ACRS-2320
PDR 080585

CERTIFIED
6/6/85

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ACRS ECCS SUBCOMMITTEE MEETING MINUTES

MAY 31, 1985

WASHINGTON, DC

Purpose: The purpose of the meeting was to review selected portions of the NRC Thermal Hydraulic research Program for the Committee's Report to the Commission on the FY 87 budget.

Attendees: Principal meeting attendees include:

ACRS	NRC
D. Ward, Chairman	L. Shotkin, RES
J. Ebersole, Member	B. Sheron, NRR
H. Etherington, Member	W. Beckner, RES
I. Catton, Consultant	F. Odar, RES
P. Boehnert, Staff	D. Solberg, RES
	D. Bessette, RES
	C. Troutman, RES

Meeting Highlights, Agreements and Requests

1. Dr. L. Shotkin noted that the FY 87 budget is not yet fixed. He said that RES is limited by the budget restrictions in what it can do and seeks ACRS advice on what should or should not be done. Th:

DESIGNATED ORIGINAL

Certified By B J R

FY 87 RES budget will be cut by ~$13.7 M. RES has cut the T/H budget by ~$6.8 M. NRR has requested that $4 M be restored for future integral testing. RES wants ACRS advise on: (1) the need for future integral system testing; (2) the need for future university research; and (3) the need for fast running codes or a fast-running desk top nuclear plant analyzer. RES is in disagreement with NRR on items 2 and 3. RES has also made a choice between TRAC and RELAP-5 for future code development as discussed below.

RES stated that the "final product" of the T/H Transients Program is user-friendly plant analyzers based on codes whose accuracy has been quantified by assessment against integral and separate effects tests. A Technical Integration Center will be set up at INEL to maintain thermal hydraulic expertise. Figure 1 shows a schematic of how the plant analyzers will be developed.

The current T/H budget for FY 87 was discussed (Fig. 2). RES has reduced the FY 87 budget by $6.8 M as shown in Figure 2. The largest single cut is $3.7 M out of $4.0 M for the proposed Advanced Test Facility leaving $0.3 M.

Regarding the choice between TRAC and RELAP-5 for future development, RES has chosen TRAC. RELAP-5 will have continued improvement and maintenance support; however, NRC will decrease its support and User support will increase to make up the difference.

2. An overview of the separate effects program was given by W. Beckner. For FY 87 the University Program is being reduced by $0.8 M ($2.0 M to $1.2 M - Fig. 3). Figures 4-6 detail the SE Program plans. In response to Mr. Ebersole, Dr. Beckner said one of the studies will address the issue of boron mixing in a BWR vessel, given an ATWS. Further discussion pointed out that some studies (Figure 5 - asterisked) will address modeling of radioactive release rates for SGTR accidents.

   RES believes a stable funding level of ~ $4 M/year for SE work is desirable. This would be broken down as follows: Universities (~ $2 M/yr), DOE Laboratories (~ $1-1.5 M/yr). Others ($0.5-1.0 M/yr). Given the budget cutback, it now looks impractical to maintain this level of support.

3. RES plans for continued integral testing capability were reviewed by D. Solberg (RES). Key points noted were:

   - Most US facilities are scheduled to be shut down by the end of FY 86 (Fig. 7), therefore there will be no domestic T/H integral testing capability in FY 87, or beyond for W, CE or GE geometry reactors.

   - NRC must depend on foreign facilities, such as ROSA-IV, for testing on new safety issues, or on US industry.

- Foreign facilities, though cooperative, have their own agenda.

- Industry testing could result in plant delays and greater costs.

Mr. Ward indicated that the last bullet appears to be an Industry, not a NRC, problem.

A number of alternate approaches for future integral testing are being explored by RES (Figs. 8-9). Two ideas that look promising are: (1) move MIST and FIST to INEL to join Semiscale, and/or (2) build an ATF (at INEL?). RES noted that the Modular Test Facility proposal of 1984 was dropped due to scaling and funding problems.

RES has established a number of criteria for the ATF study (Fig. 10). Results of a scaling study under way as part of the joint NRC/B&W IST program, as well as a ATF scaling study (Fig. 11), will be used to evaluate the most feasible ATF alternative. RES is soliciting cooperative support for the ATF concept from DOE and the Industry.

Mr. Ward said RES should be looking for phenomena or "surprises" in their T/H programs in an attempt to preclude these surprises showing up in a power plant.

