ORIGINAL

UNITED STATES
NUCLEAR REGULATORY COMMISSION

In the Matter of:)
)
RESTART OF SEQUOYAH UNIT 2)
FROM RECENT SCRAMS)
)

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FROM RECENT SCRAMS)
5 _____)

6 Monday,
June 13, 1988

7

Room 2F17 White Flint 1
8 1155 Rockville Pike
Rockville, Maryland

9

The above-entitled matter came on for hearing,
10
pursuant to notice, at 11:10 a.m.

11

APPEARANCES:

12

ON BEHALF OF THE NRC:

13

STEWART EBNETER, DIRECTOR
14 Office of Special Projects

15 JANE AXELRAD
SUSY BLACK
16 JACK DONOHEW
ANGELO MARINOS
17 TOM ROTELLO
BILL TROSKOSKI
18 PAUL HARMON
FRANK MCCOY
19 BOB PIERSON
B.D. LIAW

20

ON BEHALF OF SEQUOYAH UNIT 2:

21

ADMIRAL WHITE
22 MARK BURZYNSKI
MIKE HARDING
23 STEVE SMITH
JERRY PATRICK
24 JOHN HOSMER

25

1 MR. EBNETER: The meeting today is a public meeting.
2 The meeting is in relation to analysis of the number of trips
3 that TVA Sequoyah Unit 2 has experienced in the last month.
4 Mr. White expressed a concern about it. The NRC is concerned
5 about it. We want TVA to give us an analysis of their post-
6 trip reviews, the root cause of the problems, the corrective
7 actions taken, and particularly a review of why the post-trip
8 reviews have not been effective in preventing subsequent trips.
9 The number of trips we've had so far, the Sequoyah 2
10 went critical on May 13th. We've had five trips since then
11 which is an extraordinary amount, it's far too many. So before
12 the unit can go critical again, we need to have an
13 understanding of why these trips are occurring and what is
14 being done to correct them.
15 What we would like also is for TVA to address to us
16 anything that may be unique to their unit in relation to other
17 Westinghouse units, any specific design features that may be
18 contributing to these trips, any specific maintenance problems
19 that may be related to the trips, and any other factor,
20 particularly personnel errors, which appear to be a major
21 factor here.
22 We recognize on the review of the trips which
23 occurred on May 19th, the 23rd, June 6th, June 8th and June
24 9th, that the bulk of the trips, probably 80 percent of them at
25 this point appear to be related to balance of plant type items.

I want to emphasize to TVA that the balance of plant equipment is important to the NRC even though it may not be on the critical components list. They're not immune from NRC overview, so I want to make that clear at the beginning. If there is something wrong with balance of plant, then that's got to be corrected before the Unit can come back on.

We have with us today, the OSP staff, and we'll go around the table in a minute. But we also have the Chairman's tech assistant and Mr. Taylor's tech assistant, the Deputy EDO, and many members of the press that we've come to know. And some other organizations are also represented from the NRC, the AEOD in particular.

So I think what we'll do first, is we'll go around and introduce all the persons, and then we'll turn the meeting over to Mr. White.

So I'm Stu Ebneter, Director of Office of Special Projects.

MS. AXELRAD: Jane Axelrod, Deputy Director, Office of Special Projects.

MS. BLACK. ~~Susan~~ Suzanne Black, Assistant Director, Special Projects.

MR. DONOHEW: Jack Donohew, Sequoyah Projects Manager.

MR. MARINOS: Angelo Marinos, Chief of Reactor Operations Branch, OSB.

1 MR. ROTELLA: Tom Rotella, Project Manager.

2 MR. TROSKOSKI: Bill Troskoski, Deputy EDO Staff.

3 MR. HARMON: Paul Harmon, Resident Inspector,

4 Sequoyah.

5 MR. MCCOY: Frank McCoy, Assistant Director, TVA

6 Inspection Programs.

7 MR. PIERSON: Bob Pierson, Plant Assistance Branch.

8 MR. LIAW: B.D. Liaw, OSP.

9 MR. RICHARDSON: Steve Richardson, Director, TVA

10 Division.

11 MR. PARTLOW: Jim Partlow, Prospective OSP Director.

12 MR. BURZYNSKI: Mark Burzynski, Sequoyah Licensing

13 Staff.

14 MR. HARDING: Mike Harding, Licensing Manager,

15 Sequoyah.

16 MR. SMITH: Steve Smith. I'm Sequoyah Plant Manager.

17 MR. WHITE: Steve White, Office of Nuclear Power.

18 MR. BYNUM: Joe Bynum, Assistant Manager, Office of

19 Nuclear Power.

20 MR. PATRICK: My name's Jerry Patrick. I'm the

21 Office Group Manager at Sequoyah.

22 MR. HOSMER: I'm John Hosmer, President, Sequoyah.

23 MR. PARIS: Rick Paris, Westinghouse Electric

24 Corporation.

25 MR. FELGATE: George Felgate, NRC, OCM, KC.

1 MR. CALLAHAN: Mike Callahan, Office of
2 Congressional Affairs, NRC.
3 MR. WILLIAMS: Mark Williams, NRC, AEOD.
4 MR. PADOVAN: Mark Padovan, NRC, AEOD.
5 MR. POLK: Phil Polk, TVA.
6 MR. IPPOLITO: Tom Ippolito, TVA.
7 MR. GOODWIN: Ed Goodwin, NRC, OSP.
8 MR. HONSTOL: Dean Honstol with the ACRS Staff.
9 MS. AYERS: Carol Ayers, TVA.
10 MS. GAGNER: Sue Gagner, NRC, OGPA, PA.
11 MR. FRANKLIN: Ben Franklin, New York Times.
12 MR. ELLIS: Kenneth Ellis, Gannett News Service.
13 MR. POWELSON: Richard Powelson of Knoxville News
14 Sentinel.
15 MR. EBNETER: Okay. I guess we're ready to start
16 then.
17 Mr. White, you've got the floor.
18 MR. WHITE: As you've mentioned, since the start-up
19 of Sequoyah Unit 2 last month, we've had five trips. I'm
20 concerned over any trip. We carefully therefore with each trip
21 analyzed them. We believe that our root cause program and post
22 analyses, post trip analyses programs were good.
23 Nevertheless, after the fourth trip, because of my
24 concern, I sat down with the site director, the plant manager
25 and others, before I would authorize start-up, and I frankly

