

가

Reliability Analysis for Rotating Components of Korean Standard NPPs and Site Comparison

가
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DB 3,4 1998
 , 3,4 2002 가
 , fails to start , 4
 가 , 4 3
 가 , fails to run , 3,4
 3,4 4 , 가
 3 3 .
 30% 3,4 3,4 4 ,

Abstract

We have collected the component reliability data of Korean standard NPPs and analyzed failure data with failure mode and criticality for the estimation of failure rate per each component's failure mode. We identified some components with each high 30% ranks of failure rates of two kinds of failure mode, fails to start and fails to run. Emergency diesel generators of 4 units show high failure rate for fails to start and failure rates for fails to run of essential chiller, CVCS pump and FW pump are high. We grouped the identified components by 4 units and analyzed site comparison. We also performed failure trend analysis for principal components by reviewing component failure history.

1.

TR , DB DB DB

DB / DB DB DB

[1][2][3] DB 가(PSA, Probabilistic Safety Analysis)

PSR (Periodic Safety Review) RIR&A, MR (Maintenance Rule)

MR 5, 6 PSA

[4][5]

DB , 3,4 3,4 , PSA , , 가

(degraded)', (incipient)', (critical)',

fails to run , 가 fails to start . 2

3 4

2.

DB TR, PSA

3,4 1998 12 31 3

/ , 3,4 2002

4 3 1

DB (O/H, Overhaul) (raw data)

1.

			()	()	
3	1995-04-01	1998-12-31	1371	1176	0.858
4	1996-01-01	1998-12-31	1096	980	0.895
3	1998-08-11	2002-12-31	1604	1424	0.888
4	2000-01-01	2002-12-31	1096	962	0.877

1

3가

.[6]

- ✓ 1(/hr): /
- ✓ 2(/hr): /
- ✓ :

fails to start

fails to operate

fails to run

(traveling screen)

1

2

2

1

가

가

가

1

2

2 3

fails to start

fails to run

. 2

1,

3

1

2

fails to start

fails to run

30%

20

2. Fails to Start

		-3	-4	-3	-4
442	Pump	0	0	2.93E-05	0

451	Pump	1.49E-05	1.34E-05	1.67E-06	4.54E-06
462	Pump	0	0	0	1.08E-05
541	Pump	2.53E-05	1.82E-05	2.93E-05	1.36E-05
542	Pump	7.62E-05	2.12E-06	7.31E-06	6.90E-06
551	Pump	1.33E-05	1.33E-05	4.18E-06	1.24E-05
553	Pump	5.31E-05	0	2.93E-05	2.17E-05
553	Traveling Screen	3.10E-05	5.31E-06	1.63E-04	2.59E-04
562	Pump	0	0	1.46E-05	0
591	Diesel Generator	7.09E-05	8.50E-05	4.39E-05	4.77E-05
593	Diesel Generator	0		6.44E-05	
596	Compressor	5.31E-05	4.25E-05	2.93E-05	
624() / 605()	ACU	1.77E-05	0	5.45E-05	3.45E-05
626() / 633()	Chiller	3.54E-05	8.50E-05	2.19E-05	0
633() / 602()	Fan	2.53E-06	3.04E-06	2.09E-06	
635() / 606()	ACU	1.65E-07	0	0	0
691() / 634()	Pump	0	0	9.75E-06	0
811	Fan	0	0	1.46E-05	0

