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International Agreement Report

The Assessment of RELAP5/MOD2 Against IVO Loop Seal Tests

Prepared by
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Office of Nuclear Regulatory Research
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Prepared as part of
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ABSTRACT

RELAP5/MOD2 analyses of a full-scale and 1/10-scale atmospheric air-water loop seal facilities have been conducted. The calculations have been performed with the version 36.05 and also with a modified version with the treatment of interfacial drag changed in the loop seal bends.

The calculated residual water level differs from that measured in the experiments, the computational value being lower. The gas superficial velocity needed for loop seal clearing is also predicted lower by RELAP5. The interfacial drag modifications slightly improved the results, but an agreement with the experimental data was not found.

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EXECUTIVE SUMMARY

Experiments with IVO's full-scale and 1/10.6-scale loop seal facilities have been analysed with RELAP5/MOD2. The facilities correspond to the loop seal geometry of a VVER-1000 pressurized water reactor. The steam generated in the core and blown through the loop seal during a cold leg LOCA was in the experiments simulated by atmospheric air.

The RELAP5 calculations were performed with both the frozen version RELAP5/MOD2 36.05, and with the modified version [2] in which the treatment of the interfacial drag term in the loop seal bends was changed.

A noteworthy difference between the experimental data and the RELAP5 results was discovered. RELAP5 removes in the beginning of a calculation a large amount of water out of the loop seal and thus depletes water in the loop seal (clears loop seal) with much lower gas superficial velocity. Based on this phenomenon shortly after the beginning of the transient, flow regime predicted by RELAP5 becomes horizontal stratified whereas in the experiments a typical flow regime was slug flow. Because of the early loop seal clearing, the pressure loss across the loop seal is also too low.

The modifications to the interphacial drag improved slightly the correspondence between experimental and computational residual water level data, but a remarkable gap still remained.

The discrepancy between the experimental and computational data follows the same trend for both full-scale and 1/10.6-scale experiments.

1. INTRODUCTION

The behavior of loop seals between steam generators (SG) and reactor coolant pumps (RCP) of a pressurized water reactor (PWR) may strongly affect the reactor core water level depression and core heatup during a cold leg loss-of-coolant accident (LOCA). Especially, before a loop seal is cleared, i.e. the water in the loop seal is pushed out by the steam generated in the core, a large pressure difference over the loop can be created which lowers the core collapsed water level. Thus, the correct modelling of the loop seal in the integrated thermal hydraulic computer codes used for PWR accident analyses is of crucial importance.

Imatran Voima Oy (IVO) has performed loop seal experiments with atmospheric air-water facilities (1/1- and 1/10.6-scale) corresponding to a loop seal geometry of the Soviet VVER-1000 pressurized water reactor [1]. As a part of Finland's contribution to the International Thermal-Hydraulic Code Assessment and Application Program (ICAP) this report summarizes the results of the RELAP5/MOD2 simulations of these experiments. The RELAP5/MOD2 simulations were conducted with the frozen version 36.05 and also with a version including modifications in the interfacial drag of the loop seal bend junctions as suggested by Y. Kukita of JAERI [2].

2. TEST FACILITY

The primary loop of a VVER-1000 type PWR is shown schematically in Fig. 1 and the full-scale loop seal test facility in Fig. 2. The facility consists of high-capacity, speed-controlled fan (3 m^3/s with a head of 0.03 MPa) which provides air to the loop seal with a maximum superficial velocity of 9 m/s, buffer tank (10 m^3) to damp air flow oscillations, loop seal with inner diameter of 850 mm, RCP mock-up and an opening (0.2 m^2) in the pipe after the RCP to simulate the break. The single phase pressure drop and the over-flow edge of the RCP mock-up are similar to those of the real RCP. The initial water level in the loop seal and the inlet air superficial velocity were used as test parameters. The experiments were carried out under atmospheric pressure and at room temperature.

The superficial inlet air velocity, the pressures p_1 and p_2 (Fig. 2) and the pressure difference between the bottom and top of the lower horizontal pipe at three locations were measured. The flow regime transitions were observed visually through windows in the horizontal pipe. The residual water level in the facility was measured after each experiment.

A noteworthy difficulty in the experiments was the oscillation of air velocity which complicated the interpretation of the results. The oscillations were caused by the oscillating character of the pressure drop, especially during slug flow, combined with an unfavourable fan characteristic curve. Table 1 and Fig. 3 illustrate the pressure and velocity oscillations.

To include the effect of scaling on the loop seal behavior and especially on the flow regime transitions experiments were also performed with a 1/10.6-scale test facility as shown in Fig. 4. This model was constructed of transparent pipe having 80 mm inside diameter. The experiments are discussed in more detail in ref. [1].

Table 1. Flow and pressure drop oscillations in the full-scale loop seal experiments [1].

	Oscillation ranges		
Nominal j_G m/s	j_G m/s	Δp bar	$\bar{h}_L$
1.0	0.8-1.2	0.12-0.16	1.12
1.5	1 3-1.7	0.09-0.15	0.85
2.0	1.8-2.4	0.06-0.13	0.78
2.5	2.0-3.0	0.02-0.10	0.72

j_G = superficial air velocity in the loop seal
Δp = pressure drop across the loop seal
$\bar{h}_L$ = dimensionless residual water level = h_L/D
h_L = residual water level after an experiment
D = diameter of the pipe (= 0.85 m).

3. RELAP5 INPUT DECK AND MODIFICATIONS TO THE CODE

The loop seal nodalization model used in RELAP5/MOD2 calculations consists of totally 15 control volumes and is shown in Fi 5. The bends of the loop seal are modelled using nodes with an inclination of 45°.

The calculations were made for a steam-water system at a pressure of 2.2 bar, at which the density of saturated steam equals that of air in atmospheric pressure. The steam is supplied to the loop seal through a ' ime dependent junction'- component. The vapor velocity at the time dependent junction was set as a boundary condition. The base case RELAP5/MOD2 input deck of the full-scale experiment with the dimensionless initial water level in the lower horizontal pipe $\bar{h}_{L,init}$ = 0.8 and inlet vapor velocity j_G = 3 m/s is presented in Appendix A.

The calculations were also done with a modified RELAP5/MOD2 in which the treatment of the interfacial drag in the junction connecting volumes 50 and 70-1 and the junction connecting 70-5 and 90 was changed. Instead of determining the interfacial drag coefficients of these junctions as an average of the drag coefficients of the two adjacent volumes the junction drag coefficients were set equal to the coefficients of the horizontal neighboring volumes only (i.e. 70-1 or 70-5) [2]. RELAP5/MOD2 uses vertical flow regime maps and constitutive equations at the 45° bend nodes 50 and 90. Similar kind of treatment of the interfacial drag (together with a modification in the horizontal flow regime map) was shown to be effective in ref. [4], when a steam-water experiment under 70 bar in a 10 m long pipe with inside diameter of 180 mm was calculated with RELAP5/MOD2.

4. CALCULATION RESULTS

The calculations were performed with the IBM version of RELAP5/MOD2 cycle 36.05 on IBM 3083J with the operating system MVS/XA 2.2.0 and VSFORTRAN 2.3.0 compiler.

4.1. Full-scale experiments

The residual water level as a function of the modified Froude number in the experiments and results using both the frozen and modified versions of RELAP5/MOD2 are shown in Fig. 6. The modified Froude number is defined as:

$$Fr = \left\{\frac{\rho_G}{\rho_L - \rho_G}\right\}^{1/2} \frac{j_G}{(Dg\cos\alpha)^{1/2}} \quad , \qquad (1)$$

where ρ_G = density of the gas, ρ_L = density of the liquid, j_G = superficial velocity of the gas, D = diameter of the pipe, g = gravitational acceleration, α = inclination of the pipe. For a horizontal pipe $\alpha = 0$. For example, at 2.2 bar in a horizontal pipe with a diameter of 850 mm, a superficial gas velocity of 1 m/s corresponds to a Froude number 0.013.

In the RELAP5 input deck of the full-scale facility an error was discovered when the computer runs had been completed. A flow area of 0.30 m² instead of 0.57 m² had been used in junction (RCP) connecting components 110 and 130. However, no essential difference in the residual water levels was found as some of the cases were rerun using the correct junction area.

The experimental results in Fig. 6 are from experiments with various initial water levels whereas all the RELAP5 runs have been conducted with initial water level $\bar{h}_{L,ini} = 0.8$. In the experiments the initial water level was not seen to have any significant influence on the residual water level providing that the initial level was high enough to allow any water to be spilled out from the loop seal. Fig. 6 shows that RELAP5 clearly underpredicts the residual water level. The modified RELAP5 results are closer to the experimental data than the results from the runs conducted with frozen version of RELAP5 [1]. It should be born in mind that the data points in Fig. 6 represent averaged values, while the horizontal pipe void fraction, from which the water level values have been derived, may have a strongly oscillating character.

RELAP5 spills much more water out of the loop seal already in the beginning than in the experiments. Based on this phenomenon the flow in the lower pipe becomes soon horizontally stratified whereas in the experiments the typical flow regime was slug flow. RELAP5 predicted only very short (some fractions of a second) , if any, intermittent (bubbly or slug) flow periods. Because of the incorrect flow regime also the pressure losses across the loop seal remained lower in RELAP5 calculations than in the experiments. (see Fig. 7 and Figs. 14, 18, 22 and 26.)

In order to improve the results some minor changes in the RELAP5 model were tried, e.g. the modification of the bend by laying the volume 90 horizontal and using the 'cross-flow' option of RELAP5 in the junction between volumes 90 and 110-1. However, not any significant change in the results was obtained.

The change of initial conditions was also tried. Instead of having constant inlet gas velocity all the time, the gas velocity was increased linearly from zero to the nominal value. The residual water level was not essentially affected by this change.

The suppression of the interfacial heat transfer caused damping in the oscillations of the water level and at higher gas velocities the RELAP5 runs failed to a water property error. Also in these cases the calculated residual water level was much too low.