1 said there's got to be a common root cause to these four trips.
2 And we literally kicked it around for a day, that was
3 last Wednesday. We looked at it very closely. We had some very
4 down to earth discussions. And we simply could not come up
5 with a common thread among the first four trips. And as a
6 result, I had authorized start-up.
7 On that start-up on Thursday, we tripped again. And
8 at that point, Stu, as you know, I said, you know, stop,
9 despite the fact that we think our root cause program is good,
10 despite the fact that we think our post-analysis trip programs
11 have been good, we need to stop, we need to take another very
12 close in detail look at ourselves. And at that time, I
13 informed the NRC that I decided to do that, and asked them for
14 a meeting with the Staff to inform you of what we found during
15 that look. And of course, that's the purpose of today's
16 meeting.
17 Let me also add that I clearly understand the
18 importance of balance of plant. And as you know, from prior
19 discussions with you and your staff, we have tried to put
20 emphasis on balance of plant, recognizing that that is the
21 source of many many problems within the industry.
22 So with that, I'll turn it over to Steve Smith, Plant
23 Manager at Sequoyah, and he'll lead off.
24 MR. SMITH: Today's presentation will include a
25 general discussion of the restart of Sequoyah Unit 2, a brief

1 discussion of the design and operation of our feedwater system,
2 some discussion about the preparation of the secondary plant
3 prior to restart, a review of the individual trips and their
4 individual root causes and corrective actions, a summary of our
5 root cause evaluation, matrix display and the root cause
6 evaluation, discussion of our involvement with both the
7 industry and at the plant with our trip investigations and
8 assessment program.
9 Sequoyah Unit 2 was restarted on May 13, 1988. The
10 plant operated at approximately 100 percent power for six days.
11 From May 13th until now, we've had five reactor trips. Three
12 of those trips occurred at greater than 70 percent power, two
13 at less than 25 percent power. Of the five trips, four of
14 those trips involved the feedwater system, three of those trips
15 were the result of low load level in the steam generator as the
16 reduction of feedwater flow to the steam generators.
17 Prior to discussing the individual trips and the root
18 cause and corrective actions, I'd like to give a brief
19 discussion of the design and operation of our feedwater system.
20 I brought with me our operations group manager, Mr. Jerry
21 Patrick to do that. Jerry?
22 MR. PATRICK: Thank you, Steve.
23 Basically what we have here is a four stage
24 generator. And we have a basic Westinghouse plant layout. We
25 have seven stage heaters. Starting with your low pressure

1 heaters here, your intermediate heaters and your high pressure
2 heaters here. In the middle of this, you have a condensate hot
3 water system, condensate pumps, through various pumps up to
4 your main feed pump.
5 This main feed pump is a turbine driven steam driven
6 pumps. There's two of them. They are 80 percent capacity which
7 that means you have to have both on line to operate. It goes
8 through the high pressure heater system into a bypass and a
9 feed reg valve, feed control valve. On low load conditions, we
10 operate the bypass and then we do a manual swap over to the
11 feed reg valves.
12 The next slide, we'll go into the control circuitry
13 for the feedwater.
14 MR. EBNETER: What's significantly different between
15 Sequoyah and other Westinghouse units? Is there anything
16 significant?
17 MR. PATRICK: We're going to discuss that.
18 The feedwater control system is a basic three element
19 control system. It controls the feed reg valve right here.
20 This is similar in all the Westinghouse plants. What we have
21 is this reg valve is our greater than 25 percent power level
22 control. The bypass is what we normally start up on.
23 This bypass control now is an automatic at Sequoyah.
24 It gets a signal from a level transmitter in the steam
25 generator. We also have a turbine control system to maintain

1 this feed pump to speed it up and to slow it down, to allow
2 these valves a mid-position control span. This valve is too
3 big to operate at a low power level so we have to utilize the
4 bypass.
5 In comparison with the industry right now, shows us
6 that the -- is typical. The three element control is typical.
7 The controls and protective set points are typical. This is
8 all Westinghouse four loop plants have turbine driven feed
9 pumps, main feed pumps. The majority do not have the automatic
10 bypass to the main feed pump. Now, what this is is a bumpless
11 transfer. We do not have that.
12 And most of the plants do have automatic bypass which
13 we do have. The minority do not have the motor driven feed
14 pumps. This bypass valve right here, we put this in service,
15 we've seen an increase or decrease in trips at that time. The
16 automatic bypass, what that did for us is we had 15 after
17 January 1985, and changed over to this automatic bypass, we got
18 15 start-ups which only one tripped. Prior to that, we had 37
19 percent. Anyway, it shows to you that when we came on after
20 1985 with the automatic bypass system in, we only had one trip
21 ion the last 15 start-ups.
22 And what this also shows that one of those trips was
23 this second to last trip we had a Sequoyah. The fourth trip
24 was on the system. We can't work the trip and it's an operator
25 error.

1 MR. EBNETER: Is there anything significantly
2 different in those four loops? Both of these low level trips
3 occurred on number 2.
4 MR. PATRICK: No, sir.
5 MR. EBNETER: Nothing different.
6 MR. SMITH: But we redid the trip chart records for
7 steam generator levels, although Unit No. 2 steam generator was
8 the first in on two occasions, there was no steam generator
9 very close to it. It was just coincident that the steam
10 generator was the number two generator.
11 MR. PATRICK: Okay, on the trip-related man machine
12 interface, prior to 1985, of the 50 start-ups, 15 were done
13 because this system was not in automatic control. After 1985,
14 one of 14 caused this system. Now, that it's automatic allowed
15 us to start up. And like I said, the second to last trip or
16 the fourth trip at Sequoyah was caused by operator error. If
17 that wouldn't have happened, this system would have allowed us
18 to stay up.
19 I'll turn it back over to you, Steve.
20 MR. SMITH: Thank you, Jerry.
21 MR. LIAW: Excuse me. Can I ask you a question.
22 MR. SMITH: We have a presentation of that later on.
23 We'd like to wait until later on in the presentation to go
24 through our involvement with the Westinghouse Center group and
25 the trip reduction assessment program.

1 MR. LIAW: -- resolution, is that what you're saying?

2 MR. SMITH: Sir? Yes.

3 Next slide, please.

4 Prior to Unit 2 restart in May of this year, during

5 the 33 month shutdown for Sequoyah Unit 2, a great deal of

6 energy was concentrated on the balance of plant equipment. In

7 1986, an equipment evaluation program was conducted. That

8 program assessed the plant material conditions. It looked at

9 the affects on the plant of the extended lay up. It reviewed

10 historical work orders, work histories to identify trends and

11 recurring problems with equipment.

12 And it identified corrective and preventive

13 maintenance items to be performed. These items were gathered

14 together in an equipment evaluation book. Contained over 400

15 items. Operations reviewed and prioritized those items. All

16 priority items were reworked or worked prior to Unit start-up.

17 From January 1987 until January 1988, approximately

18 1,000 work orders were performed on the balance of plant to

19 repair or to improve material conditions.

20 Additionally, programs and personnel were looked at.

21 Dedicated training program was assembled to give to the crews

22 for Unit 2 restart. The crews were handpicked and dedicated to

23 Unit 2 prior to restart. This training program included eight

24 hours worth of feedwater transient training.