4. F. Odar discussed the status of the code maintenance program. Key points noted were:

- Goals of the program are: (1) to maintain capabilities for auditing vendor analyses, evaluating operator guidelines, and addressing safety and licensing issues for NRR; (2) provide User assistance to NRC; (3) improve physical models as requested by NRC (but with no major change in basic code structure or models); and (4) update documentation.

- The end points of the program will come around 1990 when User convenience features and physical model improvements are deemed sufficient.

- RES believes a minimum of three people will be needed for this Program. Dr. Catton cautioned that the same people maintaining the codes should be using the code as well. RES agreed.

- TRAC PF1/MOD-1, DB1/MOD-1 and RELAP-5/MOD-2 have been frozen for 2 years as part of the International Code Assessment Program (ICAP). The known/needed improvements for TRAC and RELAP were detailed (Figs. 12-18).

5. D. Bessette overviewed the ICAP. The final goals include:

- Quantify uncertainties of TRAC-PF1/MOD-1, TRAC-BF1 and RELAP-5/MOD-2 for all transients.
- Correct code errors.
- Provide improved User guidelines.
- Identify code limitations.
- Identify remaining deficiencies.

The program will end around 1990.

The key basis of the program is for foreign countries to assess the US codes (TRAC, RELAP, etc.) and provide the results to NRC. Code uncertainty is to be determined by a judicious selection of key parameters (Fig. 19). Figures 20-21 show the foreign countries participating in ICAP and the codes these countries plan to use. Validation matrices have been defined for PWR and BWR codes.

6. The nuclear plant analyzer (NPA) and plant data bank (PDB) was discussed by C. Troutman. Figures 22-23 overview the NPDB status for FY 85-89. The NPA status for the same FYs is given in Figures 24-25. The expected Users for this program are: RES Staff (in-house), I&E Operations Center, DOE Contractors, Human Factors experts and others.

7. B. Sheron (NRR) provided the following comments on the RES T/H Program:

- NRR agrees that continued availability of an integral systems test facility is desirable but they do not yet have results of any studies which justify need for a new facility. Costs vs benefits should determine whether a new facility is built, old facilities maintained, modified, etc. NRR recommend a "Test Advisory Group" (TAG) be set up, similar to that done on MIST Program, composed of government and industry representatives, to recommend the best approach.

- 2D/3D Program - NRR strongly urges UPI upper internals be reinstated and a suitable number of UPI experiments planned and scheduled for UPTF. The UPI plant ECCS model is not in conformance with Appendix K. Data is needed to bring data base up to par with bottom core flood data.

- For future code development, we agree only one code (TRAC) should be supported; however, until this transition is made, we will rely on both TRAC and RELAP-5. Some reduction in FY 87 RELAP-5 support is justified.

- For ROSA-IV - assessment of the test data by codes should be limited to use of TRAC.

- For the Separate Effects Program - university funding reduction from $2 M to $1.5 M is considered appropriate and funding for the visual loop could be reduced, since it has low priority.

- Code Assessment and Applications Program - RES has an extensive international code assessment and application program. We propose up to $0.5 M reduction in this area unless this program supports code improvement identified by assessment and agreed to by NRR.

- Desk Top Analyzer- NRR sees no need for self-contained desk top analyzers, therefore, $0.7 M would be saved since NRR does not support this program.

- Nuclear Plant Data Bank (NPDB) - the NPDB still doesn't work; the NPDB is only useful if it has data in it. We would like to see a program in place to put 4-6 decks per year into the NPDB.

