

B.47-1

B.47 LER No. 373/83-057

Event Description: Scram, LOFW with RCIC Inoperable

Date of Event: June 1, 1983

Plant: LaSalle 1

B.47.1 Summary

Following a loss of feedwater and scram, the operators at LaSalle 1 had difficulty providing adequate makeup to the reactor vessel. As the reactor core isolation cooling (RCIC) system and the motor-driven feedpump were inoperable, operators blew down reactor pressure to 250 psig to allow makeup using the condensate pumps. The status of the high pressure core spray (HPCS) system during the event is unclear. The conditional core damage probability estimated for this event is 2.1×10^{-5} .

B.47.2 Event Description

LaSalle 1 experienced trips of the condensate booster pumps and the reactor feed pumps around 0230 on June 1, 1983. Very shortly thereafter, the reactor scrammed on low level. Operators were apparently unable to restore the turbine-driven reactor feed pumps to service and the motor-driven pump was unavailable, as was the RCIC system. The status of the high-pressure core spray system during the event is not given.

Because of the difficulties experienced in providing adequate makeup to the vessel, operators blew down the vessel to 250 psig. This permitted them to make up with the condensate system.

Reactor pressure dropped from about 920 psig to about 250 psig in about one-half hour. Within a one-hour period, reactor vessel temperature dropped from 536°F to 418°F, thus exceeding Technical Specification cooldown limits. Subsequently, General Electric (GE) performed an assessment of design information provided by the reactor vessel supplier, Combustion Engineering. GE concluded that since the limiting components for thermal stress were the vessel flange bolts and, since the vessel water level never reached the flange, the vessel stresses experienced during the event were bounded by those experienced in normal shutdown. Stresses were apparently not calculated for other points in the vessel.

B.47.3 Additional Event-Related Information

None.

B.47.4 Modeling Assumptions

This event was modeled as a scram and loss of feedwater, with RCIC unavailable. HPCS was assumed to be available, although it is odd that it was not used during the event. (An additional calculation was performed assuming HPCS was unavailable, to explore the sensitivity of the model to this.)

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B.47.5 Analysis Results

The conditional core damage probability estimated for this event is 2.1×10^{-5} . The dominant core damage sequence, highlighted on the event tree in Figure B.47.1, involves the observed scram, failure of the power conversion system, main feedwater failure, HPCS success and failure of residual heat removal (RHR). If HPCS is assumed to have been unavailable, the conditional core damage probability estimate is increased to 1.3×10^{-4} .

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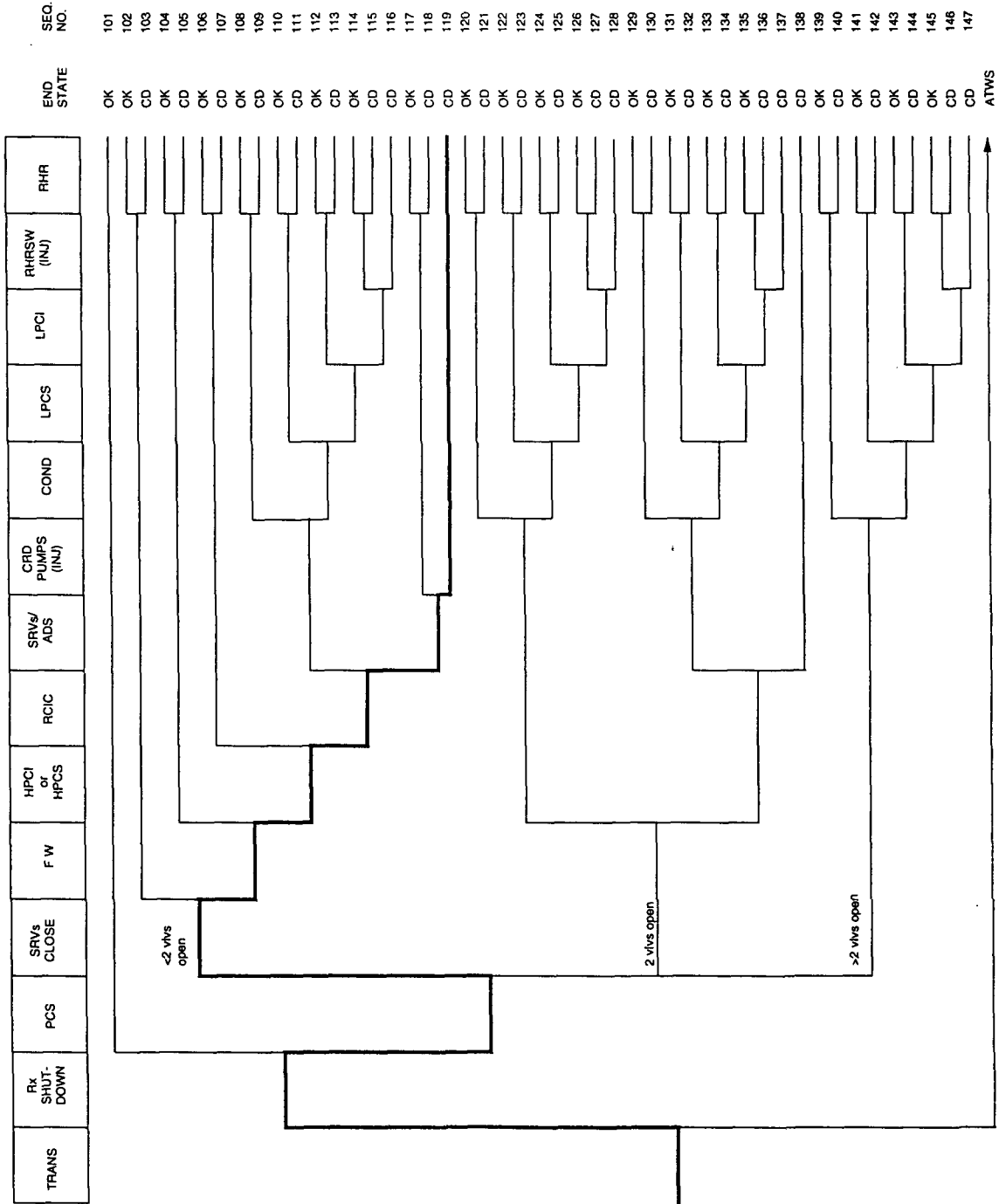