25 The overall training program was observed by NRC and

1 at least two independent groups that were established by TVA to
2 review our operational readiness. In addition to the training,
3 we established shift operations advisors to assist the shift
4 supervisor and the operations crew during transient events,
5 such as start-up and placing the feedwater control system into
6 automatic from manual.
7 We established a trend analysis program for
8 reportable occurrences to identify people, procedural and
9 equipment problems which could show a trend of degradation,
10 identify those areas for improvement. We identified the need
11 for and performed training in operator communications to assure
12 communications both in the control room and outside the control
13 room of a dedicated nature.
14 We also improved and proceduralized our trip and
15 event investigation program. That program is proceduralized in
16 plant procedures. Each individual trip investigation team
17 members are trained in the requirements of the procedure. The
18 trip investigation team is a committee that is composed of a
19 representative from our plant operations review staff, the
20 shift technical advisor that was on shift at the time of the
21 incident or trip, a senior licensed reactor operator for our
22 plant, a representative from the Division of Nuclear
23 Engineering or System Engineering, whichever expertise is
24 required and one other member as determined by the type of
25 event that occurs.

1 The plant operations review staff has had
2 considerable training in -- analysis, and root cause analysis
3 programs. Each member that sits on the trip investigation team
4 has had training to that effect.
5 The investigation program itself is a series of
6 individual interviews, group interviews, review of strip
7 charts, computer history and plant parameters and comparison of
8 the specific incident with historic events to identify trends
9 of recurring problems that we have identified in the past.
10 The trip report itself receives a further management
11 review from the plant operations review committee, and they
12 also interact with the group to identify personnel, procedure
13 or equipment problems which require correction.
14 MR. PARTLOW: Is this all before restart or after
15 restart?
16 MR. SMITH: The program right now does not require
17 that the management review be completed prior to restart, just
18 that it be completed. For four of the five restarts of the
19 plant, the management review was completed prior to restart.
20 The fifth review occurred subsequent to the restart.
21 Additional hardware improvements were made during the
22 shutdown. Those hardware improvements, although I wont'
23 discuss them in detail now, were as a result of specific plant
24 problems and our involvement with the Westinghouse owner's
25 group.

1 Are there any questions before we discuss the
2 specifics of the trips?
3 (No response.)
4 MR. SMITH: On May 19, 1988, at approximately 2:15 in
5 the afternoon, with the reactor at approximately 72 percent
6 power, a trip occurred in the Unit 2 reactor plant. The cause
7 of the trip was steam flow feed flow mismatch to the steam
8 generators. Prior to that event occurring, we had placed one
9 of the steam generator level transmitters in the trip position
10 placed at bistable and trip which would give one trip signal.
11 The reason why this level transmitter had been placed
12 in the trip condition is that we had found an unauthorized butt
13 splice in the circuitry to that level transmitter that did not
14 meet our environmental qualification requirements, and we
15 placed it in the trip position as the conservative approach
16 until the repair to that butt splice could be made.
17 During that period of time, mainterance and
18 operations personnel were actively engaged in the balance of
19 plant looking for packing land leaks, minor material conditions
20 to be corrected, level adjustments to be made, a number of
21 things that were a part of our up-grade program after re-start.
22 Normal restarts will involve leaks in the plant and small
23 adjustments. That's common to just about any plant.
24 We had assembled a maintenance and operations crew
25 and they were dedicated to that effort. One such crew was in

1 the process of adjusting a level controller on a heater drain
2 tank. The reason they were adjusting the level controller was
3 because they had observed by the site glass on the heater drain
4 tank that the level was apparently too high in the drain tank.
5 The indicator level was approximately three-quarters of a tank
6 full. The normal operating level was supposed to be
7 approximately 25 percent.
8 The site glass itself was plugged up, although this
9 was unknown to the operator and the maintenance individual
10 engaged in the maintenance activity at the time, and the
11 changes that they made to the level in the drain tank were not
12 indicated by the site glass.
13 They adjusted the level control valve to the point
14 where they pumped the tank dry. The pump tripped on loss of
15 suction and the subsequent feedwater transient combined with
16 the already injected signal gave them a two out of three logic
17 make-up for steam flow feed flow mismatch and that tripped the
18 reactor plant, as I said, at approximately 72 percent power.
19 A subsequent investigation revealed several areas of
20 concern. The primary area was the awareness level of the
21 maintenance and operations individuals conducting maintenance
22 activities in the plant. This investigation showed that they
23 did not question the lack of getting the achieved results from
24 adjusting the control of the level in the tank, did not change,
25 they did not reestablish the base conditions but continued to

1 adjust the controller in anticipation of effecting a level
2 change in the tank.
3 This in and of itself was the root cause for the
4 trip, or their lack of intense examination of the reasons why
5 they did not achieve the expected results.
6 There were some other things, though, that were
7 secondary causes. We do not feel that adequate communications
8 had occurred between them and the control room. We did not
9 feel that the procedures were specific enough to inquire of
10 those communications and to require that they stop performing
11 their activity if they do not achieve the expected results at
12 the time that they were doing it.
13 The corrective action that was taken for this trip
14 event was to troubleshoot and repair approximately ten
15 components on the secondary side. Of these components were
16 items such as the steam dump valves, there were two steam dump
17 valves that did not operate correctly during the event. A few
18 safety valves, other maintenance items that would be expected
19 on the balance of plant subsequent to a trip.
20 We had been in the process of formalizing a plant
21 troubleshooting procedure. We are expediting it at this time
22 the formalization and approval and issuance of the
23 troubleshooting procedure. It should be issued by the end of
24 this month. The procedure provides guidance to operations and
25 maintenance personnel as to their interfaces and required

1 action during troubleshooting in the plant.

2 This event was reviewed with all operations personnel

3 to help assure their awareness of what had occurred and the

4 actions to be taken in the future.

5 We are also investigating an improved communications

6 system in the plant. In reviewing this particular incident, it

7 was identified that no direct communications existed to the

8 control room at that time other than hand-held radios and this

9 is due to an existing plant deficiency where sound powered

10 phone jacks in the system were not available in all areas of

11 the plant.

12 On May 23, 1988, at approximately 12:30 in the

13 morning, the reactor at 70 percent power, a trip occurred. The

14 trip was due to reactor coolant system low flow indications.

15 The root cause of this was an individual performing a

16 surveillance instruction and he was in the process of

17 recalibrating a reactor coolant system flow transmitter. The

18 individual had valved out the transmitter not in accordance

19 with the procedure but in a fashion that he thought was more

20 safe. This particular process that he had used in valving out

21 the transmitter had drained the high side reference leg to the

22 transmitter.