In the simulations with a developmental version RELAP5/MOD2.5 v4 the maximum time step specified for the run was seen in some cases affect the residual water level [5].

4.2. 1/10-scale experiments

Fig. 8 shows the RELAP5 (modified version) results when experiments carried out with the 1/10.6 scaled loop seal model were analyzed with initial water level of $\bar{h}_{L,ini}$ = 0.8 in the analyses. It can be seen that at low Fr numbers the discrepancy between experimental data RELAP5 calculation has decreased, but at high Fr the gap is still wide.

4.3. Effect of pressure

The effect of higher pressure to the results can be seen in Fig. 9. The analyses have been conducted with the modified RELAP5. At $0.02 < Fr < 0.06$ the calculated residual water level is substantially higher than in the case when system pressure was 2.2 bar. At $Fr = 0.07$ there is a sudden drop in the residual water level. At this value of Fr, RELAP5 predicton of the flow regime in the volume 90 (having inclination of 45°) changes from slug flow to annular mist.

4.4. Effect of initial water level

Modified RELAP5 analyses results with three different initial water levels are shown in Fig. 10. All the three curves ($\bar{h}_{L,ini} = 0.6$, 0.8 and 1.0) follow the same trend. The $\bar{h}_{L,ini} = 0.6$ curve has a local minimum at about $Fr = 0.04$. Apparently, the minimum has no counterpart in reality and is of numerical origin. In the points of the local minimum, RELAP5 predicts a transition to bubbly flow whereas outside the minimum the flow always remains horizontal stratified. As mentioned earlier, initial water level level did not influence on the experimental results.

4.5. Example runs

Figs. 11 through 14 visualize the results from an example run with the frozen version of RELAP5/MOD2 related to the full-scale loop seal geometry. The initial water level was assumed to be $\bar{h}_{L,ini} = 0.8$ and the inlet superficial gas velocity $j_G = 1$ m/s ($Fr = 0.013$). Figs. 15 through 18 show the same case predicted by the modified version of RELAP5/MOD2.

After a transition period, void fractions in the horizontal part of the pipe (Figs. 11 and 15) reach a quasi-steady state. According to the results, the water level in the horizontal pipe (Figs. 11 and 15) remains relatively even. Only in the volume 70-05 in Fig. 15 water level is seen to be slighly higher than in the other horizontal volumes. In the experiments the water level was clearly inclined.

The type of oscillations predicted by frozen and modified version of RELAP5/MOD2 differ quite remarkably from each other. The lower oscillation frequency of Figs. 11 - 14 was never discovered in the experiments.

Figs. 19 through 22 present the void fractions, velocities and pressure losses predicted by the frozen version of RELAP5/MOD2 using the inlet superficial gas velocity 3 m/s (Fr = 0.038). Initial water level was also in this case $\bar{h}_{L,ini}$ = 0.8. The oscillations are now weaker, partly due to the fact that the void fractions are higher. The corresponding curves calculated with the modified version of RELAP5/MOD2 are shown in Figs. 23 through 26.

5. RUN TIME STATISTICS

All the runs were carried out using maximum time step of 0.1 s which is smaller than the Courant limit. CPU-time needed for a 100 s transient on IBM 3083J was typically 45 s. Typical grind time

$$\frac{(\text{CPU-time in secs}) \times 1000 \text{ ms}}{(\text{number of vol's}) \times (\text{number of time steps})}$$

was about 3.5 ms. CPU-time consumption is illustrated also in Fig. 27.

Table 2 shows information about computer run time statistics in an example case.

Table 2. Run time statistics.

$\bar{\alpha}_{L,0} = 0.8$
$Fr = 0.0377$, $j_0 = 3.0$ m/s
$\Delta t_{max} = 0.1$ s

Transient time (s)	Requested time step (s)	Average time step (s)	Number of time steps	Courant limit (s)	Mass error ratio	CPU-time (s)
20	0.1	0.1	200	0.234	$2.1 \cdot 10^{-4}$	13.1
40	0.1	0.1	400	0.266	$2.1 \cdot 10^{-4}$	21.0
60	0.1	0.1	600	0.250	$2.1 \cdot 10^{-4}$	28.9
80	0.1	0.1	800	0.258	$2.1 \cdot 10^{-4}$	36.8
100	0.1	0.1	1000	0.280	$2.1 \cdot 10^{-4}$	44.7

6. DISCUSSION

Although the modifications made in the treatment of interfacial drag term in the loop seal bends raised the residual water level predicted by RELAP5 closer to the experimental values the discrepancy is still remarkable. It seems obvious that RELAP5/MOD2 has problems both in the horizontal flow regime map and in the interfacial drag coefficients.

When comparing the RELAP5 flow regime predictions to the flow regimes observed in the full-scale (Ø 0.85 m) experiments it was noticed that RELAP5 tends to predict the transition from horizontal stratified to bubbly or slug flow at lower velocities. The cure to the problem is not straight-forward as the essential difficulty is the incapability of the code to take into account the history effects, e.g. the hysteresis in flow transitions: stratified - intermittent - stratified.

On the other hand, also in cases where the calculated flow regime is all the time horizontal stratified the residual water level in volumes 70-01 - 70-05 is clearly lower than in the experiments, e.g. in most of the cases with $\bar{h}_{L,ini}$ = 0.6. Also, in RELAP5 predictions a transition to a horizontal slug flow usually depleted the loop seal of water. This phenomenon was not observed in the experiments.

7. ACKNOWLEDGEMENT

The loop seal analyses with RELAP5/MOD2 were initiated by Mr. Petri Vuorio.

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[5] O. Kymäläinen: Developmental Assessment of RELAP5/MOD3 against the Data of IVO Loop Seal Experiments. To be presented at the ICAP meeting Oct 18-20, 1989, Bethesda, MD.

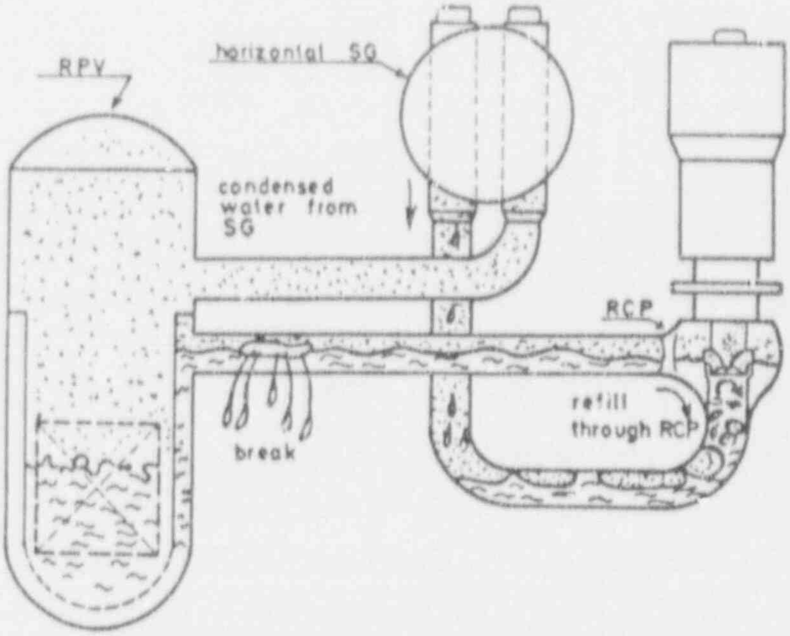

Figure 1. Primary loop of VVER-1000 with a cold leg break [1].

FULL-SCALE LOOP SEAL FACILITY

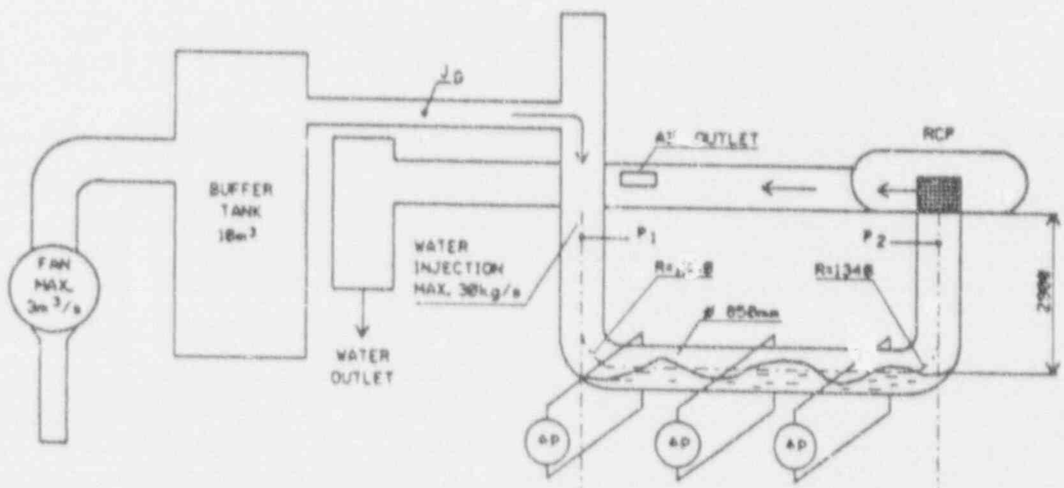

Figure 2. Full-scale loop seal test facility.