8. The meeting was adjourned at 1:05 pm. The Subcommittee Members then watched a presentation of the BNL BWR NPA.

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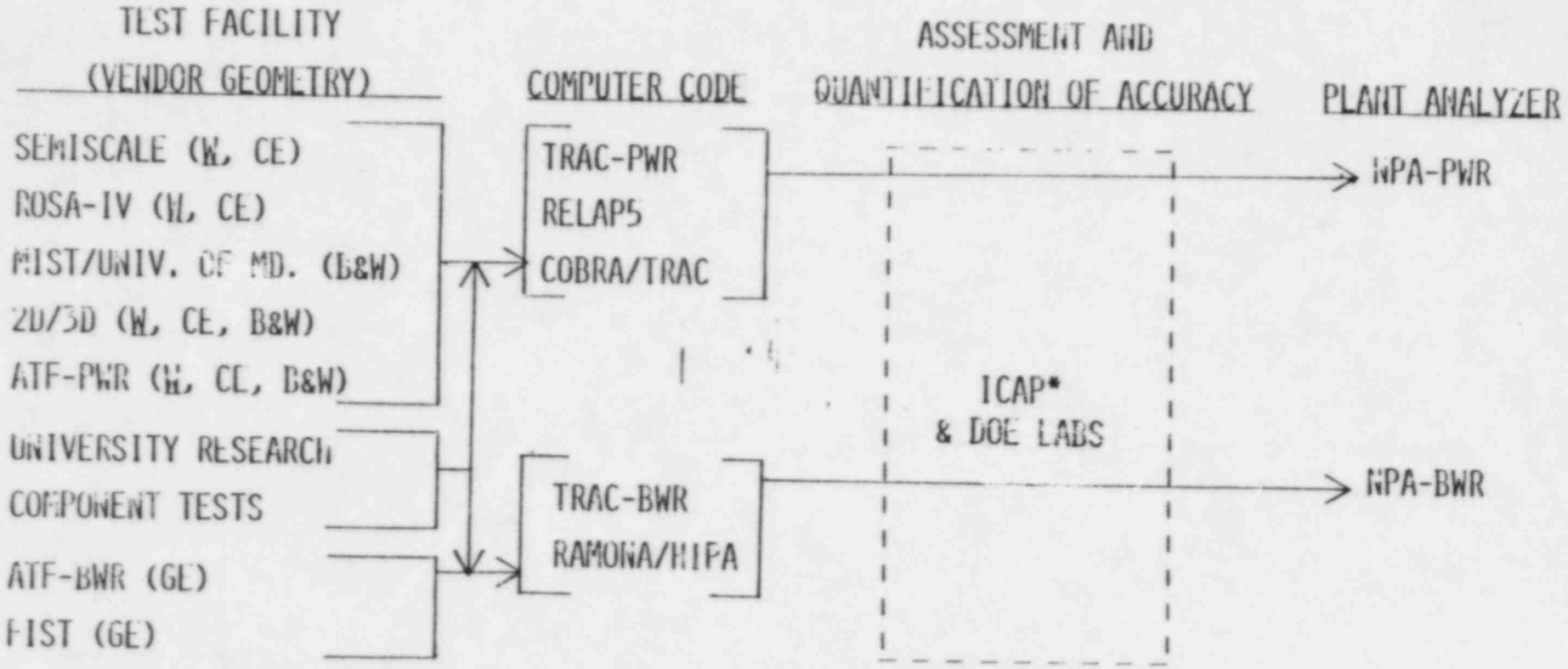
NOTE: Additional meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C., or can be purchased from Ann Riley & Associates, Ltd., 1625 I Street, N.W., Suite 921, Washington, DC 20006 (202/293-3950).

THERMAL HYDRAULIC TRANSIENTS (CONTINUED)

MAJOR TOOLS



*INTERNATIONAL CODE
ASSESSMENT PROGRAM
(USING DATA FROM INTERNATIONAL
TEST FACILITIES)

FIG. 1

THERMAL HYDRAULIC TRANSIENTS

($ - MILLIONS)

	FY 1985	FY 1986	REQ FY 1987	MARK FY 1987	Δ
INTEGRAL FACILITIES	$ 16.2	$ 12.0 (11.7)	$ 14.8	$ 9.8	
ROSA-IV	1.1	1.7 (1.4)	2.0	1.6	- 0.4
SEMISCALE	4.3	2.9	0.5	0.5	
CONTINUING INTEGRAL TESTING	0.3	0.5	4.0	0.3	- 3.7
MIST FACILITY	5.3	3.4	1.5	1.5	
MIST FULL-POWER UPGRADE	0	0	3.0*	2.1	- 0.9
2D/3D	4.6	3.2	3.6	3.6	
FIST FACILITY	0.6	0.3	0.2	0.2	
SEPARATE EFFECTS	2.3	3.2	4.0	3.5	
UNIVERSITIES	0.9	1.3	2.0	1.2	- 0.8
DOE LABS AND OTHERS	1.4	1.9	2.0	2.0	
TRANSIENT MODELS AND CODES	5.2	6.5	7.8	6.5	
CODE ASSESSMENT/APPLICATION	2.0	3.1 (2.9)	3.1	2.7	- 0.4
CODE MAINTENANCE/PLANT ANALYZER	3.2	3.4 (3.1)	4.7	4.1	- 0.6
	$ 23.7	$ 21.7 ** (20.9)	$ 26.6	$ 19.8	- 6.8

* TOTAL FUNDING REQUIRED FOR MIST FULL-POWER TESTING (COST-SHARING TO BE DISCUSSED WITH INDUSTRY).

