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The RETRAN Newsletter

August, 1998

Summary of Activities

This issue of the RETRAN Newsletter contains a summary of the Ninth International RETRAN Meeting, information on the submittal of RETRAN-3D to the NRC, and interesting articles from code users . Your contributions are greatly appreciated. We, EPRI and CSA, encourage everyone to participate in this newsletter.

Previous issues of the RETRAN Newsletter are available from the RETRAN Web Pages at http://www.csai.com/retran.

In This Issue...

Summary of the Ninth International RETRAN Meeting

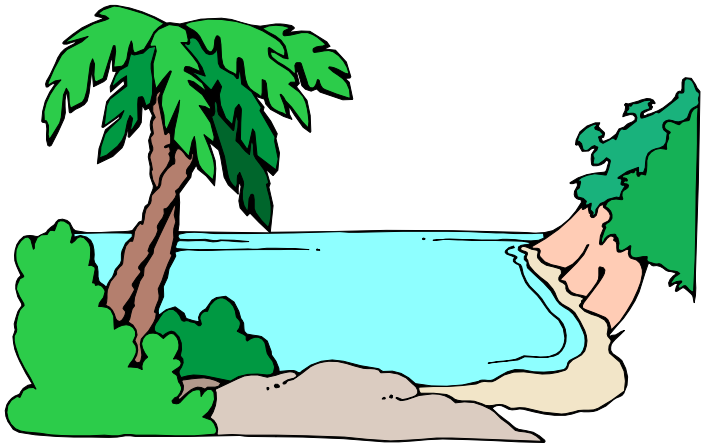
Garry C. Gose, CSA

The Ninth International RETRAN Meeting was held in Monterey, California, on June 7-10, 1998. Forty-four individuals representing 32 organizations from the United States, Switzerland, Spain, Japan, and Taiwan participated in the meeting. The participants included members of electric utilities, a government regulatory agency, a reactor fuel vendor, research laboratories, and independent consultants.

One objective of these meetings is to exchange information concerning RETRAN. Discussions of analysis results, the use of the program for new applications, and modeling techniques that can be used for various transients were elements of many of the presented papers. This meeting, the Ninth International Meeting, included technical sessions devoted to presentations in EPRI's new software analysis tools, CORETRAN, and RETRAN-3D.

Mr. Lance Agee, the RETRAN Project Manager at EPRI, delivered the feature address of the Plenary session with a presentation summarizing some of the EPRI activities in the nuclear safety analysis area. This presentation included information on the Robust Fuel Program (RFP) which went into effect in January 1998 and the design review and licensing submittal of RETRAN-3D. He presented his vision of the future for applications, and identified working groups for specific analysis on small breaks and BWR stability as important in the area of new applications.

Summary of the Ninth International RETRAN Meeting (Cont'd)



The plenary session continued with an invited panel discussion, " Analysis Needs for Supporting Nuclear Plants in the 21st Century". Dan Garner of the Institute of Nuclear Power Operations, Larry O'Dell from Siemens Nuclear Power Corporation, and Jack Haugh of EPRI presented their views regarding electrical industry needs for safety and reliability assessment. This session involved quite a bit of participation by all the attendees in the question and answer session that followed the panel.

Another panel presentation was held to start the second day of the meeting. This panel discussed licensing issues. Dick Cacciapouti of Duke Engineering & Services gave the reactor physicist's view of the licensing process. James Boatwright, TU Electric, talked about the maintenance group activities that have provided for the continued support of the RETRAN-02 Safety Evaluation Report, and Dan Hughes summarized findings of the EPRI-sponsored design review of RETRAN-3D and it's implications relative to licensing matters. The subject of an NRC review of RETRAN-3D was one subject that was discussed during the question/answer period.

The technical sessions for RETRAN included presentations of RETRAN-3D and RETRAN-02 analysis results as well as some of the current development activities. Technical papers included descriptions of analyses performed in support of plant operations as well as for licensing, topical report, and plant support activities. Two papers were presented on the use of RETRAN-3D for advanced BWR applications.