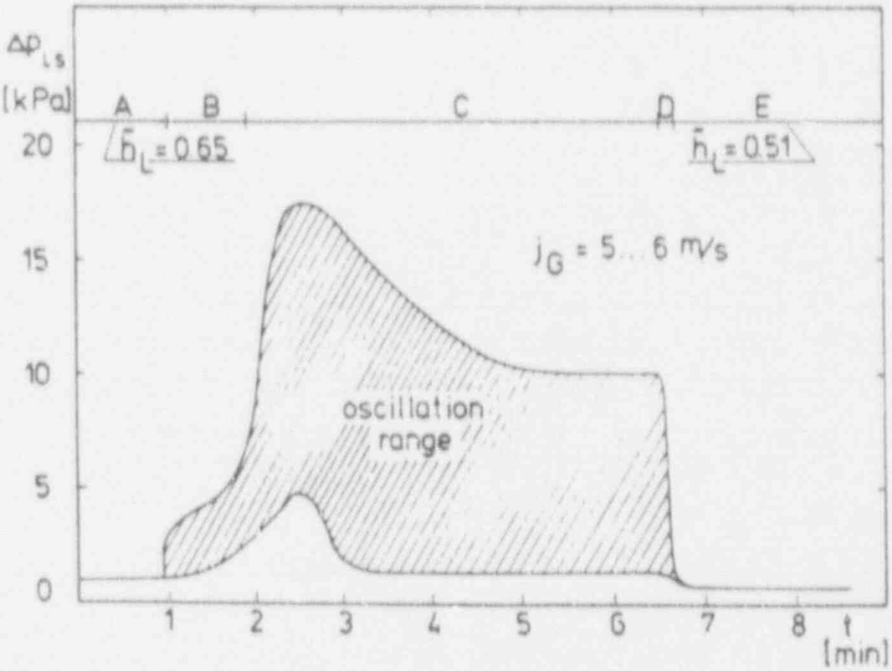

Figure 3. Pressure loss oscillations in the full-scale loop seal experiments.

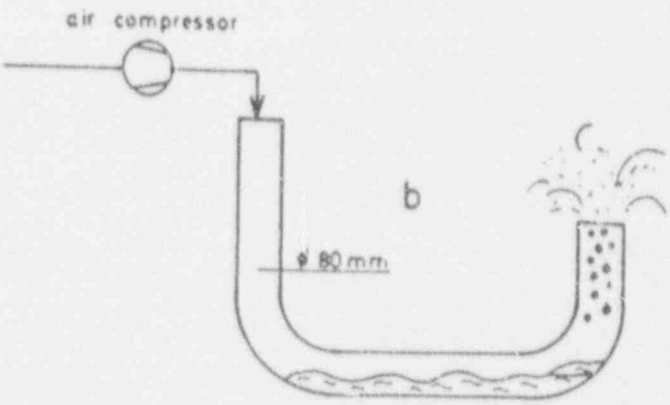

Figure 4. 1/10.6-scale loop seal test facility.

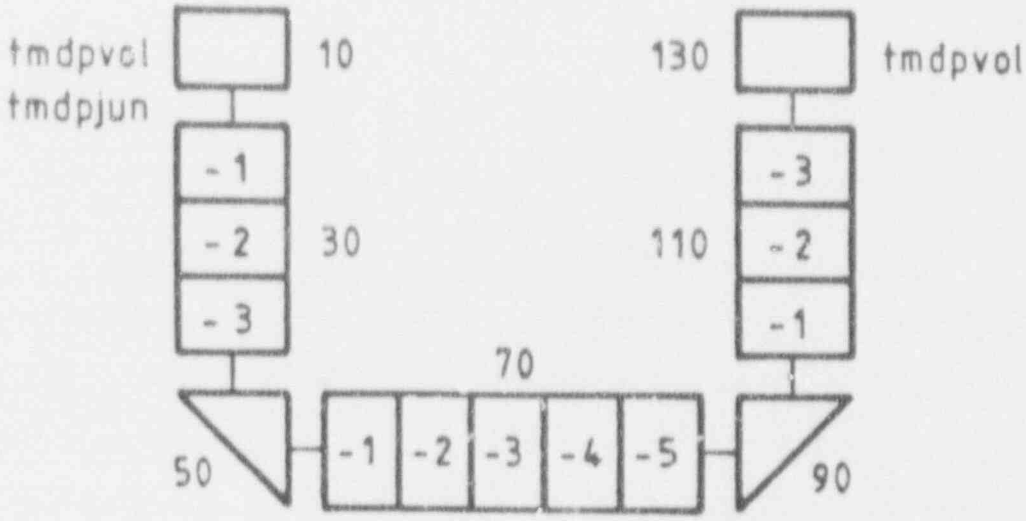

Figure 5. Nodalization model of the loop seal.

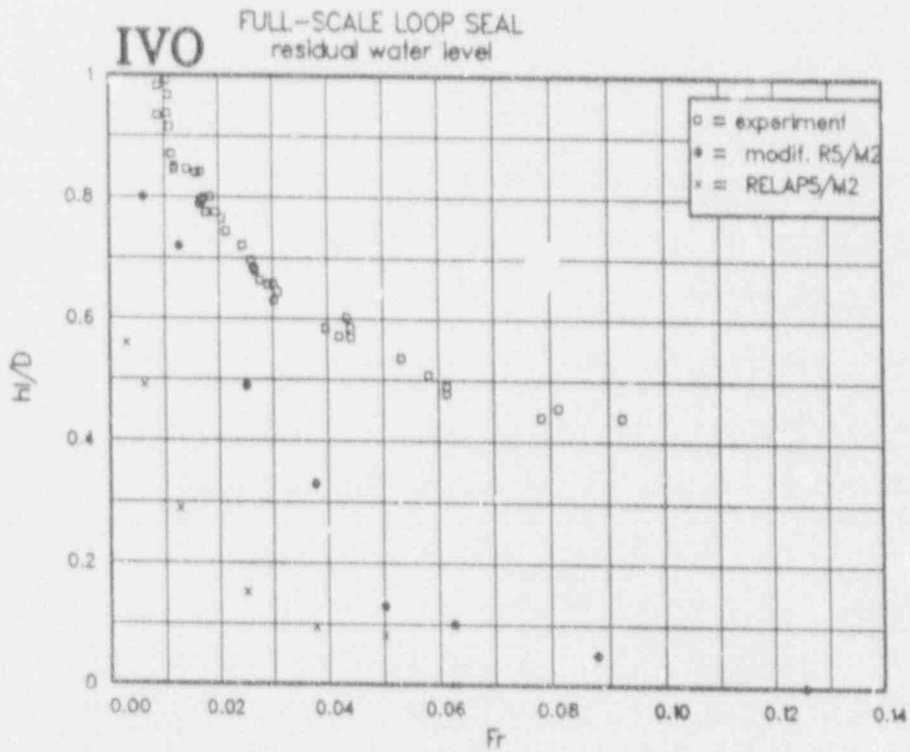

Figure 6. Residual water level in full-scale experiment and RELAP5 simulation~ with frozen and modifed version. Initial water level in tha analyses = 0.8.

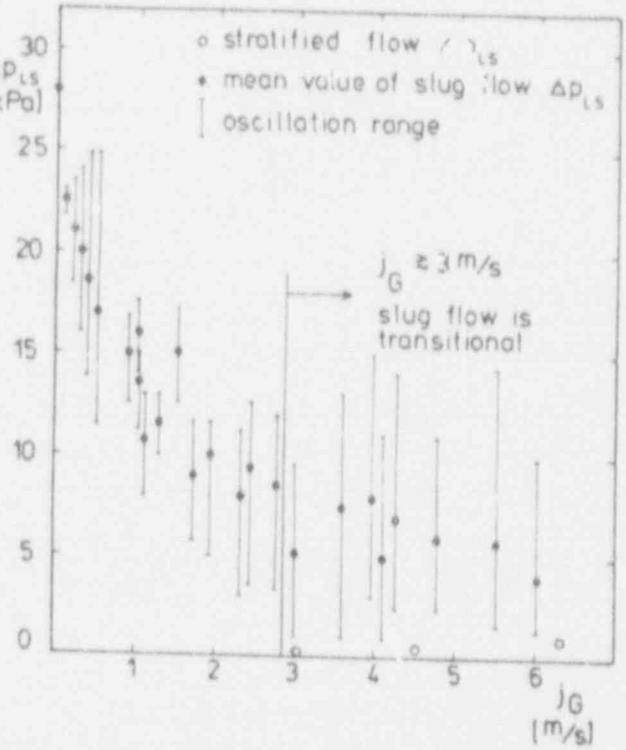

Figure 7. Pressure losses over the loop seal during slug flow in the full-scale experiment .

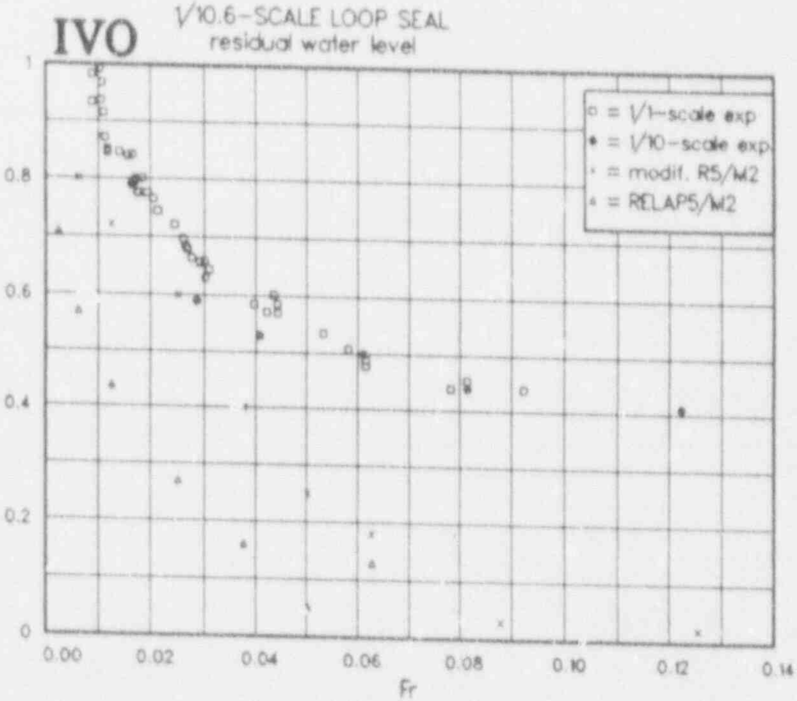

Figure 8. Residual water level in 1/10.6-scale experiments and RELAP5 simulations. Initial water level in the analyses = 0.8.