** $0.8M FY 1986 ALLOCATION TO CONTAINMENT RESEARCH

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SEPARATE EFFECTS PROGRAM FUNDING

CATEGORY	FY85	FY86	FY87 (REQ)	FY87 (MARK)
UNIVERSITY	0.9	1.3	2.0	1.2
DOE LABS	0.7	1.1	1.3	1.3
OTHERS	0.7	0.8	0.7	0.7
TOTAL	2.3	3.2	4.0	3.2

F16.3

FY87 SEPARATE EFFECTS PROGRAM PLANS

UNIVERSITY PROGRAMS ($ 1.~~5~~2M)

* U of Md FACILITY
* OTSG THERMAL HYDRAULICS
* BORON MIXING & PTS
* CONDENSATION
* VISUAL LOOPS & ANALYSIS CENTERS
  (REDUCED BY BUDGET MARK)

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FY87 SEPARATE EFFECTS PROGRAM PLANS

DOE LABS ($ 1.3M)

* INEL EXPERIMENTAL DATA BANK

* INEL SEPARATE EFFECTS TESTS
  - FLUID MIXING
* - CCFL IN SG TUBES
* - STEAM SEPARATOR PERFORMANCE
  - HIGH TEMPERATURE CIRCULATION

* * IODINE PARTITION

* ANL FLOW REGIME/SCALING

FY87 SEPARATE EFFECTS PROGRAM PLANS

OTHERS ($ 0.7)

* SMALL BUSINESS PROGRAM
* WRSR INFORMATION MEETING
* RES SUPPORT SERVICES
* BWR DYNAMICS
* STEAM EXPLOSIONS .

THERMAL HYDRAULIC TRANSIENTS: MAJOR TEST FACILITIES

	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991
SEMISCALE	F/S TEST SERIES LIQUID HOLDUP TESTS	SBLOCA W/D HPI SCALING COUNTERPART	CLOSEOUT ANALYSES MOTHBALL				
MIST/OTIS (B&W)	MIST CONSTRUCTION	MIST TESTS: CHARACTERIZATION, MODE TRANSITION, SBLOCA	MIST TESTS: SGTR, FEED AND BLEED, FULL-POWER MODS	FULL-POWER TESTING	CLOSEOUT ANALYSES		
FIST (GE)	PHASE II ANALYSES AND REPORTING	CLOSEOUT ANALYSES					
ROSA-IV (JAPAN)	TPTF S.G. H.T. LSTF TESTING FACILITY SHAKEDOWN	LIQUID HOLDUP TMI, SBLOCA, ANTICIPATED TRANSIENT	ALTERNATE ECC, PLANT RECOVERY TECHNIQUES	H.T. IN S.G. NATURAL CIRCULATION PRIMARY LOOP COOLING MECHANISM	CLOSEOUT ANALYSES		
MB-2 (W)	TESTS: SLB, SGTR						
CCTF-II (JAPAN)	BEST-ESTIMATE TESTS						
SCTF-II (JAPAN	FORCED FEED TESTS						
SCTF-III (JAPAN)	SHAKEDOWN TESTS	COLD LEG INJECTION TESTS	COMBINED INJECTION TESTS	CLOSEOUT ANALYSES			
UPTF (GERMANY)	CONSTRUCTION COMPLETED SHAKEDOWN TESTING	SEPARATE EFFECTS TESTS	INTEGRAL EFFECTS TESTS	CLOSEOUT ANALYSES			
ADVANCED TEST FACILITY (ATF)	SCALING STUDY	DESIGN	START CONSTRUCTION (W/CE)	ATF-PWR TESTING START CONSTRUCTION ATR-BWR	ATF-PWR TESTING ATF-BWR TESTING	ATF-PWR TESTING ATF-BWR TESTING	ATF-PWR TESTING ATF-BWR TESTING