23 That high side reference leg is part of a common leg

24 that goes to three flow transmitters for that reactor coolant

25 loop. When the individual valved the transmitter back in, the

1 reactor coolant system of course had to fill the void that he'd
2 created in the reference leg. That void caused a spike in the
3 common reference leg. Subsequent other transmitter alarmed.
4 That created two out of three logic and the plant tripped on
5 low reactor coolant flow in one loop.
6 Subsequent investigation indicated a primary cause of
7 failure to follow procedures on the part of the instrument
8 mechanic who was performing the calibration.
9 The secondary cause was that the procedure was being
10 conducted at too high a power level. Had the procedure been
11 conducted at below 35 percent power, it would have required
12 this type trip indication for two reactor coil loops before
13 actual trip occurred.
14 The corrective action that was taken was to evaluate
15 the performance of SI-246 which was the surveillance
16 instruction being performed at the time to determine if it
17 should ever be performed above 35 percent power.
18 Reemphasized and provided necessary management
19 attention toward compliance with plant procedures. Reviewed
20 past reactor trips to determine if similar situations had
21 occurred and brief the instrument mechanics and operators on
22 this event.
23 And to review all instrument maintenance
24 surveillances to determine if a similar situation could occur
25 from other surveillance instructions.

1 We currently have a program in effect which is doing
2 a detailed review of our surveillance instructions to assure
3 that they can be performed at power. As most of you are aware,
4 during the 33 months that Sequoyah was shut down, most of the
5 surveillance instructions were revised both technically an din
6 their format. Certain of those SI's could not be field
7 validated until the plant was at power.
8 The program that's being conducted at this time is to
9 identify which surveillances have to be performed at power, to
10 review the equipment that the surveillance is performed on, to
11 review the surveillance itself, and to determine if the
12 surveillance had ever been performed prior to the shutdown at
13 power. If it had been, then to determine if any modifications
14 had been made to the equipment or procedure, to assess those
15 modifications as to their affect on operating plant equipment.
16 MR. EBNETER: Do you have a completion date on that?
17 MR. SMITH: The completion date is approximately a
18 month and a half. The requirement that I have is that for each
19 surveillance to be performed, that investigation has to be
20 conducted for the specific surveillance before it can be
21 performed in the plant unless that specific surveillance has
22 run the end of its surveillance cycle.
23 It's an on-going activity. As I said, it's about a
24 month and a half activity to get it all done.
25 On June 6, 1988, with the reactor at approximately 98

1 percent power, a trip occurred to the unit as a result of steam
2 generator low load level. The cause of the trip was testing
3 was in progress, the performance of a surveillance inspection.
4 This particular surveillance to the reactor safeguard cabinet
5 or safety features actuation system to a test panel and the
6 actual surveillance itself was intended to energize three slave
7 relays. Those particular relays were used to shut the feed reg
8 valves loss of feedwater accident.
9 The circuitry itself was designed to have a bypass
10 circuit. A diode was missing in that bypass circuit. The
11 bypass circuit was used to maintain the feed reg valve open so
12 that this particular test could be done at any power level.
13 This particular surveillance, although it had been performed on
14 several occasions prior to Unit 2 restart, had never been
15 performed on Unit 2 at power.
16 The surveillance itself is currently required every
17 18 months during shutdown surveillance. It had been identified
18 in our safety analysis report as being required every three
19 months. This was discovered during the 33-month shutdown and
20 the frequency of performance had been upgraded to every three
21 months until a revision to the FSAR could be effected to bring
22 it in line with our technical specification.
23 The surveillance itself, as I said, had been
24 performed just prior to start-up and this was a scheduled
25 reperformance. When the surveillance was performed, because

1 the blocking diode was not in place, the feed reg valve
2 actually did go shut which reduced feedwater flow to the steam
3 generators and the unit tripped on low load steam generator
4 level in number 4 steam generator.
5 Our subsequent investigation indicated two things:
6 that there was an unidentified material condition. This
7 material condition could only have been identified had we
8 performed the surveillance at power or if we had done a
9 complete 100 percent circuitry review on this circuit.
10 Also, again, we identified a problem with the
11 procedure scheduling, not that this surveillance, if the diode
12 had been there, would have been detrimental to plant operation,
13 but it was actually unnecessary to perform this surveillance at
14 all, that it had been changed to an 18-month surveillance and
15 we were performing it on a quarterly schedule.
16 Our corrective actions were to revise and review our
17 scheduled surveillances, the schedule for our surveillances and
18 insure that the proper performance and frequency was specified.
19 We performed a maintenance search to determine if the missing
20 diode existed in any other test cabinets.
21 We did some troubleshooting and repair on four
22 secondary site valves. During the trip itself, an event
23 occurred where an operator opened the vacuum breaker to the
24 condenser. This evolution is normally only performed when you
25 have a problem with the turbine generator set itself and it's

1 necessary to break vacuum to speed up the rapid slowing down of
2 the turbine generator so that you can stop it in a much quicker
3 time frame.
4 This switch was inadvertently turned, opened the
5 valve. As a result of that, we're looking at all local switch
6 installations in the plant to verify or identify those that
7 might be in areas where they could be bumped and inadvertently
8 the position changed during operation. And we will install
9 plastic covers over those that we feel require further
10 protection.
11 Also we discovered during this trip, that particular
12 switch cannot be overridden from the control room, it does not
13 have a neutral position. And we've identified a modification
14 to the switch so that's it's spring loaded to a neutral
15 position and can be overridden from the control room.
16 On June 8, 1988, with the reactor at approximately 60
17 percent power, a trip occurred at 13:19 in the afternoon. This
18 trip was a result of low load steam generator level. In
19 investigating this trip, we determined the causal factors to be
20 some problems with equipment on the secondary side, that is,
21 one feedwater pump had been isolated because of a leak, and the
22 other feedwater pump was experiencing fluctuations in flow
23 control due to bypass valves on that feedwater pump being at
24 manual.
25 We had an operator at the controls who had not in the

1 past done a start-up in Unit 2 and he had no direct plant
2 experience with making the transfer from manual control to
3 automatic control.
4 He is a licensed operator. He's gone through all of
5 our simulator training and had practice at the controls. This
6 was the first time he was doing it by himself.
7 We also discovered during our investigation of this
8 particular trip event that not all operators make the feedwater
9 transfer from the manual to the automatic controls in the same
10 manner. And we'll discuss that later.
11 During this event, the BOP operator got into trouble
12 with some fluctuations of feedwater control. He asked a more
13 experience lead operator for assistance. When the experienced
14 lead operator became involved, he attempted to place the
15 controls in automatic, we did lose, we had a loss of feedwater
16 to the steam generator and we tripped on low load level in the
17 steam generator.
18 The corrective action that was identified for this
19 incident was to provide experienced dedicated coaching
20 individual in the control room during start-ups and other
21 events to assure that qualified individuals are there and
22 available to assist other operators during events which require
23 a great deal of attention and manual manipulations of controls.
24 That third reactor operator will be in the control
25 room for all start-ups in the future.