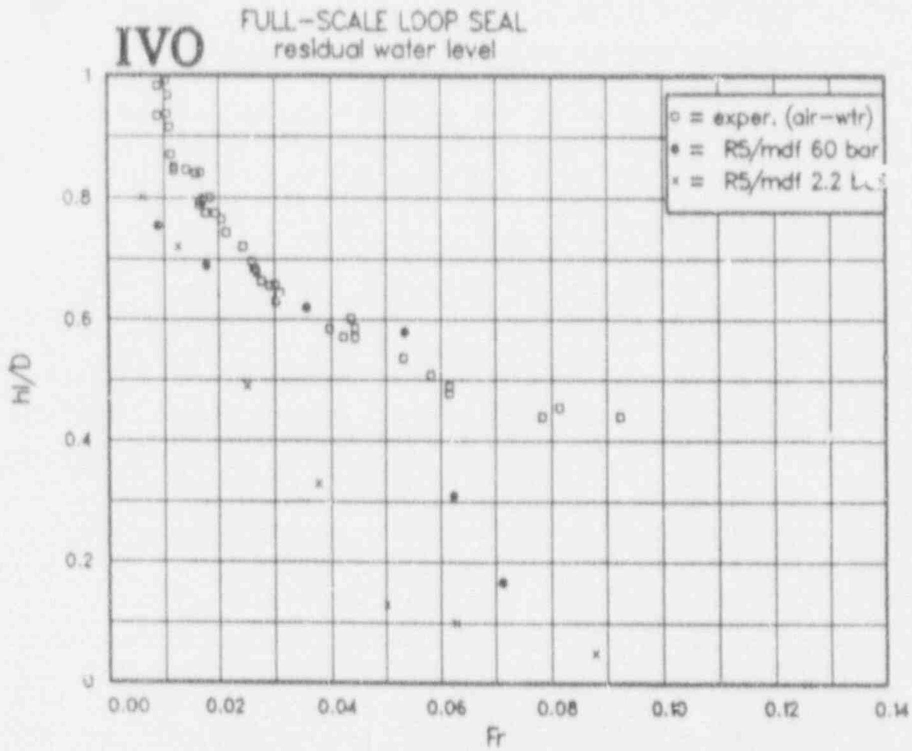

Figure 9. Effect of higher pressure on residual water level.

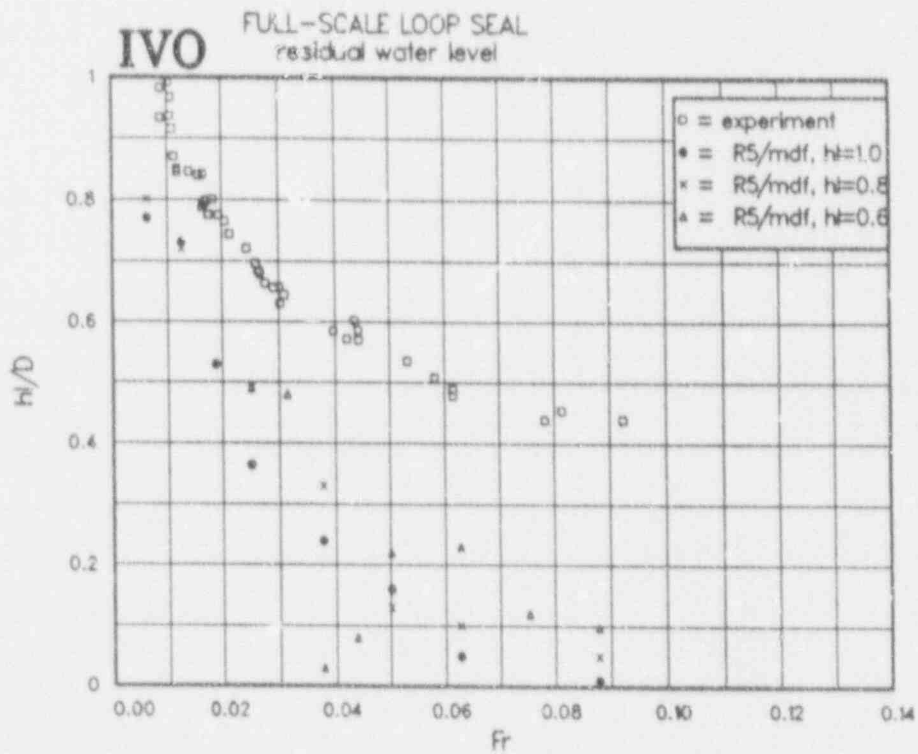

Figure 10. Effect of initial water level on residual water level.

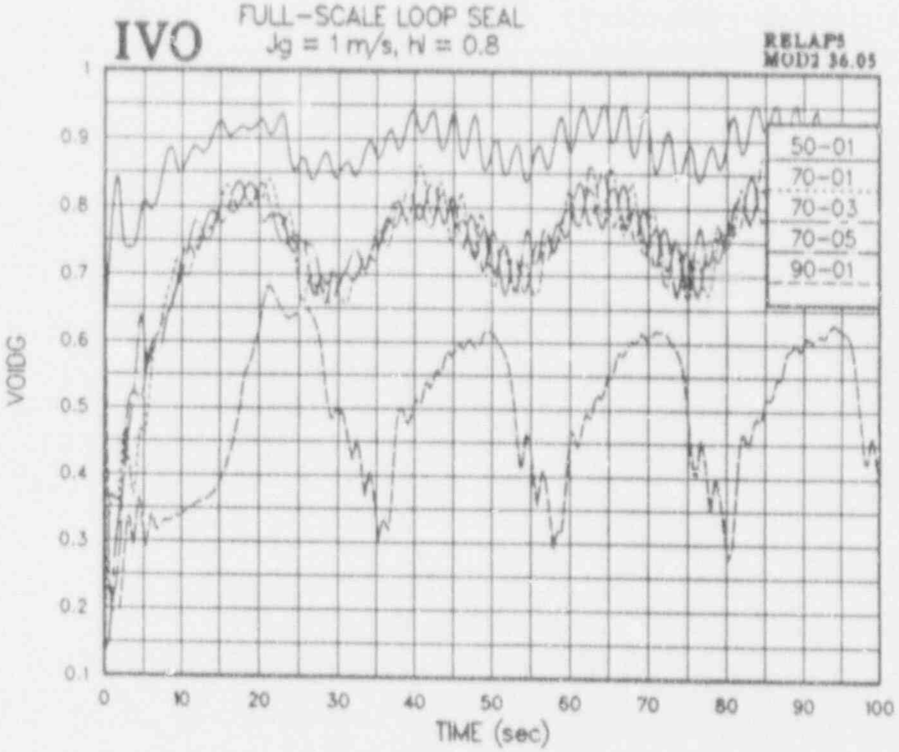

Figure 11. Void fractions in the horizontal section.

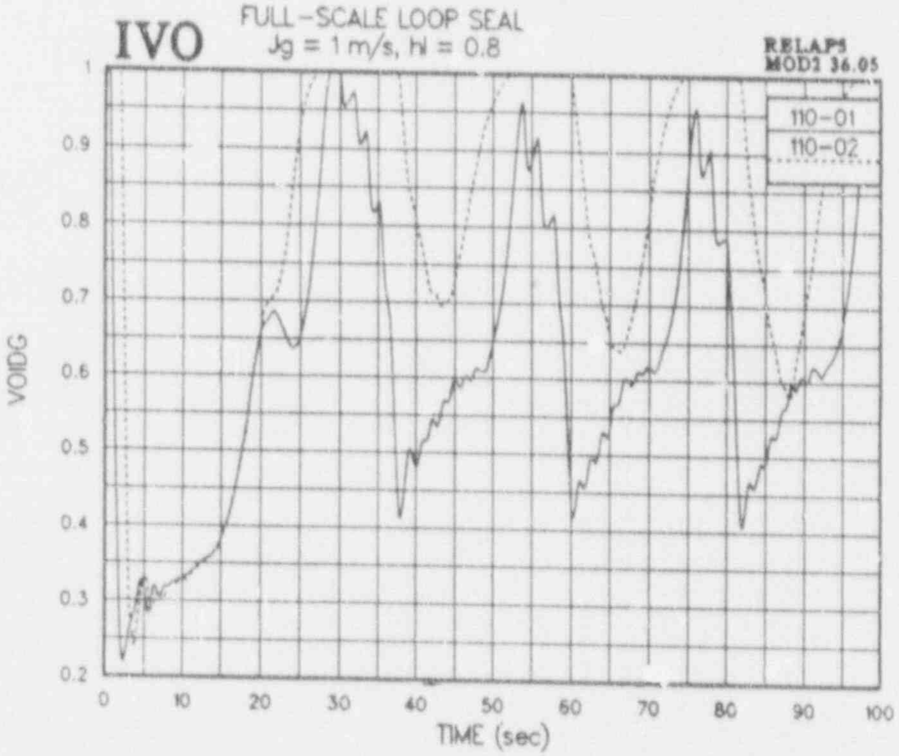

Figure 12. Void fractions in the vertical riser section.