FIG. 7

ALTERNATIVE APPROACHES

ALTERNATIVE	COST ($M) INITIAL	COST ($M) ANNUAL	PRO	CON
1. EXISTING FACILITIES AT PRESENT LOCATION				
SEMISCALE	0	10-15	•CONTINUE KNOWN TECHNOLOGY •FULL CAPABILITY FROM EACH FACILITY •MOST EXPERT OPERATING STAFF	•MAX OPERATING COST •RELATIVELY INFLEXIBLE
MIST	0			
FIST	0			
2. ONE OR MORE EXISTING FACILITIES AT INEL				
SEMISCALE	0	~3-5	•MINIMUM OPERATING EXPENSES •PROVIDES MOST EXPERT CONTRACTOR STAFF	•NEED FOR GE, B&W AND EPRI CONCURRENCE •SOME LOSS OF TEST CAPABILITY POSSIBLE •UNKNOWN COST TO MOVE, INSTALL AND CHECKOUT FACILITY •RELATIVELY INFLEXIBLE
MIST	UNK			
FIST	UNK			

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ALTERNATIVE APPROACHES (CONT'D)

ALTERNATIVE	COST ($M) INITIAL	COST ($M) ANNUAL	PRO	CON
3. CONSTRUCTION ROSA IV-TYPE/MPR OPTIONS	13-$90	~3-5	SAME AS PREVIOUS	•LOW INITIAL COST RESULTS IN LOSS OF CAPABILITY; TO MAINTAIN CAPABILITY IS HIGH COST •FLEXIBLE AT HIGH COST
4. VISUAL LOOP (+ SEPARATE EFFECTS TESTING AS NEEDED)	<1	<1	•RAPID RESPONSE •SELECTIVELY IMPROVES UNDERSTANDING	•LIMITED APPLICABILITY TO TB STATED NEEDS
5. ADVANCED THERMAL/ HYDRAULIC FACILITY	<5	$\lesssim$3-5	•BEST SCALING APPROACH •MULTIPLE FACILITIES AT LOW COST •PROVIDES MOST EXPERT CONTRACTOR STAFF	•INITIALLY LIMITED TO ONE VENDOR DESIGN •MAY BE SOMEWHAT SCENARIO LIMITED

FIG 1

STUDY CRITERIA

- CAPABLE OF TESTING A WIDE RANGE OF CHAPTER 15, DOMINANT RISK EVENTS AND OPERATIONAL EVENTS THAT HAVE OCCURED
- CAPABLE OF TESTING A WIDE VARIATION OF SYSTEM GEOMETRIES
- PROVIDE SUFFICIENTLY CREDIBLE RESULTS FOR CODE ASSESSMENT, NRC STAFF ACTION AND MAINTENANCE OF STAFF EXPERTISE
- ADEQUATE INSTRUMENTATION AND DATA ACQUISITION FOR INTENDED USES
- AUTOMATED CONTROL AS FEASIBLE TO MINIMIZE OPERATING STAFF AND FOR USE WITH MULTIPLE TEST FACILITIES
- PROVIDE A DOCUMENTED DEFENDABLE SCALING BASIS
- CAPABLE OF PROVIDING BOTH LOOP THERMAL HYDRAULIC DATA AND OPERATOR INTERACTION RESULTS
- QUICK TURNAROUND TIME (2-4 WEEKS)
- LOW ACQUISITION COST (LESS THAN $5 MILLION PER FACILITY TYPE) AND LOW OPERATING COSTS (3-5 MILLION/YR FOR MULTIPLE FACILITY COMPLEX)

FIG. 10

ADVANCED FACILITY SCALING STUDY

1. EVALUATE PLAUSIBLE SCALING RATIONALS
   - UP TO 4 SCALING RATIONALS
   - SCALING RELATIONSHIPS AND ASSUMPTIONS
   - EVENT CONTROLLING PHENOMENA
   - ABILITY TO MODEL CONTROLLING PHENOMENA
   - WORKSHOP OF EXPERTS

2. SELECTION OF DATA BASE
   - SELECT B.E. TRANSIENT ANALYSES FOR LWRS

3. CONCEPT EVALUATION
   - DEVELOP SCALED CONCEPTS
   - ASSESS CONCEPT ABILITY TO PROVIDE PROTOTYPE RESPONSE

4. COMPUTER CODE ANALYSIS OF PROPOSED FACILITIES

5. FACILITY COST ESTIMATES

FIG. 11

KNOWN NEEDED IMPROVEMENTS (TRAC-PWR)