3. Fails to Run

		-3	-4	-3	-4
451	Pump	1.31E-04	9.34E-05	2.37E-04	1.21E-04
461	Pump	0	4.25E-06	0	0
462	Pump	0	3.82E-05	4.68E-05	4.33E-06
541	Pump	6.73E-05	7.22E-05	6.29E-05	5.42E-05
551	Pump	7.53E-05	1.26E-04	1.66E-05	1.45E-06
553	Pump	1.18E-05	3.12E-05	1.95E-05	2.17E-05
553	Traveling Screen	3.99E-05	1.31E-04	1.44E-04	1.35E-04
561	Pump	0	3.40E-05	0	0
591	Diesel Generator	3.90E-05	2.55E-05	0	0
596	Compressor	4.25E-05	1.27E-04	5.85E-05	4.33E-05
624()/605()	ACU	3.54E-06	1.91E-05	0	0
626() / 633()	Chiller	6.84E-04	4.04E-04	1.40E-04	1.78E-04
633() / 602()	Fan	2.53E-06	3.04E-06	2.09E-06	
635() / 606()	ACU	8.24E-07	4.15E-06	1.24E-06	2.51E-06
811	Fan	1.06E-05	2.83E-05	2.05E-05	6.50E-05

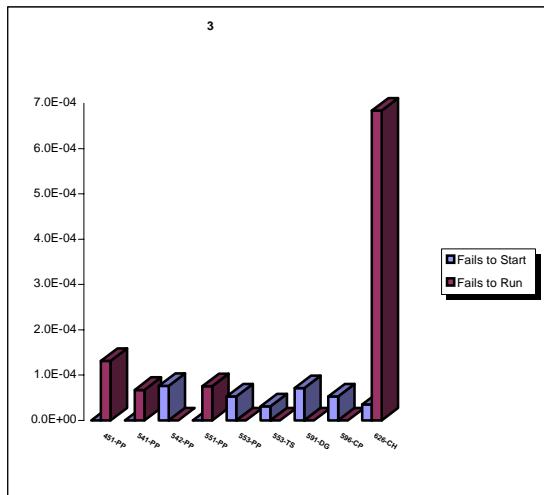
2 fails to start 30% , 4
 (EDG)가 (596)
 (553) (traveling screen) 3 가 .

3 fails to run , 3,4 3,4
 (451) , (541) 가 3
 3 .

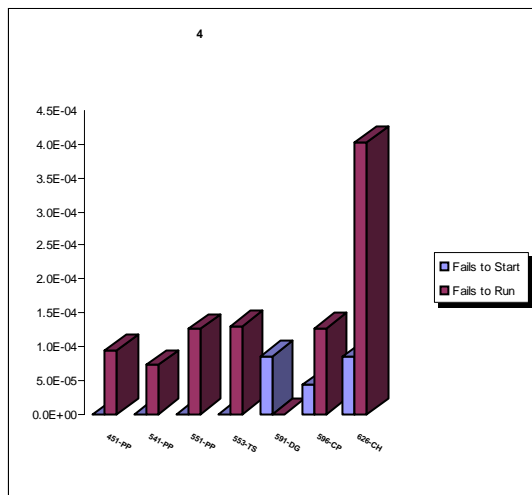
3.