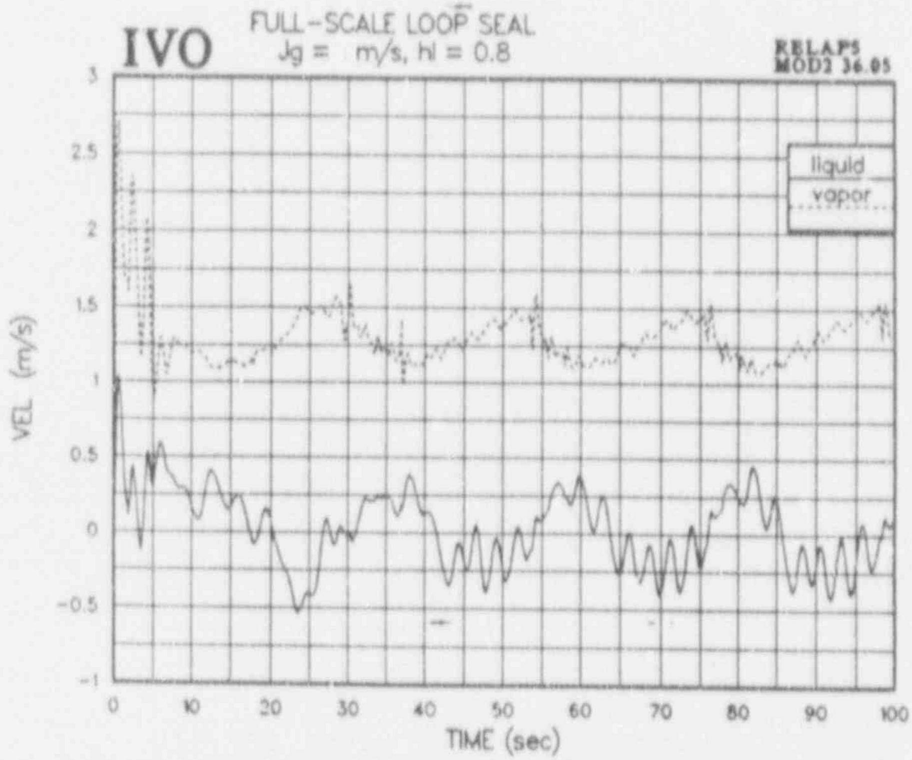

Figure 13. Velocities at junction 70-03.

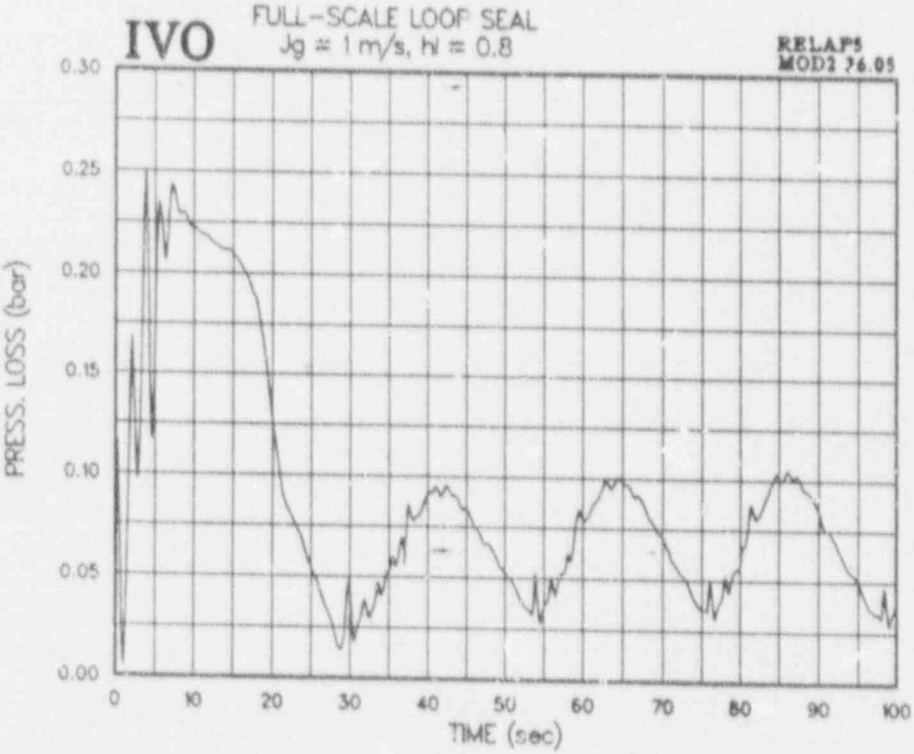

Figure 14. Pressure loss across the loop seal.

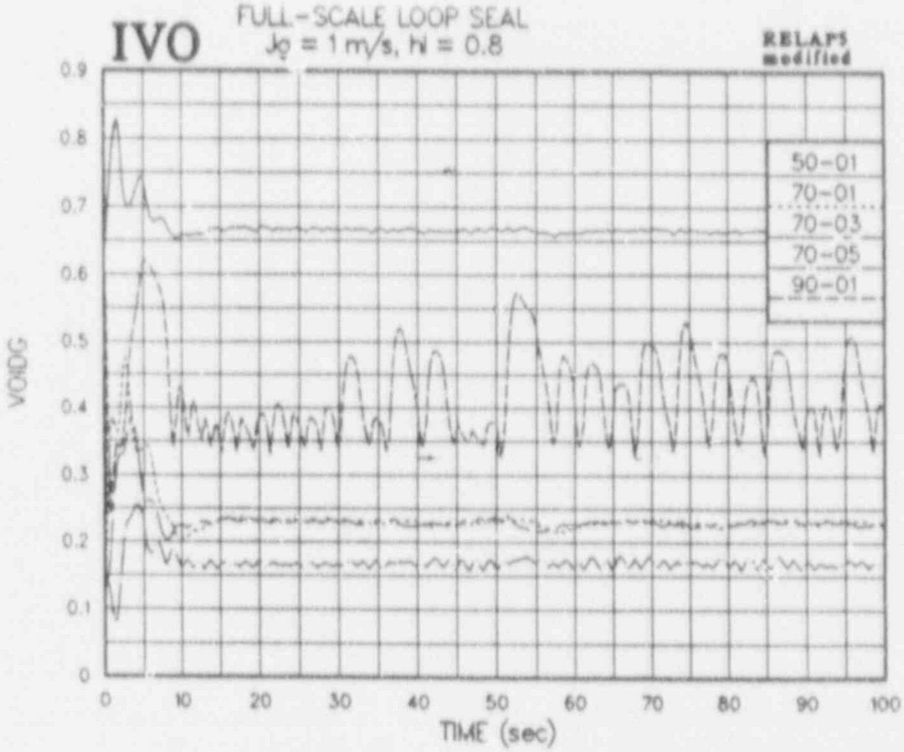

Figure 15. Void fractions in the horizontal section (modified RELAP5/MOD2).

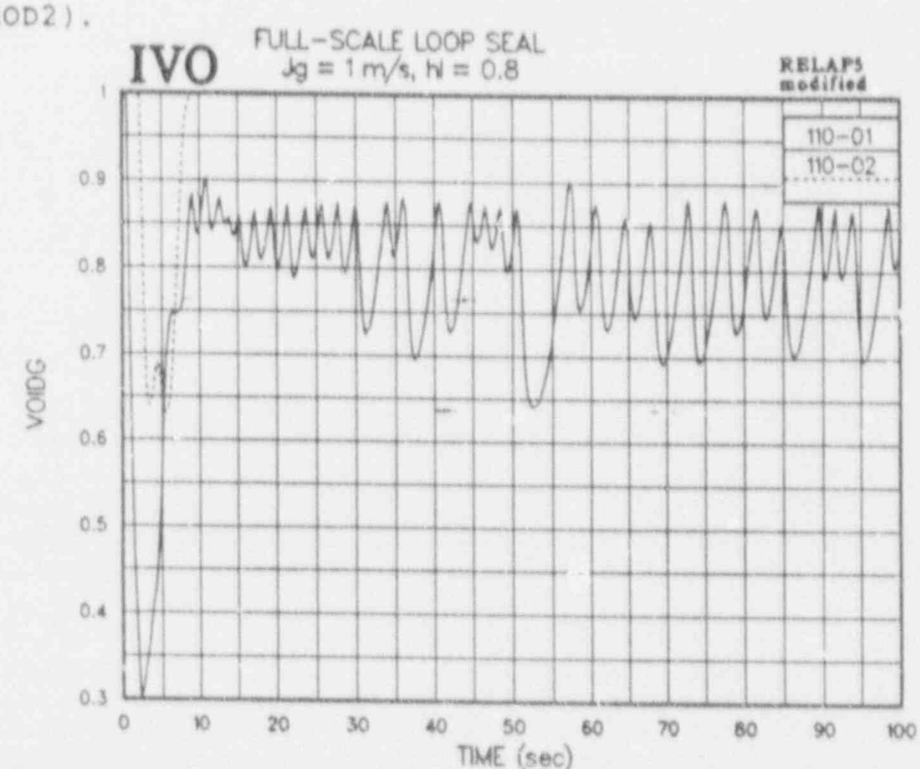

Figure 16. Void fractions in the vertical riser section (modified RELAP5/MOD2).

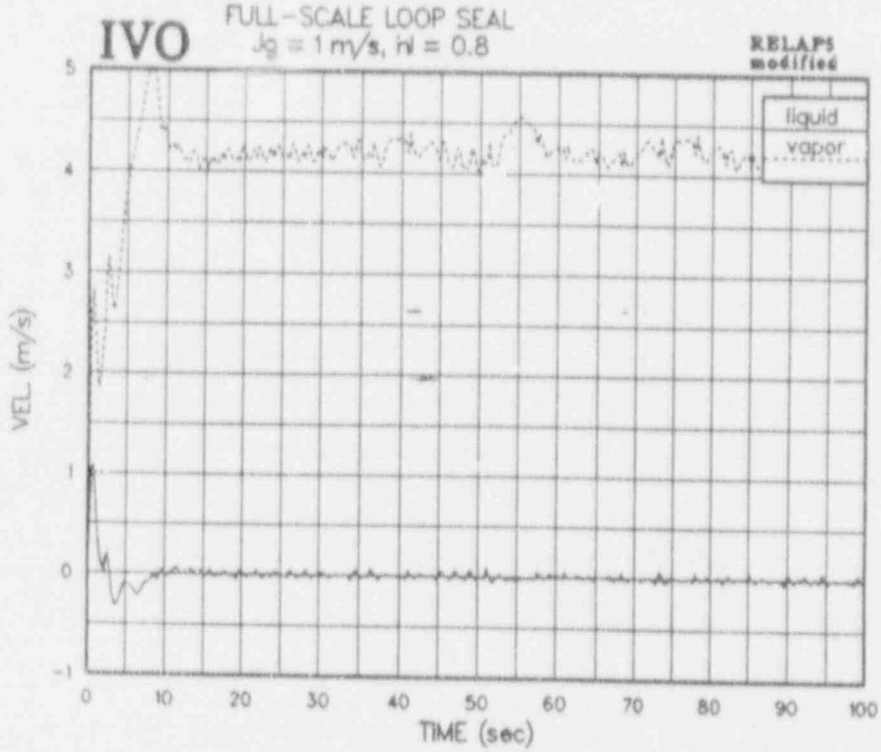

Figure 17. Velocities at junction 70-03 (modified RELAP5/MOD2).