DESCRIPTION	IMPACT ON SAFETY CALC.	SOURCE
• STEADY STATE AUTOMATIC INITIALIZATION	CALCULATIONS RUN TOO LONG WITHOUT AUTOMATIC INITIALIZATION	NRR
• NO CCFL MODEL	ERRORS IN CALCULATIONS IN UPI TYPE PLANTS FOR LOCAS	2D&3D, ICAP, LANL (NRR)
• CONDENSATION MODEL	ERRORS IN CALCULATIONS AT ECC INJECTION POINTS IF VAPOR FRACTION IS HIGH	ICAP, CODE DEVELOPERS (NRR)
• SEPARATOR MODEL (100% SEPARATION)	TOO MUCH STEAM CARRYOVER IN STEAM LINE BREAK ACCIDENTS	CODE DEVELOPERS, WORKSHOP MTGS, ICAP
• DEENTRAINMENT MODEL FOR UPPER PLENUM	EXCESSIVE WATER CARRYOVER TO HOT LEGS - ERRONEOUS STEAM BINDING	2D&3D, LANL
• POST CHF HEAT TRANSFER (INTERFACIAL DRAG)	EARLY REWET (SUCH AS IN LOFT) IS NOT PREDICTED ACCURATELY. UNCERTAINTY CAN BE AS LARGE AS 400K.	RES, ICAP, LANL
• FLOW REGIME MAP	STRATIFIED FLOW NOT ALWAYS PREDICTED WELL, IMPACT REFLUX COOLING AND ECCS INJECTION	ICAP, LANL

FIG 1.

KNOWN NEEDED IMPROVEMENTS (TRAC-PWR) (CON'D)

DESCRIPTION	IMPACT ON SAFETY CALC.	SOURCE
• CHOCKING MODEL IN STRATIFIED FLOW	SMALL BREAK LOCA CALCULATIONS IN ERROR	RES, ICAP, LANL
• VARIABLE GAS GAP	REACTIVITY CALCULATIONS IN TRANSIENTS ARE IN ERROR. FUEL ROD TEMPERATURE PROFILE IS IN ERROR.	ICAP, USER WORKSHOP LANL
• MULTI-SOURCE VESSEL CELL	MINIMAL IMPACT, USER CONVENIENCE	ICAP, USER WORKSHOP, LANL
• EM MODELS	CANNOT PERFORM APPENDIX K TYPE CALCULATION	NRR

E11-13

KNOWN NEEDED IMPROVEMENTS (RELAP5)

DESCRIPTION	IMPACT ON SAFETY CALCULATIONS	SOURCE
• STEADY STATE AUTOMATIC INITIALIZATION	CALCULATIONS RUN TOO LONG WITHOUT AUTOMATIC INITIALIZATION	NRR
• EM VERSION	PRESENT APPENDIX K TYPE CALCULATION CANNOT BE PERFORMED	NRR
• OUTPUT TAPE RESTRUCTURE	WASTE ON I/O AND TAPE STORAGE	INEL
• VECTORIZATION	SLOW IN COMPUTATION SPEED HENCE LONG RUNNING TIME	INEL & NRR
• DOCUMENTATION IMPROVEMENT	LESS EFFICIENT OR WRONG USE OF THE CODE	ICAP
• PORTABILITY IMPROVEMENT	LESS EFFICIENT & LIMITED USE AND APPLICATION OF THE CODE	INEL & ICAP

F16.14

KNOW NEEDED IMPROVEMENTS (RELAP5)(CONTINUED)

DESCRIPTION	IMPACT ON SAFETY CALCULATIONS	SOURCE
• TIME STEP CONTROL IMPROVEMENT	LESS EFFICIENCY IN USING THE CODE	DOMESTIC ASSESS
• POST-CHF HEAT TRANSFER MODELS (FILM/TRANSITION BOILING & TMIN)	QUENCHES IN LOBI NOT CALCULATED CORRECTLY	ICAP, DOMESTIC ASSESS
• CONDENSATION MODEL	OCCASSIONALLY GIVES ERRONEOUS RESULTS DURING ECC INJECTION SOMETIMES GREATLY INCREASES RUNNING TIME BY REQUIRING SMALL TIME STEPS	ICAP, DOMESTIC ASSESS
• NO FORMAL CCFL MODEL	LARGE BREAKS, SMALL BREAKS, PARTICULARLY WITH UPI	DOMESTIC ASSESS
• INTERFACIAL DRAG MODEL	INTERACTS WITH POST-CHF HEAT TRANSFER MODEL	ICAP, DOMESTIC ASSESS