1 Because of the distinct operating conditions we
2 found between our simulator and our own plant in that our
3 simulator does not actually model the rapidity of changes in
4 the feedwater system of steam generators during certain
5 transients, we have a recommendation to modify the simulator so
6 it more closely represents the plant itself.
7 Our operator training our operating procedure for the
8 system will be revised to implement a primary operational
9 method for doing the manual to automatic conversion. We'll
10 discuss that later.
11 And we found three secondary side items that required
12 repair.
13 On June 9, 1988, with the reactor at approximately 20
14 percent power at 05:12 in the morning, the reactor tripped.
15 The reactor trip was a result of steam generator low load
16 level. The reactor trip was the direct result of a mechanical
17 failure in the plant in that our plant sealing steam system
18 which can be supplied by either auxiliary steam or from the
19 main steam system itself experienced a failure on the glass
20 sealing steam regulator. We had the glass sealing steam bypass
21 in the open position. It was being supplied by main steam at
22 about 140 pounds of pressure. This evolution caused a higher
23 pressure condition in the heater drain tank, number 7 heater
24 drain tank.
25 This condition did not allow the feedwater heater

1 shell sides strings A and B to drain as they normally do. A
2 level build up in the shell side of the feedwater heaters which
3 resulted in an isolation of strings A and B feedwater heaters.
4 Subsequently resulted in a reactor trip on steam generator low
5 load level.
6 The root cause investigation in this area identified
7 that it was directly due to mechanical equipment failure. Our
8 corrective action is multi-fold. Our evaluation indicated some
9 other areas that required more attention than just the
10 mechanical equipment failure itself.
11 One of the things we found again was the way that we
12 operated the system. We found that the current evaluation
13 process of work orders for Unit 2 did not place enough emphasis
14 on the balance of plant equipment. We feel that the operators
15 that were reviewing these work activities did not feel the
16 individual affect of each work order, and did not have a means
17 of looking at the aggregate affect of each work order of
18 balance of plant equipment.
19 We have subsequently developed a program that prior
20 to each shift, the shift supervisor and each of the unit shift
21 supervisors prior to going on shift, review individual work
22 orders and cumulative work orders on systems. We've
23 established a work control center for Unit 2 work activities.
24 Material conditions are displayed on system P&ID drawings in
25 that room so the review can be conducted as to the specific and

1 aggregate affect of all work orders as performed prior to the
2 shift supervisor and unit shift supervisors assuming the shift.
3 MR. WHITE: We think that's been a pretty good
4 program.
5 MR. SMITH: They've reviewed it on Unit 1. We did
6 not have it fully implemented for Unit 2.
7 MR. EBNETER: Do you think it will prevent some of
8 this?
9 MR. SMITH: Yes. It gives you a better overall
10 picture of the status of the system.
11 MR. WHITE: Looking at that whole system and seeing
12 where all of the parts fit together, and that's what that
13 system does for us.
14 MR. SMITH: One of the recommendations that was
15 contained in the Westinghouse Owners' Group Program and that we
16 confirmed that we need a stronger emphasis on during this trip
17 was who plays the role of prominence in the horseshoe area of
18 the control room during specific events in the plant.
19 Westinghouse Owners' Group recommendation following a
20 number of trips of this nature indicated that the balance of
21 plant operator who is normally the second in command in the
22 horseshoe area should be the principal operator during the
23 start-up transient of taking the feedwater system from manual
24 control to automatic control.
25 Our program is currently being revised to put him in

1 the lead responsibility for that transient. Our program will
2 also include, as I said, the third operator in the horseshoe
3 area to provide assistance and advice during these transients.
4 Also, our operating procedures are being revised to establish a
5 primary and alternate method for performing the start-up, the
6 primary method being the one that was used successfully for the
7 first three plant start-ups.
8 MR. LIAW: Steve, are you saying that events occur
9 when the operators switch from the automatic to manual or
10 manual to automatic?
11 MR. SMITH: Yes, sir.
12 Jerry, would you like to give a more detailed
13 description on how the event occurred?
14 MR. PATRICK: We're talking Event 5?
15 MR. SMITH: Right.
16 MR. LIAW: You said something about mechanical
17 failure.
18 MR. SMITH: Right. The individual already had the
19 feed pump in automatic control. He had the feed reg bypass
20 valve in automatic control, and he was manually controlling the
21 feed reg valve.
22 MR. LIAW: Manual control.
23 MR. SMITH: Right.
24 MR. LIAW: You make some description about the
25 general layout in the control room as how that was done?

1 MR. PATRICK: What you actually do at about 20 to 30
2 percent power, you have the feed pump in automatic --
3 MR. LIAW: No, you already showed me that. Tell me
4 what inside the control room, what happened then?
5 MR. PATRICK: You have the feed pump in automatic and
6 you had the bypass in automatic. Your feed reg valve is in
7 manual. It's like I said earlier, the feed reg valve is a very
8 sensitive at low power. It's in manual. So the operator has
9 to have -- we were standing here and I was looking at the
10 board, he would have this in automatic, and he'd transfer
11 control to the automatic main reg down here. He has to look at
12 all these parameters. He has to look at his feed flow, feed
13 header pressure, those four things, and then bring this up, and
14 bring this down. Once this valve takes control, --
15 MR. LIAW: No, tell me, just one person or two
16 persons?
17 MR. PATRICK: At that time, there's one person in
18 that, playing that role. There's one person playing that role.
19 MR. LIAW: I thought as part of the Owners Group
20 issue, or the group of Westinghouse plans, had determined that
21 one was not enough, wasn't it?
22 I'm just asking a question.
23 MR. BYNUM: No, sir, I don't think so.
24 MR. LIAW: I'm not making an assertion I'm simply
25 asking.

1 MR. WHITE: No. But we have said that, what Steve
2 said earlier, that despite that, what we want to do is get
3 another experienced guy looking over the shoulder available to
4 help --
5 MR. LIAW: I agree.
6 MR. WHITE: It's very clear I think anybody that's
7 watched this evolution has come to the conclusion, gee, it
8 would be nice to have an extra guy there, experienced whose
9 done this before. You watch it, you can't come to any other
10 conclusion, which is the conclusion we've come to.
11 MR. BYNUM: We did consider what you said about
12 having two people good, but they're so interactive that you
13 cannot change one steam generator level without affecting the
14 other three, so, but we did consider that and decided that
15 would not be --
16 MR. LIAW: I have had some private discussions with
17 Bob Pierson and my understanding was for a three stage, he
18 indicated that is a very very sensitive at low power level.
19 MR. WHITE: It is extremely sensitive and the reason
20 we want the back-up guy there is in the event of --
21 MR. LIAW: No, I'm not just talking about the back-up
22 guy but what you can do. I thought as part of the Owners'
23 resolution, there's a modification to the whole control scheme.
24 MR. WHITE: There are some other things that we'll
25 get into. We have that yet to go.