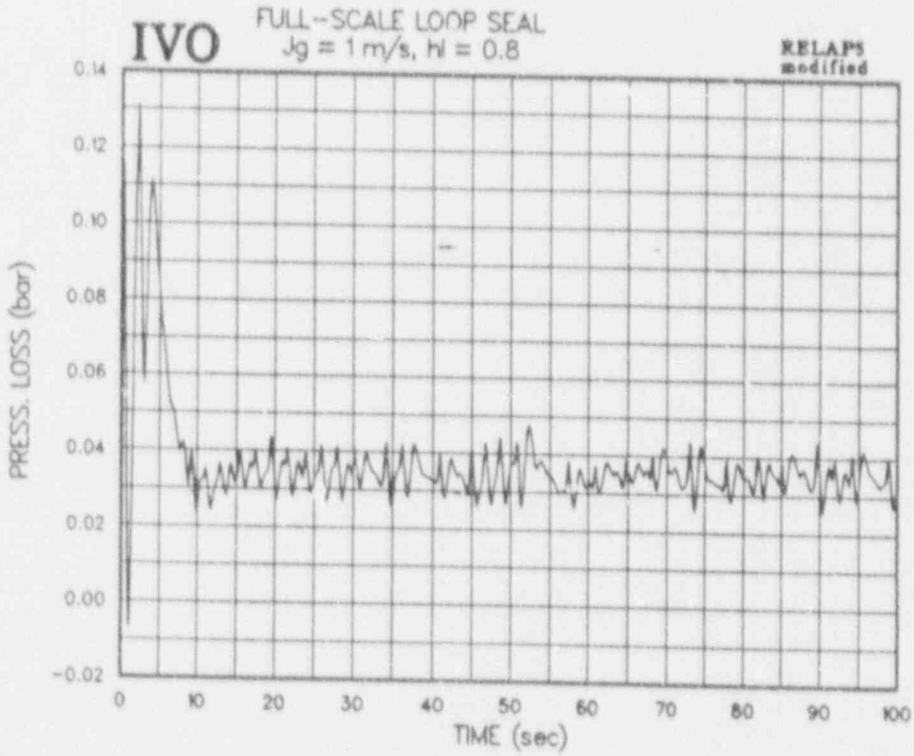

Figure 18. Pressure loss across the loop seal (modified RELAP5/MOD2).

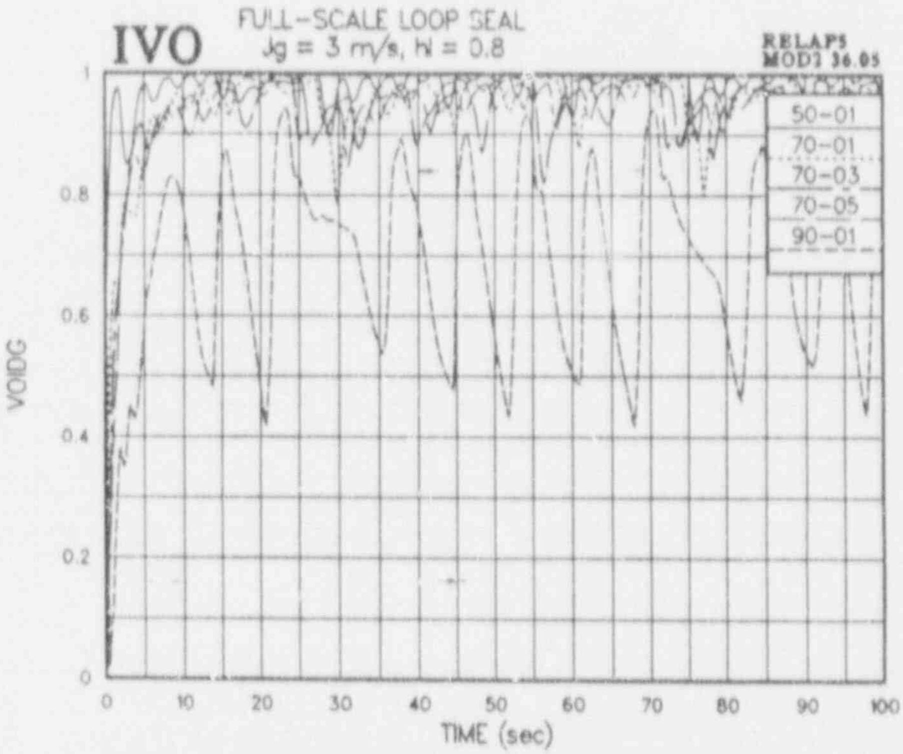

Figure 19. Void fractions in the horizontal section.

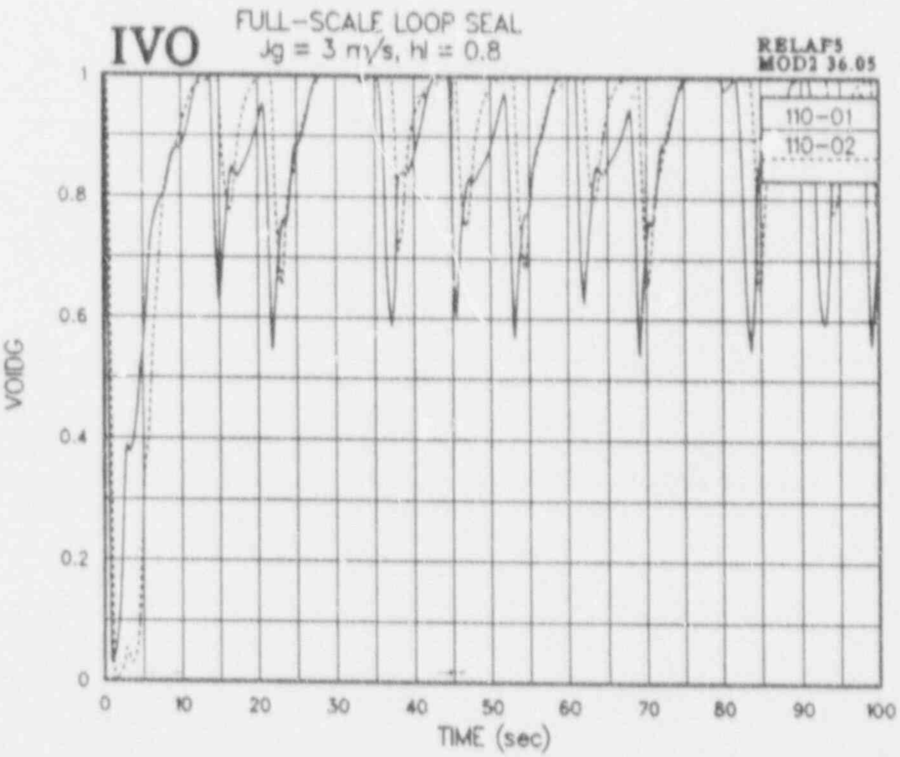

Figure 20. Void fractions in the vertical riser section.

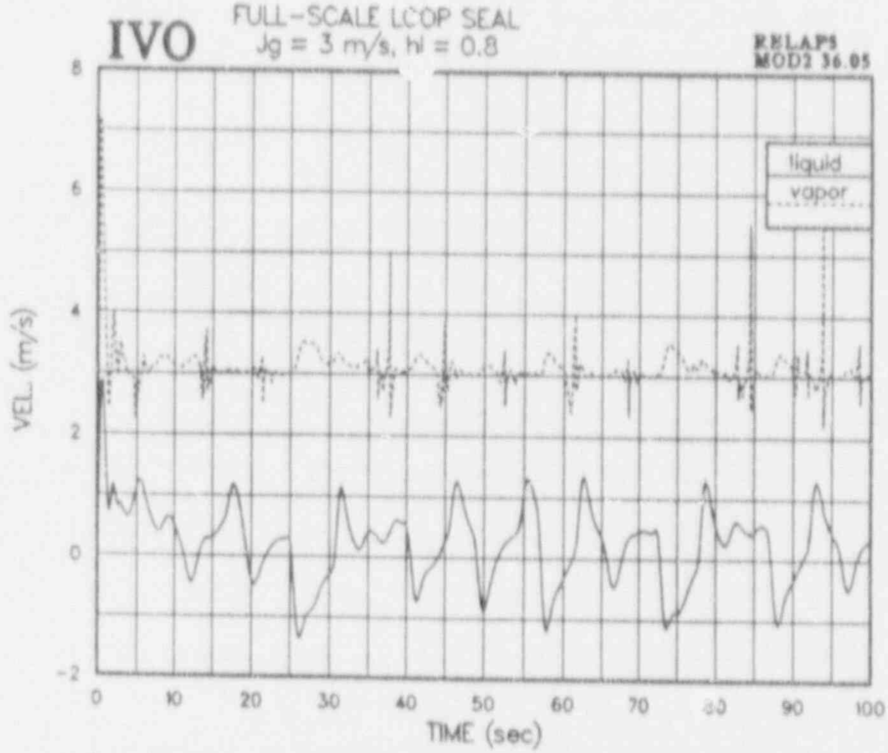

Figure 21. Velocities at junction 70-03.