FIG. 13

KNOWN NEEDED IMPROVEMENTS (RELAP5)(CONTINUED)

DESCRIPTION	IMPACT ON SAFETY CALCULATIONS	SOURCE
• 100% SEPARATOR MODEL	MAKES MODELING SOME EXPERIMENTS & TRANSIENTS DIFFICULT, PARTICULARLY INSTEAM GENERATORS, ERRONEOUS CALCULATION OF CARRYOVER IN STEAM LINE BREAK ACCIDENT	INEL
• CHOKING MODEL IN STRATIFIED FLOW	SMALL BREAK LOCA CALCULATIONS IN ERROR	RES, DOMESTIC ASSESS., ICAP, NRR
• RADIATION MODEL	ACCIDENTS WITH LONG DRYOUT PERIODS	ICAP
• METAL/WATER REACTION	ERRONEOUS CLAD TEMPERATURE CALCULATION UNDER SEVERE ACCIDENT CONDITION	RES
• NATURAL CIRCULATION WITH NONCONDENSIBLES	STEAM GENERATOR HEAT TRANSFER, AND REFLUX COOLING	RES, DOMESTIC ASSESSMENT

KNOWN NEEDED IMPROVEMENTS (TRAC-BWR)

DESCRIPTION	IMPACT ON SAFETY CALCULATIONS	SOURCE
• CHOKING MODEL IN STRATIFIED FLOW	SMALL BREAK/CRACKS LOCA CALCULATIONS IN ERROR	NRR
• CONDENSATION MODEL	OCCASIONALLY GIVES ERRONEOUS RESULTS DURING ECC INJECTION. SOMETIMES GREATLY INCREASES RUNNING TIME BY REQUIRING SMALL TIME STEPS	ICAP, DOMESTIC ASSESSMENT, INEL
• POST-CHF HEAT TRANSFER MODELS (FILM/TRANSITION BOILING & TMIN)	QUENCH TEMPERATURE AND TIME WILL NOT BE CALCULATED CORRECTLY	DOMESTIC ASSESS
• INTERFACIAL DRAG MODEL	INTERACTS WITH POST-CHF HEAT TRANSFER MODEL	DOMESTIC ASSESS

FIG 17

KNOWN NEEDED IMPROVEMENTS (TRAC-BWR)(CONTINUED)

DESCRIPTION	IMPACT ON SAFETY IMPROVEMENTS	SOURCE
• CORE SPRAY MODEL	ERRONEOUS CALCULATION IN UPPER PLENUM FLOW AND TEMPERATURE DISTRIBUTIONS, CCFL PHENOMENA AND CORE COOLING	RES, INEL
• EM VERSION	PRESENT APPENDIX K TYPE CALCULATION CANNOT BE PERFORMED	NRR
• BRITISH UNIS FOR INPUT/OUTPUT	USER CONVENIENCE	UTILITIES

FIG. 13

DETERMINING CODE UNCERTAINTY

- SELECT KEY PARAMETERS FOR EACH CLASS OF PLANT AND TRANSIENT

PWR

KEY PARAMETERS	LARGE BREAK LOCA	SMALL BREAK LOCA	TRANSIENT
PRIMARY	CLAD TEMPERATURE	CLAD TEMPERATURE	PRIMARY SYSTEM SUBCOOLING
SECONDARY	CORE COOLANT INVENTORY	COOLANT INVENTORY AND DISTRIBUTION	PRIMARY SYSTEM INVENTORY
TERTIARY		STEAM GENERATOR INVENTORY	STEAM GENERATOR INVENTORY