The third day focused mainly on multidimensional analyses as well as the CORETRAN and RETRAN-3D programs. Roger Anderson of Northern States Power delivered an invited paper to start these sessions. This presentation focused on the value of multidimensional analysis for utilities in the future.

One paper summarized the extension of CORETRAN for depletion applications. Another paper described the application of CORETRAN in evaluating a current fuel related issue, axial offset anomaly. Two papers described new models and solution methods for the CORETRAN thermal hydraulics. Two summaries of CORETRAN depletion benchmarks and a paper on new models and applications using RETRAN-3D multidimensional kinetics were presented.

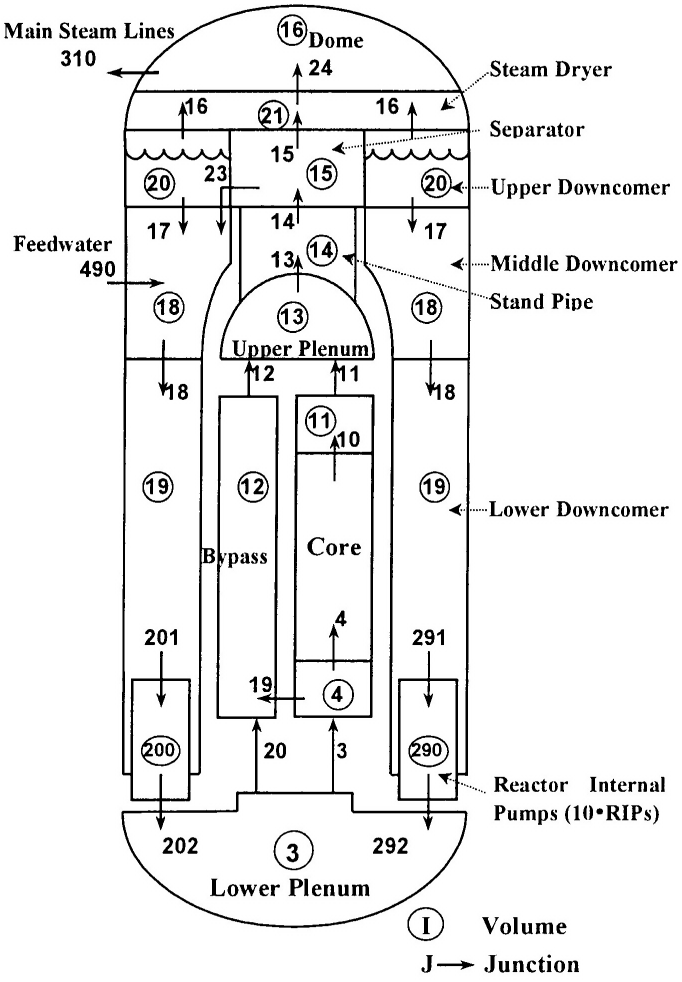
The final session was devoted to multidimensional neutron kinetics analyses of the TMI steam line break event. Three different organizations presented results for the analyses using three different codes, CORETRAN, ARROTTA, and TRAC/PF1-NEM.

The continuing interest in RETRAN, as demonstrated by the participation in the meeting and the variety of presentations, is encouraging to EPRI and CSA, the co-sponsors of the meeting. The Proceedings of this meeting, including complete papers of the presentations and a list of participants, will be printed as an EPRI publication and distributed to those individuals who attended the meeting. Others may obtain a copy of the Proceedings from the Research Reports Center.

First Use of RETRAN to Model ABWR is Reported in Monterey

In a paper that described a few "firsts", Dr. Michitsugu Mori of Tokyo Electric Power Company (TEPCO) presented results from a RETRAN-3D analysis of the world's first ABWR. The Kashiwasaki-Kariwa Nuclear Power Station (Unit 6) is a 1365 Mwe ABWR placed in commercial operation by TEPCO in November 1996 and Dr. Mori's work was the first application of RETRAN-3D to this new generation of boiling water reactors.

Examination of the accompanying figure reveals that there are no jet pumps or recirculation pumps in the ABWR design which sets it apart from previous BWR generations. The ABWR design presents new challenges to the modeling community due to its reactor internal pumps (RIP), replacing the conventional jet pumps and external recirculation pumps. The ABWR system uses ten RIPs in the lower plenum and downcomer, peripherally bottom mounted on the reactor pressure vessel.