Figure B.47.1 Dominant core damage sequence for LER 373/83-057

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 373/83-057
 Event Description: Scram, LOFW with RCIC inop
 Event Date: June 1, 1983
 Plant: LaSalle 1

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	2.1E-05
Total	2.1E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
103 trans -rx.shutdown PCS srv.ftc.<2 -MFW rhr.and.pcs.nrec	CD	1.2E-05	5.5E-03
105 trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci rhr.and.pcs.nrec	CD	6.2E-06	2.8E-03
414 trans rx.shutdown rpt	CD	6.7E-07	1.0E-01
119 trans -rx.shutdown PCS srv.ftc.<2 MFW hpci RCIC srv.ads c rd(inj)	CD	5.8E-07	8.1E-02
413 trans rx.shutdown -rpt slcs	CD	4.1E-07	1.0E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
103 trans -rx.shutdown PCS srv.ftc.<2 -MFW rhr.and.pcs.nrec	CD	1.2E-05	5.5E-03
105 trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci rhr.and.pcs.nrec	CD	6.2E-06	2.8E-03
119 trans -rx.shutdown PCS srv.ftc.<2 MFW hpci RCIC srv.ads c rd(inj)	CD	5.8E-07	8.1E-02
413 trans rx.shutdown -rpt slcs	CD	4.1E-07	1.0E-01
414 trans rx.shutdown rpt	CD	6.7E-07	1.0E-01

** non-recovery credit for edited case

SEQUENCE MODEL: d:\asp\models\bwrc8283.cmp
 BRANCH MODEL: d:\asp\models\lasalle1.82
 PROBABILITY FILE: d:\asp\models\bwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

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Branch	System	Non-Recov	Opr Fail
trans	1.5E-03	1.0E+00	
loop	1.6E-05	5.3E-01	
loca	3.3E-06	6.7E-01	
rx.shutdown	3.5E-04	1.0E-01	
PCS	1.7E-01 > 1.0E+00	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.7E-01 > 1.0E+00		
srv.ftc.<2	1.0E+00	1.0E+00	
srv.ftc.2	1.3E-03	1.0E+00	
srv.ftc.>2	2.2E-04	1.0E+00	
MFW	2.9E-01 > 1.0E+00	3.4E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	2.9E-01 > 1.0E+00		
hpci	2.0E-02	3.4E-01	
RCIC	6.0E-02 > 1.0E+00	7.0E-01 > 1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	6.0E-02 > 1.0E+00		
srv.ads	3.7E-03	7.0E-01	1.0E-02
crd(inj)	1.0E-02	1.0E+00	1.0E-02
cond	1.0E+00	3.4E-01	1.0E-03
lpcs	2.0E-02	1.0E+00	
lpci	6.0E-04	1.0E+00	
rhrsw(inj)	2.0E-02	1.0E+00	1.0E-02
rhr	1.0E-03	1.6E-02	1.0E-05
rhr.and.pcs.nrec	1.0E-03	8.3E-03	1.0E-05
rhr/-lpci	0.0E+00	1.0E+00	1.0E-05
rhr/lpci	1.0E+00	1.0E+00	1.0E-05
rhr(spcool)	2.0E-03	1.0E+00	1.0E-03
rhr(spcool)/-lpci	1.0E-03	1.0E+00	1.0E-03
ep	2.9E-03	8.7E-01	
ep.rec	1.7E-01	1.0E+00	
rpt	1.9E-02	1.0E+00	
slcs	2.0E-03	1.0E+00	1.0E-02
ads.inhibit	0.0E+00	1.0E+00	1.0E-02
man.depress	3.7E-03	1.0E+00	1.0E-02