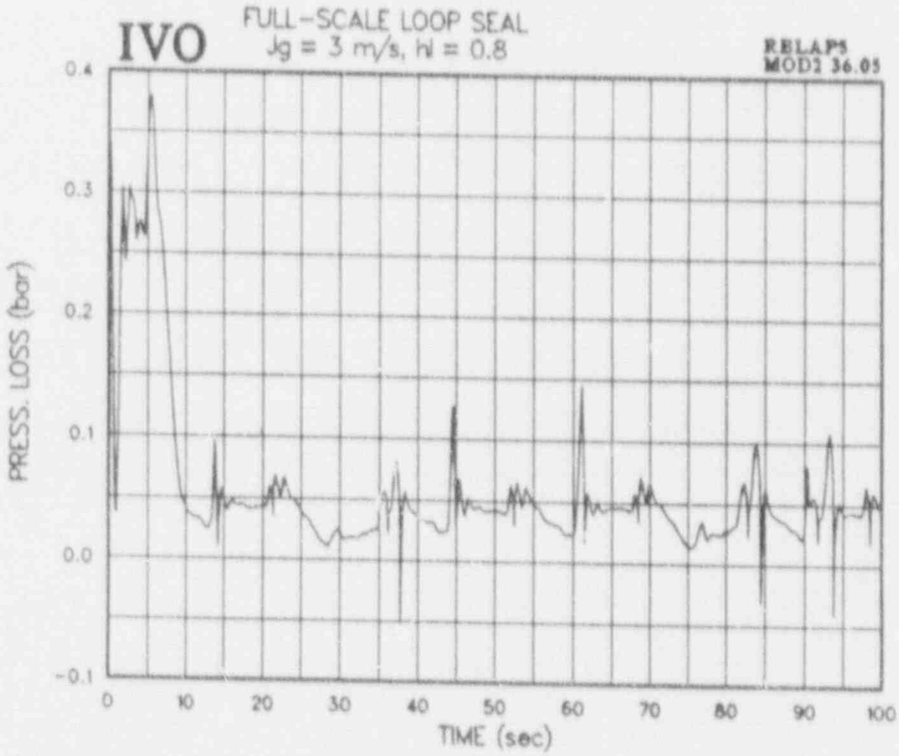

Figure 22. Pressure loss across the loop seal.

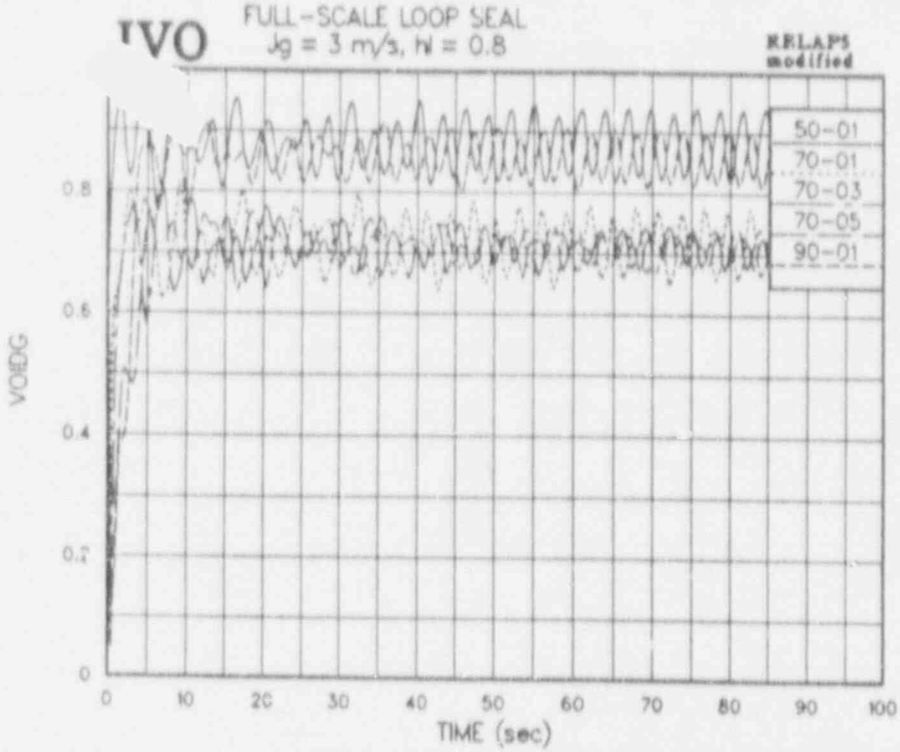

Figure 23. Void fractions in the horizontal section (modified RELAP5/MOD2).

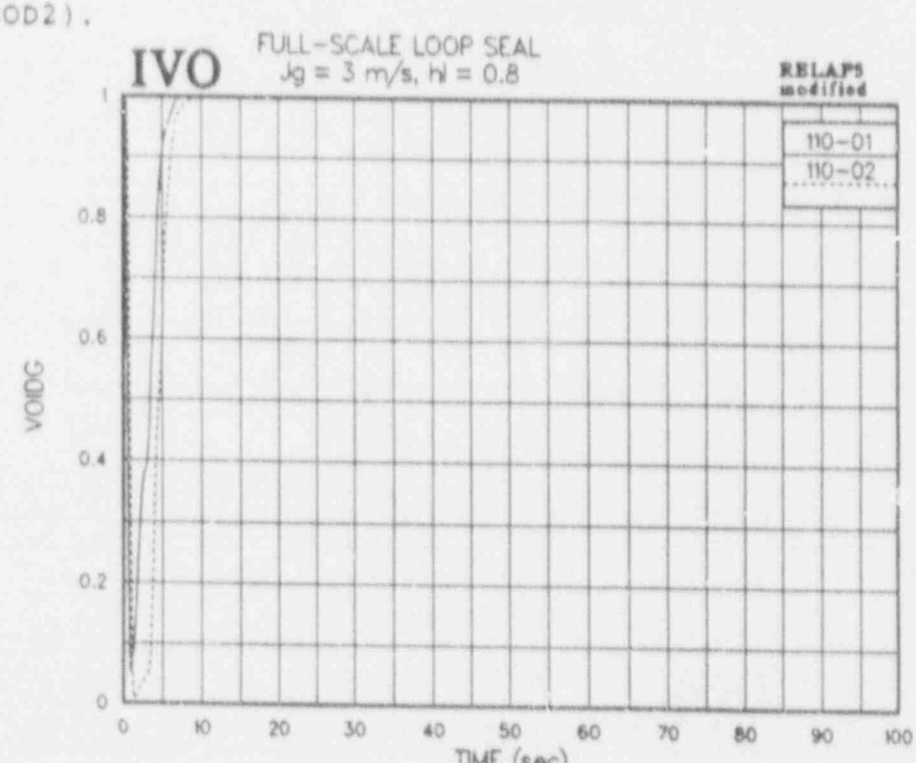

Figure 24. Void fractions in the vertical riser section (modified RELAP5/MOD2).

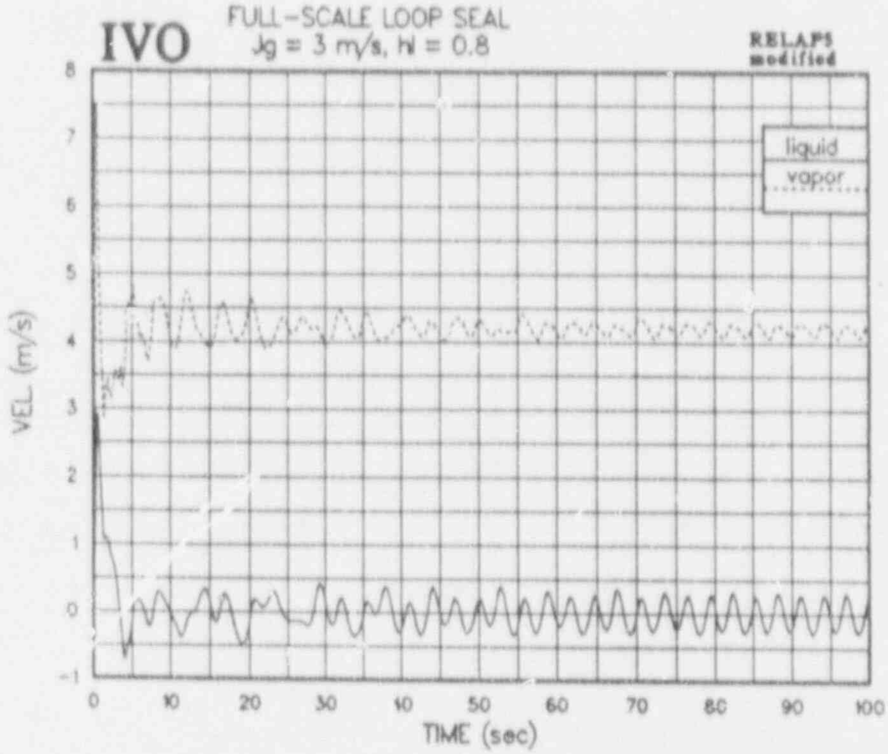

Figure 25. Velocities at junction 70-03 (modified RELAP5/MOD2).

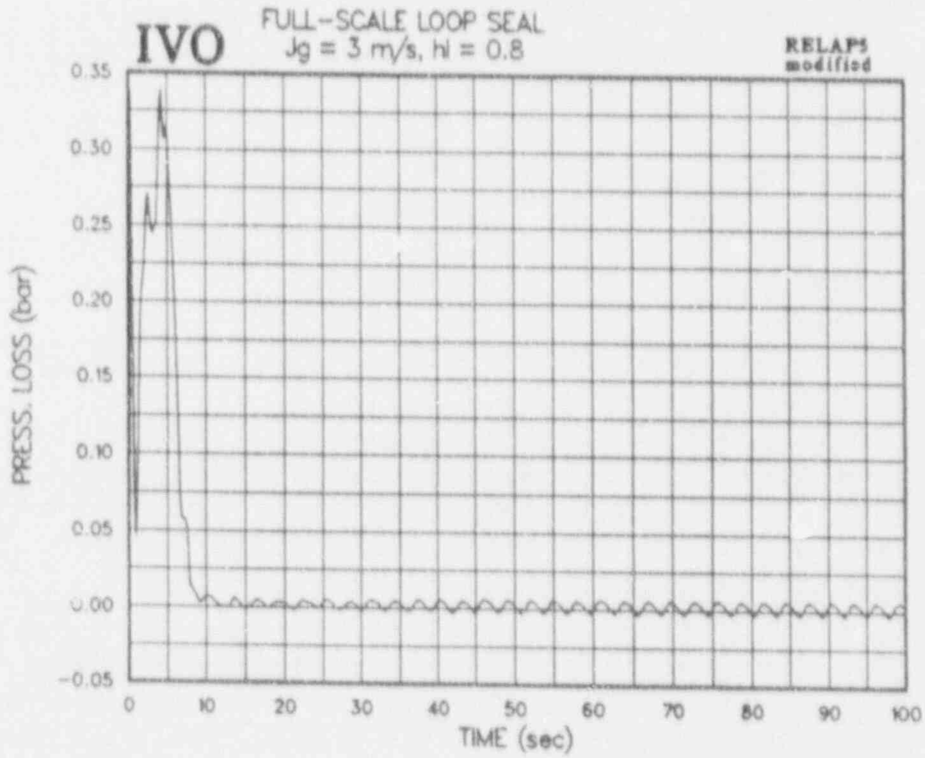

Figure 26. Pressure loss across the loop seal (modified RELAP5/MOD2).