While the design of the coolant flow system is new, features of the flow control system are more familiar using a conventional three element control system that adjusts the reactor feedwater flow to compensate for the water level departure from a fixed set point as well as the steam flow mismatch.

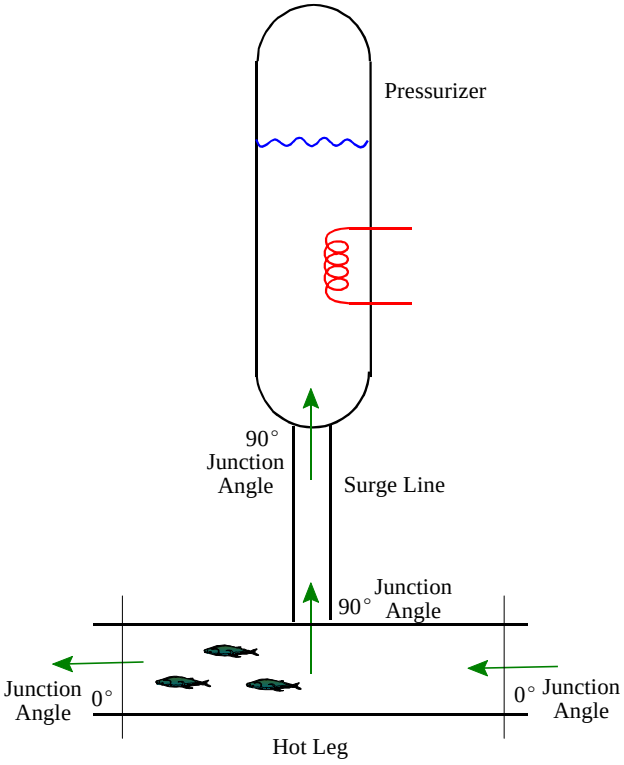
The analysis that Dr. Mori presented focused on the modeling of the RIPS and the behavior of the flow control system when simulating one, two, and three RIP trip events that were part of a startup test series. The analysis dealt with pump trips and the ability of the flow control system to respond to the loss of a pump. The comparison of the RETRAN-3D results with ABWR plant data provides a valuable source of validation data for these new applications.

Dr. Mori reported that the effort was directed towards verifying the RETRAN model of the ABWR system, the behavior of the feedwater control system, and the ability to correctly predict the water level is important towards that end.

The results of Dr. Mori's analysis showed that RETRAN-3D can model the resultant powers and flows from the pump trip cases and that the water level is also reasonably predicted.

In a follow up discussion, Dr. Mori added some perspective to the work that TEPCO presented in Monterey (page 5).

TechTips



In RETRAN, the junction angle is used to model the vector nature of the momentum flux terms in the momentum equation. The angle is used to compute upstream flow in the same direction as junction flow for the momentum flux terms. The angles of junctions entering and leaving a volume must be defined from a consistent coordinate system within the volume. Whenever two junctions connected to the same volume have equal angles, the junctions are parallel. A branch is represented by a 90° offset from the main flow path junctions. However, since volumes are connected through flow paths, the user needs to remember to maintain some consistency for the entire flowing network.

Take the example of a pressurizer surge line. If the hot leg junctions have 0° angles then the branch to the surge line should be modeled with a 90° angle to get the correct momentum flux contribution from the hot leg in the surge line direction. For a typical PWR with the pressure specified in the pressurizer, the correct momentum flux modeling can result in a significant change in the pressure propagated into the rest of the system. The table below shows the effect of the surge line angle on the initial hot leg pressure for two typical PWR models. The trick here is to remember that parallel junctions have equal angles. The junction from the surge line volume into the pressurizer volume is parallel to the surge line inlet junction and therefore must also have a 90° angle.

		Initial Hot Leg Pressure (psia)	
	Pressurizer Pressure (psia)	Surge Line Junction Angle 0°	Surge Line Junction Angle 90°
ATWS*	2250	2242	2258
UCRW*	2220	2205	2242

*These are the RETRAN sample problems modified to use 0° or 90° junction angles in the pressurizer surge line. For both cases the hot leg main flow path junctions have 0° angles.