* branch model file
 ** forced

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 373/83-057
 Event Description: Scram. LOFW with RCIC inop
 Event Date: June 1. 1983
 Plant: LaSalle 1

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	1.3E-04
Total	1.3E-04

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
119	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC srv.ads c rd(inj)	CD	8.5E-05	2.4E-01
138	trans -rx.shutdown PCS srv.ftc.2 HPCI srv.ads	CD	1.6E-05	7.0E-01
103	trans -rx.shutdown PCS srv.ftc.<2 -MFW rhr.and.pcs.nrec	CD	1.2E-05	5.5E-03
109	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC -srv.ads -c ond rhr	CD	5.7E-06	3.6E-03
111	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC -srv.ads c ond -lpcs rhr	CD	2.9E-06	1.8E-03

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
103	trans -rx.shutdown PCS srv.ftc.<2 -MFW rhr.and.pcs.nrec	CD	1.2E-05	5.5E-03
109	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC -srv.ads -c ond rhr	CD	5.7E-06	3.6E-03
111	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC -srv.ads c ond -lpcs rhr	CD	2.9E-06	1.8E-03
119	trans -rx.shutdown PCS srv.ftc.<2 MFW HPCI RCIC srv.ads c rd(inj)	CD	8.5E-05	2.4E-01
138	trans -rx.shutdown PCS srv.ftc.2 HPCI srv.ads	CD	1.6E-05	7.0E-01

** non-recovery credit for edited case

SEQUENCE MODEL: d:\asp\models\bwrc8283.cmp
 BRANCH MODEL: d:\asp\models\lasalle1.82

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PROBABILITY FILE: d:\asp\models\bwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.5E-03	1.0E+00	
loop	1.6E-05	5.3E-01	
loca	3.3E-06	6.7E-01	
rx.shutdown	3.5E-04	1.0E-01	
PCS	1.7E-01 > 1.0E+00	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.7E-01 > 1.0E+00		
srv.ftc.<2	1.0E+00	1.0E+00	
srv.ftc.2	1.3E-03	1.0E+00	
srv.ftc.>2	2.2E-04	1.0E+00	
MFW	2.9E-01 > 1.0E+00	3.4E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	2.9E-01 > 1.0E+00		
HPCI	2.0E-02 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	2.0E-02 > 1.0E+00		
RCIC	6.0E-02 > 1.0E+00	7.0E-01 > 1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	6.0E-02 > 1.0E+00		
srv.ads	3.7E-03	7.0E-01	1.0E-02
crd(inj)	1.0E-02	1.0E+00	1.0E-02
cond	1.0E+00	3.4E-01	1.0E-03
lpcs	2.0E-02	1.0E+00	
lpci	6.0E-04	1.0E+00	
rhrsw(inj)	2.0E-02	1.0E+00	1.0E-02
rhr	1.0E-03	1.6E-02	1.0E-05
rhr.and.pcs.nrec	1.0E-03	8.3E-03	1.0E-05
rhr/-lpci	0.0E+00	1.0E+00	1.0E-05
rhr/lpci	1.0E+00	1.0E+00	1.0E-05
rhr(spcool)	2.0E-03	1.0E+00	1.0E-03
rhr(spcool)/-lpci	1.0E-03	1.0E+00	1.0E-03
ep	2.9E-03	8.7E-01	
ep.rec	1.7E-01	1.0E+00	
rpt	1.9E-02	1.0E+00	
slcs	2.0E-03	1.0E+00	1.0E-02
ads.inhibit	0.0E+00	1.0E+00	1.0E-02
man.depress	3.7E-03	1.0E+00	1.0E-02

* branch model file

** forced