fails to start fails to run

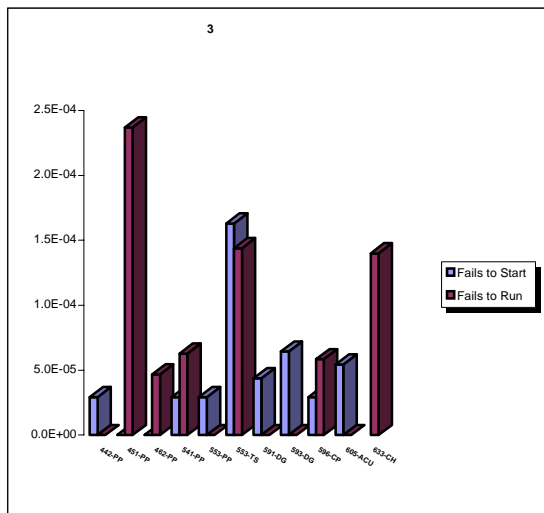
30%



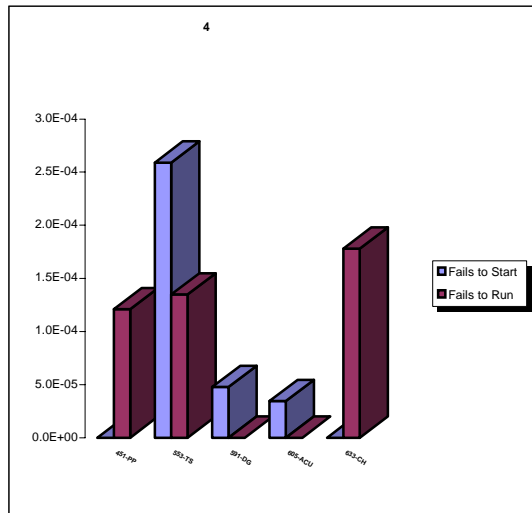
1. 3



2. 4



3. 3



4. 4

4
 , 4 가 가 , 3 3 fails to start
 6 8 , 3 4 4 . Fails to run
 , 4 3 가 6 3 3 4
 가 . 3,4 (626) , 3,4
 (553) 4 3 (596)
 fails to start fails to run .

1) 3,4

1 3 6 가 fails to start 4
 fails to run . (626) fails to run
 ,
 가 . 가 fails to run , 01CA,
 02CA, 01CB, 02CB 12, 11, 4, 11 .
 3 fails to start (542)
 . fails to start 3
 1
 8 , 7 02PB .
 4 fails to start 626 가
 . fails to start 3 01KB
 , 02CA 4 , 01CA 02CB 2 .
 Fails to run 3 가 626 가
 02CA(9) , 01CB(7) , 02CB(3) , 3
 01CA fails to run .

2) 3,4

3 가 가 fails to start fails to run
 30% , 8 fails to start 6
 fails to run . (442) fails to
 start 3 01A 01B 1 fails
 to start .
 3 fails to run (451) fails
 to run 가 가

stripper 가 . 451 fails to run gas
 5 , BAC 3 ,
 가 fails to run
 가 PP01, PP02, PP03,
 PP04 14, 5, 8, 10 .

(553) fails to start fails to run
 . Fails to start TS09A/09B (ESW traveling screen)
 , fails to run TS04(CW traveling
 screen D) TS05(CW traveling screen E)가 7 5

4 553 fails to start fails to start
 가 , TS09A 7 fails
 to start TS01(CW traveling screen A) 가 5

553 fails to run TS01, TS02, TS09A fails to run
 to run 3 . (633) fails to
 run CH02A CH01A, CH01B CH02B 2, 4, 2

4.

, .
 DB 3,4 1998
 , 3,4 2002 가 .
 가

, fails to start , 4
 (EDG)가 , (596) (553)
 3 가 , fails to run
 , 3,4 3,4 4 (:626, :633) ,
 (451) , (541) 가 .

30% 3,4
3,4 4 , . 3 가
가 , 4 가 가 3 3 fails to
start 6 8 3 4 4 .
Fails to run , 4 3 가 6 3 3
4 가 . fails to
start fails to run .

3 , fails to start
3 1
8 , 7 02PB 4
fails to start 626 가 .
fails to start 3 01KB ,
02CA 4 , 01CA 02CB 2 . fails to run
02CA(9) , 01CB(7) , 02CB(3) , 01CA fails to run

3 553 fails to start fails to run
. TS09A/09B 가 fails to start
, fails to run TS04 TS05가 7 5
. 4 553 fails to start
fails to start 가 , TS09A
7 traveling screen fails to start , TS01
가 5 .

가

KEPRI, 2 2 , , ,

1. , “ ”, KAERI/TR-2132/2002, 2002
2. , “ DB ”, KAERI/TR-2130/2002, 2002
3. , “ ”, KAERI/TR-2129/2002, 2002
4. , “KEPRI 5,6 가 ”, 2002
5. , “ ”, KAERI/TR-1788/2001, 2001
6. , “ DB ”, 2002
, , 2002