Summary of RETRAN-3D Code Trouble Reports

A total of 150 trouble reports had been filed as of June 30, 1998. Of these, 134 reports have been resolved, while 16 remain unresolved. A summary of the unresolved trouble reports is shown below. Additional information for RETRAN-3D trouble reports is available at http://www.csai.com/retran/r3dtrpt/index.html.

TROUBLE REPORT NO.	TYPE OF PROBLEM	CORRECTION NO.	IDENT	COMMENTS
7	Steam separator model fails	***	*******	
22	Problem using Wilson bubble rise model & error when using low power initialization	***	*******	
			MOD001	(partial fix)
30	2-loop Oconee w/5-eq. fails in steady state	***	*******	
40	Results do not agree with data	***	*******	
48	Steady state fails after 6 iterations	***	*******	
		006	MOD001g	(partial fix)
52	MOC does not return to the initial temp.	***	*******	
54	MOC solution; no null transient for two-phase	***	*******	
60	Anomalous countercurrent flooding	***	*******	
81	Steady-state failure at iteration #6	***	*******	
116	Fails in steady-state initialization	***	*******	
122	Problems with EOS convergence	***	*******	(water packing)
127	Lack of convergence error	***	*******	(mass transfer)
142	Timestep selection causes 3-D kin to fail	***	*******	
144	TAUGL model doesn't apply for horiz. flow	***	*******	
145	SS fails to converge for low press. and flow	***	*******	
150	SS solution void fraction oscillation	***	*******	

Interview with Dr. M. Mori, TEPCO, on the First ABWR

Q: Now that TEPCO has demonstrated that RETRAN-3D can model the TEPCO ABWR system, what is the next step? Are there plans for additional ABWR analysis using RETRAN-3D?

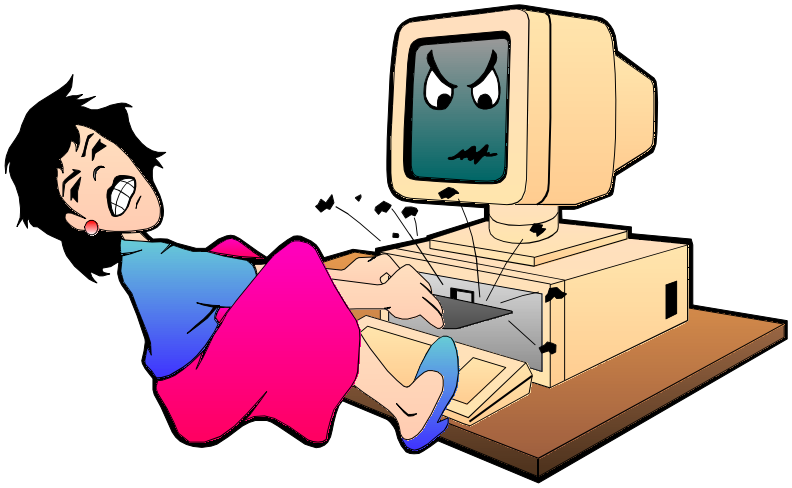
A: Experiences of use of RETRAN-3D for analysis of ABWR shall be extended to coming ABWRs of TEPCO. In addition of RIP trip analyses presented in Monterey, MSIV closure, turbine trip, GLR events, and other events shall be demonstrated by RETRAN-3D.

Q: How many ABWR systems will be in the future for Japan?

A: Successful commercial operation of the first and second ABWRs, K6 and K7 of TEPCO, will stimulate utilities to introduce the next ABWR. Not-a-few number of ABWR in future of Japan will be expected.

Q: Are there any advantages or options that RETRAN-3D has that helped you analyze the system?

A: Utility user friendly.



Summary of RETRAN-02 Trouble Reports

The following is a summary of RETRAN-02 Trouble Report/Code Maintenance Activity.

