure is used for the convergence criteria.

(7) The pressure is the unknown and must be found iteratively. From this requirement, the pressure convergence criteria follow directly.

The pressure solution method used in RETRAN-01 did not result in a converged solution for some limiting cases. The pressure search has been improved in RETRAN-02, with pressure still used in the convergence criteria.

(8) Discuss step 3 of the solution technique in detail, in particular, the linear equations for each region. Is the term $\left.\frac{\partial r}{\partial p}\right|_h$ a typographical error?

(8) The term is a typographical error and should be the partial of the specific volume. The method for finding the pressurizer pressure has been modified in RETRAN-02.

(9) What is done when the pressurizer completely fills or completely empties?

(9) This question addresses the same item as Question VI-22 of the NRC Request Number 1. See the response for that question.

(10) Show how the phase separation model described in Chapter III is used in conjunction with the pressurizer model.

(10) This question addresses the same item as Question VI-23 of the NRC Request Number 1. See the response for that question.

(11) How is the engineering enthalpy rise factor computer and how is it used?

(11) This question addresses the same item as Question VII-3 of the NRC Request Number 1. See the response for that question.

(12) How is the complete transient energy equation option activated when eq. (VII.4-3) is inadequate for a hot channel calculation? Discuss the option.

(12) This question addresses the same item as Question VII-4 of the NRC Request Number 1. See the response for that question.

(13) There is a typographical error on Page VII-24. VII.5-8 should be replaced by VII.4-5.

(13) Yes.