BWR

	LOCA	TRANSIENT
PRIMARY	CLAD TEMPERATURE	COOLANT INVENTORY

51.19

TABLE 1 PARTICIPATING COUNTRIES AND CODES

COUNTRY	ORGANIZATION	RELAP5	TRAC-PWR	TRAC-BWR	COBRA
AUSTRIA	AUSTRIAN RESEARCH CENTER SIEBERSDORF	X			
BELGIUM	TRACTIONAL	X			
CANADA	ATOMIC ENERGY OF CANADA LTD. (1)		X		
FINLAND	TECHNICAL RESEARCH CENTER OF FINLAND	X			
	IMATRAM VOIMA OY POWER COMPANY				
F.R.GERMANY	FEDERAL MINISTRY FOR RESEARCH & TECHNOLOGY				
	KRAFTWERK UNION AKTIENGESELLSCHAFT	X	X	X	
	GESELLSCHAFT FUR REAKTORSICHERHEIT	X	X	X	
	KERNFORSCHUNGSZENTRUM KARLSRUHE	X			
	PROJECT HDR	X			
ITALY	ENEA	X	X	(2)	
JAPAN	JAPAN ATOMIC ENERGY RESEARCH INSTITUTE	X	X		
KOREA	KOREA ADVANCED ENERGY RESEARCH INSTITUTE	X			
NETHERLANDS	NETHERLANDS ENERGY RESEARCH FOUNDATION	X			
SPAIN	CONSEJO DE SEGURIDAD NUCLEAR	X	X		
SWEDEN	SWEDISH NUCLEAR POWER INSPECTORATE (3)	X	X		
	STUDSVIK ENERGITEKNIK AG				

TABLE 1 (CONT'D)

COUNTRY	ORGANIZATION	RELAP5	TRAC-PWR	TRAC-BWR	COBRA
SWITZERLAND	SWISS FEDERAL INSTITUTE FOR REACTOR RESEARCH	X		X	X
TAIWAN	TAIWAN POWER COMPANY (3)	X	X	X	
UNITED KINGDOM	UNITED KINGDOM ATOMIC ENERGY AUTHORITY-CEGB, NII, NCC, BNFL	X	X		
UNITED STATES	NUCLEAR REGULATORY COMMISSION	X	X	X	X
CEC	JOINT RESEARCH CENTER ISPRA ESTABLISHMENT	X	X		

(1) LIMITED ONLY TO USE OF CODE TO SUPPORT NRU TESTS

(2) OPTION

(3) RELAP5 AND/OR TRAC-PWR

P16.21

NUCLEAR PLANT DATA BANK

FY 85
- o COMPLETED WORK AT PROFESSIONAL SOFTWARE (TDC)
- o TRANSFER SOFTWARE TO ENGINEERING MODELLER (LANL)
- o INDEPENDENT DATA ENTRY CONTRACTORS IDENTIFY ERRORS IN SOFTWARE AND DOCUMENTATION

FY 86
- o ERRORS TO BE CORRECTED AT/BY LANL
  - DATA ENTRY AND MINIMUM SET OF DATA
  - DOCUMENTATION
  - INTERFACE SOFTWARE TO TRAC
    E.G. BYPASS
- o DEMONSTRATION BY LANL OF RESAR-3S DATA ENTRY AND DECK CREATIONS AND RENODALIZATIONS

FY 87
- o EXTEND NPDB TO WE.2L, WE.3G, B&W, CE
- o CONTROLS AND SECONDARY

FIG. 22

NUCLEAR PLANT DATA BANK (CONT'D.)

- FY 88 — EXTEND NPDB TO BWR
- FY 89 — COMPLETE NPDB TO BWR

COSTS	FY 1986	$ 450 (INCLUDES $250K FY 85 CARRYOVER) + $50K TDC
	FY 1987	400
	FY 1988	100
	FY 1989	300
TOTAL		$1250K

F16.23

NPA

	INEL	LANL
FY86	• 3 MORE PLANTS' MASKS • INTERACTIVE X-Y PLOTS • TRAC-BWR SELF-INITIALIZE • COMPLETE SECONDARY + CONTROL SYSTEMS MASKS	• IMPROVE TRAC-NPA • DATA BASE MOD • GENERIC 1-D COMPONENT • PARALLELIZATION • DEMO ON CRAY XMP-48
FY87	• BWR-4 MASK + 1 NPA-BWR DECK • TWO STEP NUMERICS ON 3-D COMPONENTS OF TRAC-BWR • CONSULTATION TO USERS	• IMPLEMENT TRAC-NPA ON A PARALLEL PROCESSOR • CONSULTATION TO USERS
FY88	• COMPLETE TRAC-BWR 2-STEP NUMERICS • IMPLEMENT NPA EXEC. AND TRAC-BWR ON PARALLEL PROCESSOR • CONSULTATION	• MAINTENANCE + CONSULTATION

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NPA (CONT'D.)

	INEL	LANL
FY89		
	* MAINTENANCE	* MAINTENANCE

NPA FY86 $ 750K = 400 + 350
87 $1000K = 700 + 300
88 $ 500K = 400 + 100
89 $ 200K
$2450K

F16.25