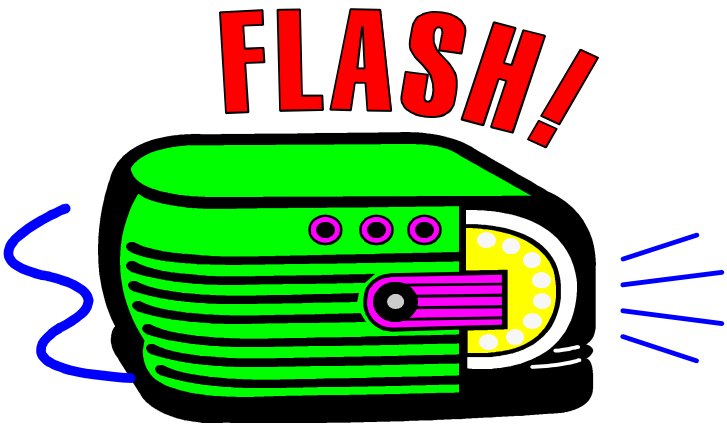
Unresolved Trouble Reports

- 1 From MOD001
- 5 From MOD002
- 4 From MOD003
- 3 From MOD004
- 9 From MOD005

A list of trouble reports and the status can be obtained directly from the EPSC.

Additional information is available from the RETRAN-02 Trouble Report Page at http://www.csai.com/retran/r02trpt/index.html.

NO.	TROUBLE REPORT TYPE OF PROBLEM	CORRECTION NO.	IDENT	COMMENTS
1	Error 209 in TEMZ	***	*******	MOD001 Error
61	Delta T for Conductor with TDV	***	*******	Need Input Deck
121	OTSG Low Power Initialization	***	*******	
139	Failed Using Large Time Step	***	*******	Need Input Deck
140	Spurious Trips on High Level	***	*******	Need Input Deck
177	Overflow in WAT9	***	*******	Need Input Deck
209	Pump Coast Down Rates	***	*******	Need Correct Deck
272	Junction Properties at Break	***	*******	Need Input Deck
317	Junction Property Error	***	*******	
334	Time-Dep. Volume Input	***	*******	
342	Control Block Output near Zero	***	*******	Cannot Reproduce Error
354	Large Step Change in PHIR	***	*******	
366	Mixture/Liquid Level Difference	***	*******	Need Input Deck
376	Control Reactivity, No Motion	***	*******	
394	Anomalous Heat Trans. Behavior	***	*******	
408	OTSG Heat Transfer Problems	***	*******	
413	Incorrect Vsn No. in IBM Output	***	*******	Cannot Reproduce Error
439	Decay Heat Input	***	*******	
440	Kinetic Energy/Time Dep Area	***	*******	
442	Poor Diagnostics	***	*******	
443	Liquid Region Work Term	***	*******	
444	Positive Slip Velocity	***	*******	



RETRAN-3D Submitted to NRC for Review

Gregg Swindlehurst, Duke Energy

By letter dated July 9, 1998, the RETRAN Maintenance Group submitted the RETRAN-3D code documentation (EPRI NP-7450, Revision 2, Volumes 1-4) to the NRC for review. This submittal is a significant milestone in the evolution of the RETRAN family of codes, and begins the transition process for licensing applications from RETRAN-02 to RETRAN-3D. It is expected that NRC review and approval will significantly broaden the use of RETRAN-3D, and will enable RETRAN users to take advantage of the many upgrades in code models, such as the three-dimensional core representation, the expanded nonequilibrium field equations, and noncondensable gas flow. All users will benefit from the improved steady-state initialization capabilities, and, in particular, the significant improvement in execution time. In these times of great emphasis on doing more faster with less resources, the improved execution time alone is very beneficial to all users.

The following organizations offered their support of the submittal to the NRC. This expression of support did not involve any commitment - only general support of NRC review for the benefit of the industry.

Baltimore Gas & Electric
Commonwealth Edison
Detroit Edison
Duke Engineering & Services
Duke Energy
GPU Nuclear
Illinois Power
New York Power Authority
Northern States Power
PECO Nuclear
Pennsylvania Power & Light
South Texas Project Nuclear Operating Co.
TU Electric
Union Electric
Virginia Power
Washington Public Power Supply System
Wisconsin Public Service
Wolf Creek Nuclear Operating Co.