1 MR. SMITH: Well, what you're talking about, we
2 weren't intending to discuss today. What you're talking about
3 is the reduction of the trip set point or the removal of the
4 set point on the steam generator low load level altogether.
5 That's at Westinghouse WCAP 11345.
6 MR. LIAW: Only one part of it.
7 MR. WHITE: Is that the part you're talking about, in
8 other words, doing away with that, as I understand the thing,
9 putting in a time delay, and doing away with the trip entirely.
10 MR. SMITH: Well, let me explain the process. That
11 particular area was looked at very strongly in the November
12 December time frame in 1986. Just last year in '87, did the
13 NRC give approval for one plant to implement those
14 recommendations and that was the Callaway plant. We're very
15 closely watching the Callaway plant at this time to see what
16 affect that has on their trip history. And as you know,
17 Callaway has a somewhat phenomenal trip history. Right now,
18 they don't have any.
19 They started out as being one of the highest rate of
20 trip plants in the country. They had 28 in one year, I
21 believe.
22 MR. EBNETER: You might make that.
23 MR. SMITH: We don't intend to.
24 MR. WHITE: No, we won't.
25 MR. LIAW: How many of them were in Taiwan when first

1 they started. I understand they had a terrible time.

2 MR. WHITE: In Taiwan?

3 MR. LIAW: Yes.

4 MR. SMITH: I have no idea, sir.

5 MR. PATRICK: I don't know specific numbers but they

6 did have a large number of trips.

7 MR. LIAW: At a low power level.

8 MR. PATRICK: Yes, at low power level, a large number

9 of trips. And since they've had several years of operation,

10 that rate of trip at low power level has decreased.

11 MR. LIAW: Well, the reason it decreased, I guess

12 that's the point I'm trying to get at, the reason it decreased

13 they modified the control logic?

14 MR. PATRICK: No. The reason it decreased was more

15 experience on the part of the operators. They did not change

16 the logic.

17 MR. LIAW: No, that's not true. I was there last

18 year. And I think they had visited the Japanese. And my

19 understanding is they have converted because of that.

20 MR. WHITE: To what? To do away with the scram

21 itself?

22 MR. LIAW: Two separate areas. One is automatic, the

23 second is also to reduce the set point.

24 MR. PATRICK: But when you're talking automatic,

25 though, you've got to remember our main feed reg valve will

1 operate automatically. Our bypass valve will operate
2 automatically. But there's no automatic swap over that's not
3 automatic. We have the automatic feature on both the bypass
4 and the main rig.
5 MR. EBNETER: Who made the judgment to let this
6 inexperienced guy do this and not give him any help? It's my
7 understanding that he did have some apprehensions about going
8 through this evolution. It seems to me that -- who makes that
9 sort of judgment? Was it the Shift ASE or?
10 MR. PATRICK: Mr. Ebneter, I'm responsible for
11 managing the shift and it's scheduled on a weekly basis. The
12 operator in question asked for help during the evolution of the
13 feed pump with the feed pump in automatic. He got the help.
14 There was a lead -- that operator was one of our more
15 experienced men came to his aid. But similar to what you were
16 talking about having too many hands in the pot, that guy comes
17 in at the wrong time, it can be just as detrimental.
18 MR. SMITH: Let me clarify something here.
19 The three start-ups prior to the fourth, there was a
20 third man in the horseshoe and he was dedicated to the
21 evolution. The fourth one did not have a man in the horseshoe.
22 There was no requirement for that. The individual that was
23 scheduled to be the third man in the horseshoe had to go to
24 training that day and no one else was available.
25 The decision was made at the shift supervisor level

1 to continue with the evolution with the experienced operator
2 giving the inexperienced operator assistance when necessary.
3 MR. WHITE: But to answer your question, based on the
4 fourth trip, I said we're not going to do it that way any more.
5 So there isn't going to be -- I made the decision and the
6 decision is we're not going to do it that way any more.
7 MR. EBNETER: But that doesn't show up in your
8 corrective action.
9 MR. SMITH: Yes, sir, it does.
10 MR. EBNETER: It doesn't come out that way to me.
11 MR. WHITE: Sorry about that. Let me tell you, as
12 soon as I went in --
13 MR. EBNETER: What we'd like to know is what you're
14 going to do is going to make something happen, or prevent these
15 things from happening.
16 MR. WHITE: Let me tell you. As soon as that trip
17 was over, I went into the control room and talked to those
18 operators that day and went through this evolution with them
19 after it had happened. I made the decision and went back and
20 said, hey, we're never going to do it that way again. So it
21 isn't a question of somebody making a decision down below. The
22 decision's been made.
23 MR. EBNETER: Well, you know, we went through six
24 start-ups -- and I couldn't believe it when we get into two
25 trips.

1 MR. WHITE: Yes. These are the two that we expected
2 to happen when we first started up.
3 MR. EBNETER: That's right.
4 MR. WHITE: You know, because of the sensitivity that
5 B.D. talks about, we all expected those two trips, and they
6 didn't happen.
7 MR. LIAW: Yes. And the low power sensitivity so it
8 must be low power.
9 And I don't mind telling you that somebody
10 characterized it as Westinghouse's biggest boo boo or
11 something. I don't know.
12 MR. WHITE: Well, I was asked the question the other
13 day, what would I do as a result of the sensitivity, and my
14 answer was, if you've got a Westinghouse Plant, you've got the
15 sensitivity. If you buy the Westinghouse plant now. That
16 doesn't mean there aren't other things you could and shouldn't
17 do, and that's what we're trying to tell you is there are other
18 things that we are doing and have done because of that
19 sensitivity.
20 MR. EBNETER: Yes. We want to know what else you're
21 doing too, design-wise.
22 MR. WHITE: We will get into that, too.
23 MR. SMITH: Our trip review program includes
24 requirements for the specific review for root cause of each
25 event and then the comparison of that event to previous events.