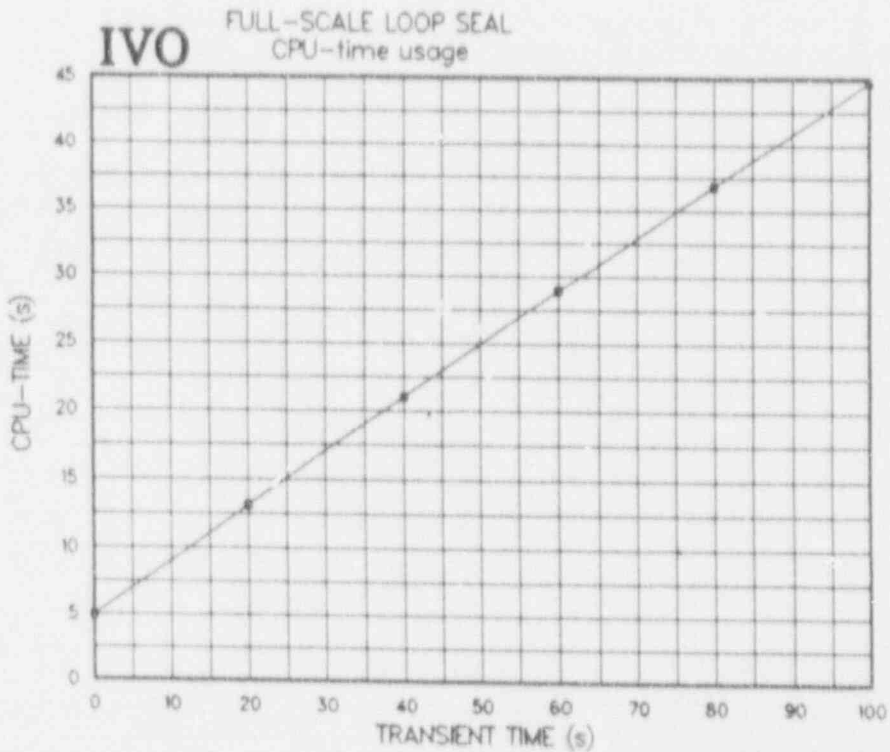

Figure 27. CPU-time consumption of RELAP5/MOD2 36.05 on IBM 3083J when calculating full-scale loop seal behavior (J_g = 3 m/s, $\bar{\alpha}_{L,ini}$ = 0.8, Δt_{max} = 0.1 s).

APPENDIX A. EXAMPLE OF RELAP5 INPUT DECK FOR FULL-SCALE LOOP SEAL

```
*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
= IVO FULL-SCALE LOOP SEAL FACILITY
*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
*
* gas inlet superficial velocity = 1 m/s
* initial dimensionless water level (hl/D) in the loop seal = 0.8
*
*
*-------------------------------------------------------------------------
100       NEW       TRANSNT
105       2.0       4.0
201       100.   1.0-6  0.1     00002  1      200    200
*---------- MINOR EDIT ---------------------------------------------------
301       VOIDG     030010000
302       VOIDG     030020000
303       VOIDG     030030000
304       VOIDG     050010000
305       VOIDG     070010000
307       VOIDG     070030000
309       VOIDG     070050000
310       VOIDG     090010000
311       VOIDG     110010000
312       VOIDG     110020000
313       VOIDG     110030000
314       VELFJ     070030000
315       VELGJ     070030000
316       CNTRLVAR  10
317       CNTRLVAR  20
318       FLOREG    030020000
319       FLOREG    050010000
320       FLOREG    070010000
321       FLOREG    070030000
322       FLOREG    070050000
323       FLOREG    090010000
324       FLOREG    110020000
330       VELF      070030000
331       VELG      070030000
*---------- COMPONENT 10 , INLET VOLUME ----------------------------------
0100000   INLETVOL  TMDPVOL
0100101   0.57   1.0    0       0      -90.   -1.0   5.0-4  0   00000
0100200   002
0100201   0.0       2.2+5     1.0
*---------- COMPONENT 20 , INLET JUNCTION --------------------------------
0200000   INLETJUN  TMDPJUN
0200101   010000000 030000000 00000
0200200   0
0200201   0.0       0.0       1.0       0.0
*---------- COMPONENT 30 , VERTICAL PIPE #1 ------------------------------
0300000   PIPE1     PIPE
0300001   3
0300101   0.57      3
0300301   1.000     3
0300601   -90.      3
0300801   5.0-4     0         3
0301001   00        3
0301101   00000     2
0301201   002       2.2+5     1.0       0 0 0     3
0301301   0.0       0.0       0                   2
*---------- COMPONENT 40 , CURVE JUNCTION #1 -----------------------------
```

```
0400000   JUNC1     SNGLJUN
0400101   030010000 050000000 0.57     0.0      0.0      00000
0400201   0         0.0       0.0      0
*---------- COMPONENT 50 , CURVE #1 ------------------------------------
0500000   CURV1     SNGLVOL
0500101   0.57  1.00  0      0      -45.  -0.707  5.0-4  0.0 00000
0500200   002       2.2+5    2216.0-6
*---------- COMPONENT 60 , CURVE JUNCTION #2 ---------------------------
0600000   JUNC2     SNGLJUN
0600101   050010000 070000000 0.57     0.0      0.0      00000
0600201   0         0.0       0.0      0
*---------- COMPONENT 70 , HORIZONTAL PIPE -----------------------------
0700000   HORIZ     PIPE
0700001   5
0700101   0.57      5
0700301   1.0       5
0700601   0.0       5
0700801   5.0-4     0         5
0701001   00        5
0701101   00000     4
0701201   002       2.2+5     217.0-6  0 0 0    5
0701301   0.0       0.0       0                 4
*---------- COMPONENT 80 , CURVE JUNCTION #3 ---------------------------
0800000   JUNC3     SNGLJUN
0800101   070010000 090000000 0.57     0.0      0.0      00000
0800201   0         0.0       0.0      0        * CONDITIONS
*---------- COMPONENT 90 , CURVE #2 ------------------------------------
0900000   CURV2     SNGLVOL
0900101   0.57  1.0   0      0      45.    0.707  5.0-4  0.0  00000
0900200   002       2.2+5    2216.0-6
*---------- COMPONENT 100 , CURVE JUNCTION #4 --------------------------
1000000   JUNC4     SNGLJUN
1000101   090010000 110000000 0.57     0.0      0.0      00000
1000201   0         0.0       0.0      0
*---------- COMPONENT 110 , VERTICAL PIPE #2 ---------------------------
1100000   VERT2     PIPE
1100001   3
1100101   0.57      3
1100301   1.00      3
1100601   90.       3
1100801   5.0-4     0         3
1101001   00        3
1101101   00000     2
1101201   002       2.2+5     1.0      0 0 0    3
1101301   0.0       0.0       0                 2
*---------- COMPONENT 120 , OUTLET JUNCTION ----------------------------
1200000   OUTLJUN   SNGLJUN
1200101   110010000 130000000 0.57     30.0     30.0     00100
1200201   0         0.0       0.0      0
*---------- COMPONENT 130 , OUTLET VOLUME ------------------------------
1300000   OUTLVOL   TMDPVOL
1300101   0.57  1.0   0      0      90.    1.0    5.0-4  0.0  00000
1300200   002
1300201   0.0       2.2+5     1.0
*---------- CONTROL VARIABLES ------------------------------------------
20501000  PLOSS      SUM        1.0-5      0         0
20501001  0.0        1.0        P 030010000
20501002  -1.0       P 130010000
*
20502000  TOTALM     SUM        1.0        0         1
20502001  0.0        0.57       RHO 030010000
```

```
20502002  0.57        RHO 030020000
20502003  0.57        RHO 030030000
20502004  0.57        RHO 050010000
20502005  0.57        RHO 070010000
20502006  0.57        RHO 070020000
20502007  0.57        RHO 070030000
20502008  0.57        RHO 070040000
20502009  0.57        RHO 070050000
20502010  0.57        RHO 090010000
20502011  0.57        RHO 110010000
20502012  0.57        RHO 110020000
20502013  0.57        RHO 110030000
*----------- EXPANDED [illegible] ----------------------------------------------------
20800001  FIJ         030010000
20800002  FIJ         040000000
20800003  FIJ         070030000
20800004  FIJ         100000000
20800005  FIJ         110020000
. ACTA EST FABULA , PLAUDITE !
```

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11. ABSTRACT (200 words or less)

RELAP5/MOD2 analyses of a full-scale and 1/10-scale atmospheric air-water loop seal facilities have been conducted. The calculations have been performed with the version 36.05 and also with a modified version with the treatment of interfacial drag changed in the loop seal bends. The calculated residual water level differs from that measured in the experiments, the computational value being lower. The gas superficial velocity needed for loop seal clearing is also predicted lower by RELAP5. The interfacial drag modifications slightly improved the results, but an agreement with the experimental data was found.

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