Getting the NRC to actually review the RETRAN-3D code submittal will be difficult given their budget situation and their recently stated policy of not reviewing any code topical reports without an associated technical specification revision request. What is likely to be needed to start the NRC review is a lead utility to submit a RETRAN-3D application that is needed for a license amendment. Another possibility is to seek NEI assistance in starting the NRC review process. Please forward any ideas that you have on the NRC review process to me by E-mail (gbswindl@duke-energy.com) or call (704) 382-5176. I would like to thank Lance Agee, Jim McFadden and the CSA staff, and the Steering Committee, for their assistance in preparing and reviewing the RETRAN-3D submittal package.

About This Newsletter

RETRAN Maintenance Program

The RETRAN Maintenance Program is part of a program undertaken by EPRI to provide for the support of the software developed in the Nuclear Power Division. The main features of the Subscription Service include:

- the code maintenance activities for reporting and resolving possible code errors,
- providing information to users through the User Group Meetings and this newsletter, and
- preparing new versions of RETRAN.

The RETRAN Maintenance Program now has 31 organizations participating in the program, including 23 member utilities, 5 organizations from outside of the U.S., and 3 nonmember utilities from the U.S. A Steering Committee, composed of representatives from the participating organizations, advises EPRI on various activities including possible enhancements for the code and the scheduling of future code releases. Information regarding the Maintenance Program can be obtained from

Lance Agee
EPRI
P. O. Box 10412
Palo Alto, CA 94303
lagee@epri.com or (650) 855-2106

Newsletter Contributions

The RETRAN Newsletter is published for members of the Subscription Service program. We want to use the newsletter as a means of communication, not only from EPRI to the code users, but also between code users. If this concept is to be successful, contributions are needed from the code users. The next newsletter is scheduled for December 1998 and we would like to include a brief summary of your RETRAN activities. Please provide your contribution to CSA, P. O. Box 51596, Idaho Falls, ID 83405, or to the E-mail addresses below by December 4, 1998. ***Contributors of a feature article will receive a RETRAN polo shirt.*** We are looking forward to hearing from all RETRAN licensees.

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Garry Gose	gcg@csai.com
Pam Richardson	pam@csai.com

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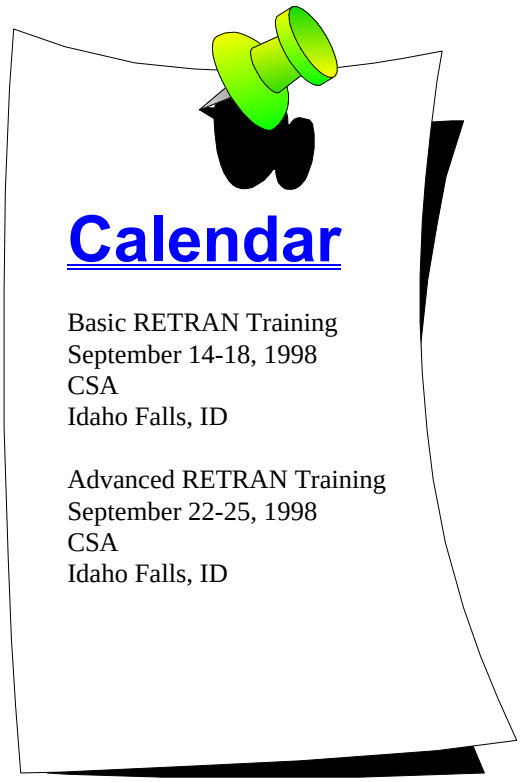

Calendar

Basic RETRAN Training
September 14-18, 1998
CSA
Idaho Falls, ID

Advanced RETRAN Training
September 22-25, 1998
CSA
Idaho Falls, ID

EPSC Contacts

EPSC Hours:	7 a.m. to 8 p.m. EST
EPSC Hotline:	(800) 763-3772
EPSC Fax:	(619) 453-4495

For Nuclear Quality Assurance related questions, call Clark Wallace at (619) 622-6611.

Please supply us with technical tips for our new section TechTips *and you will receive a RETRAN mouse pad.*