1 We look historically at material and equipment
2 conditions and how the plant responded from a trending fashion.
3 Our root cause analysis for these events when compared one to
4 the other do not indicate a common thread for the cause of the
5 events.
6 There are similarities between trips 4 and 5, which
7 we have discussed, but there is no common thread through those
8 other than the fact that four of the trips involved the
9 feedwater system, three of the trips were because of steam
10 generator low load level caused by perturbations in the
11 feedwater system.
12 MR. EBNETER: What about staff attitude? I don't see
13 that on here? At least three or four of these were related to
14 judgment and attitude and failure just to have the right ethic?
15 MR. WHITE: Let me address that one. My feeling is
16 this: Almost without exclusion, literally a hundred percent of
17 any incident that I have ever reviewed, I categorize as people-
18 related. If there isn't a diode in the system, a person did
19 that. If there's a piece of equipment that fails to operate,
20 it is usually due to maintenance and other issues.
21 And so I look at all of these thing as in that
22 respect as people-related.
23 MR. EBNETER: I would agree with you but they may be
24 random. Look at here. Here's one, trip one, lack of good
25 judgment, unclear procedure. Here's trip number two, failure

1 to follow procedures. This man deliberately departed from that
2 procedure.
3 MR. WHITE: That's right. And he was punished for
4 it.
5 MR. EBNETER: Do we have this so-called ethic?
6 MR. WHITE: Well, that's the point I'm leading to, is
7 that in this thing, we have I think made some pretty great
8 strides in the nuclear ethic in the primary plants. We are in
9 the process, and you know, you don't set a specific program to
10 do it, you do it with management attention and leadership. But
11 the nuclear ethic in my opinion needs to be pushed into the
12 secondary plant.
13 MR. EBNETER: When are you going to do that?
14 MR. WHITE: We're in the process, we've already
15 started. You know, in terms of doing it, you're looking at the
16 people who do that kind of thing right at this table.
17 MR. EBNETER: When do you think you'll see some
18 progress?
19 MR. WHITE: I think we already have seen some
20 progress.
21 MR. BYNUM: If you look at the work activities that
22 we're doing right now, I mean --
23 MR. EBNETER: Well, I might agree with that. You
24 know, I've walked through the balance of plant side many many
25 times and it looked very nice, clean, very few leaks, and I got

1 all these assurances that boy, the sprinkler will run beautiful
2 because we really put a lot of time on --
3 MR. WHITE: Not from me, you didn't. Not from me,
4 you didn't.
5 MR. EBNETER: TVA, TVA. So I'm really surprised when
6 I see all these things on balance of plant.
7 MR. WHITE: Well, let me tell you how I view that.
8 What happened was, we started that plant up, and as Jerry's
9 words are, until you take that plant, Mr. White, and you shake
10 it, then you find out what's wrong. And that's what we've been
11 doing. We've taken that plant and shaken it.
12 MR. EBNETER: Let me tell you something, Mr. White,
13 you better stop shaking it and get it running right.
14 MR. WHITE: I understand. But what I'm trying to say
15 is we're trying to learn from those mistakes, and the mistakes
16 always involve --
17 MR. EBNETER: Well, I hope we're at the point where
18 we're done learning.
19 MR. WHITE: Well, I do too. I do too.
20 MR. SMITH: If we're at the point where we're done
21 learning, we won't be very successful. We'll always learn, and
22 we need to make progress.
23 MR. WHITE: Well, in the thrust of what he's saying.
24 MR. EBNETER: Well, I would agree with you. I don't
25 want to learn and I don't think TVA should have to learn

1 through these types of experiences. I think these, at least
2 not at this rate.
3 MR. WHITE: What I'm saying is we will, you know, the
4 way the world is, we will continue to have mistakes. And what
5 I want to do is learn from those mistakes. I don't want any
6 more trip kinds of mistakes, is what I'm saying. I think we
7 you know, the record shows that when you first start up a
8 plant, there are a rash of trips. And as far as I'm concerned,
9 we've had our rash, and now we'll make other mistakes and we
10 will learn from the other mistakes.
11 I don't have any other answer.
12 MR. SMITH: As I said, we have conducted a review for
13 common root cause, and although we do not find a common thread
14 running through the five trips, there are some areas that are
15 common to the trips. As I said, four of five were caused by
16 heat flow perturbations from the secondary side of the plant.
17 Three of the five trips were the result of steam generator low
18 load level.
19 What we found during our reviews also were a few
20 problems programmatically, and a potential operator attitude
21 problem. And as I said, our work control program had been
22 fully implemented for Unit 1 but had not been implemented for
23 Unit 2. It is now implemented for Unit 2 and requires the
24 shift supervisor and assistant shift supervisor review of
25 maintenance items prior to the start of the shift, and that he

1 review their aggregate affect on each system and use his
2 operator training and knowledge to determine the composite
3 affect on the plant and plant operations.
4 This is especially necessary prior to restart
5 activities in the plant.
6 In interviewing the individuals on shift, it was
7 indicated that they felt some pressure to restart the plant
8 despite maintenance activities that needed to be performed.
9 When questioned about who they felt the pressure from, it was
10 indicated that they felt it more from themselves than anyone
11 else, they felt a need to get the plant up in power and keep it
12 at power to prove that Sequoyah was a good unit.
13 MR. WHITE: Now that's something that management has
14 to step in and correct, because I don't want my operators
15 putting pressure on themselves to start up if there's a problem
16 at the secondary plant that's got to be fixed. And that's part
17 again of the nuclear ethic.
18 MR. EBNETER: I agree.
19 MR. WHITE: They put pressure on themselves, you
20 know.
21 MR. EBNETER: What forum though do those operators
22 have other than at shift turnover which is only your own data.
23 MR. SMITH: The operators --
24 MR. BYNUM: That's where the work control group
25 really comes in. The operations people in the work control

1 group look at the work prioritize it, and --

2 MR. WHITE: Let me answer it this way.

3 MR. EBNETER: Let me tell you something. That war

4 room, I've heard this complaint from the operators personally,

5 that the people down in the war room that are juggling papers

6 and schedules and they don't know what in the hell the

7 operators are doing.

8 MR. WHITE: Let me answer the question.

9 MR. BYNUM: The work control group's not --

10 MR. EBNETER: But even the work control group. The

11 operators --

12 MR. WHITE: Now, let me answer your question. The

13 rubber meets the road right with this guy. And this guy, well,

14 let me tell you. He knows my philosophy. There's no question

15 that he understands my philosophy.

16 MR. EBNETER: Your philosophy didn't stop that.

17 MR. WHITE: I understand that. And we've had some

18 discussions.

19 MR. EBNETER: Let me explore that maintenance a

20 little more. In talking with my staff, they felt that perhaps

21 balance of plant maintenance had been deferred maybe because

22 the operators didn't want to bring it up or it was an

23 accumulation of WRs and I asked my staff how they knew and what

24 indicators they were looking for. Well, they didn't have any.

25 Is that true, or is there a tendency to defer balance of plant

1 maintenance?

2 MR. WHITE: Let me answer that in two ways: first of

3 all, after the first trip, I got together with the operational

4 with the plant manager and said, look I want the plant

5 controlled by the operators. There's a trip that I felt should

6 have been better controlled by the operators. So when you're

7 doing maintenance of that plant, I want the operators to be in

8 control.

9 We then had the second trip and that was a procedural

10 non-adherence. And nevertheless, I said, look, in this thing

11 the operators have to maintain better control over maintenance

12 and SI. After the third trip, which was a missing diode, it

13 became a self-inflicting thing. Smith already knew my feelings

14 on the thing.

15 The result of that was, and my opinion is that it got

16 harder and harder to do maintenance. The controls, in my

17 opinion, got greater and greater because I wanted better plant

18 control and I think I went too far. I think as a result it got

19 too hard to do maintenance in the plant and some of it slipped.

20 So now what we've got to do is got to pull that

21 pinion back a little bit so that we maintain control but don't

22 make it so damn hard that people can't get work done.

23 MR. EBNETER: So you did defer too maintenance work?

24 MR. WHITE: In my opinion, yes.

25 MR. EBNETER: I guess we would like you to tell us

1 how you're going to solve that problem. In addition, I would
2 like in response to that to know how the control room operators
3 are getting feedback on equipment that they think should be
4 operating before they start.
5 MR. PATRICK: Basically --
6 MR. WHITE: Write it down. Send me a letter on it.
7 Did somebody write that question down?
8 MR. EBNETER: It's on the record. Seriously, the
9 staff needs to know, and I can understand your problem. It is
10 a problem of balancing things out.
11 You know, I was sort of amazed that the staff should
12 tell me that there was that much maintenance activities that
13 should have been done on the balance of plant site. We keep
14 referring back to the fact that TVA had told me that the
15 balance of plant was in good shape, and I thought it was in
16 good shape, because I went all through it.
17 MR. SMITH: I need to interject here.
18 MR. WHITE: Until, I expected --
19 MR. EBNETER: Send me the letter.
20 MR. SMITH: I want to explain something, okay. That
21 the bulk of maintenance activities that you're alluding to
22 didn't occur until the run at 100 percent power. You can see
23 very plainly on the trend charts that we keep -- and we keep a
24 lot of trend charts --
25 MR. EBNETER: Staff? Did you hear that? Trend

1 charts.

2 MR. SMITH: Control room work orders went from about

3 32 orders to 100.

4 MR. EBNETER: Okay. When that trend chart starts to

5 slope going up, somebody ought to stop and say, what's going

6 on.

7 MR. SMITH: Good point. That's what we do now.

8 MR. EBNETER: The Staff is going to do that, too.

9 By the way, do you have a good set of plant

10 indicators, performance indicators?

11 MR. WHITE: We have what we had before.

12 MR. EBNETER: They need to be improved.

13 MR. WHITE: I understand.

14 MR. EBNETER: The Chairman told you that. I keep

15 asking for those indicators.

16 MR. HARDING: We've been talking to your staff

17 project manager as well as any AEOD on developing appropriate

18 plant additional trend indicators, and as a matter of fact,

19 there's a meeting set up for I guess next month. Jack, is that

20 about right?

21 MR. DONOHEW: We haven't finally set up the date, but

22 we've had an individual from AEOD who visited the site in

23 April.

24 MR. EBNETER: You were there in April and here it is

25 June and we still don't, still fooling with it. And I talked

1 to you last year about it, and Herb Abercrombie. So I think
2 somebody ought to put some attention on that.
3 Okay, I am glad you got that indicated. And I would
4 like somebody on it. That might be your root cause right
5 there, your maintenance. Part of it.
6 MR. SMITH: We do feel that the root cause, or at
7 least the underlying root cause for the fourth were
8 attributable to maintenance conditions and an attitude that I
9 can handle the plant in manual, I don't need the plant in
10 automatic, I run it in manual so it's okay.
11 MR. WHITE: It was a contributor the fourth. The
12 operator being inexperienced a contributor and in the fifth, we
13 think it's the primary.
14 MR. EBNETER: You did tell me you were going to
15 discuss long term design?
16 MR. WHITE: Yes, it's coming.
17 MR. SMITH: We've talked about our on-site specific
18 programs for the review of individual root cause and common
19 root cause for events that occur on site. And what we'd like
20 to discuss next is our industry participation with the
21 Westinghouse Owners' Group so that we have the benefit of the
22 cumulative Westinghouse plant knowledge of the work that we're
23 doing.
24 To discuss that is Mr. Mark Burzynski.
25 MR. BURZYNSKI: What I would like to do is give you

1 an overview of TVA's participation in the Westinghouse Owners'
2 Group true production and assessment program, both prior to our
3 plant shut down 33 months ago, and since that time, to give you
4 an idea of what the program has told us and how we benefit from
5 it and what we continue to do in the future to utilize this
6 information.
7 First off, we've had an active involvement in this
8 program from its inception. Prior to plant shutdown, the
9 efforts were focused on data assessment, and there we looked at
10 our own cumulative trip histories to try and draw some
11 conclusions from it. We participated with the owner's group
12 effort to consolidate a database for a five-year period of all
13 Westinghouse plant trip data.
14 We established a plant comparison database so that we
15 could identify similarities and differences to try and target
16 improvements based on differences in performance.
17 We also embarked on an effort to optimize our
18 technical specifications and in the areas of trip reduction,
19 two things that we did was one, we reduced the low load level
20 trip set point from 21 percent down to 18 percent based on
21 margin that was available in the design.
22 And secondly, we transferred testing requirements
23 from a monthly basis to a quarterly basis for the solid state
24 protection system to avoid spurious trips at power.
25 And the last area is we looked at particular design

1 improvements that were based on Sequoyah unique experience.
2 The initial cut of the data assessment, you looked at your own
3 performance and targeted improvements based on what you knew
4 about yourself.
5 So that's the nature of the effort at that point in
6 time.
7 Since that, we've continued to be involved. The
8 activities have shifted now somewhat. We're now into an
9 implementation program for preventive maintenance for what we
10 identified as problem components based on our own experience as
11 well as typical experience. We're evaluating current design
12 changes for effecting --
13 MR. LIAW: Excuse me. First of all on the first one,
14 you mentioned solid state. Just roughly in terms of percentage
15 wise, how many of them maybe contributed to the trips.
16 MR. SMITH: Well show you that later on.
17 MR. BURZYNSKI: I don't have a number for inadvertent
18 actuations --
19 MR. LIAW: I just wanted a comparison because I saw
20 some data which had one solid state caused about 30 which can
21 contribute to --
22 MR. BURZYNSKI: Yes, the number's in the one to three
23 percent range. The reason we did it early on was we had the
24 data as found as left drift data to readily support a tech spec
25 change, so while it wasn't you know a big contributor, it was

1 an easy to implement solution.

2 MR. LIAW: I'm not talking about a tech spec change,

3 but rather if you identify those whose failure could cause a

4 trip, the reasonable thing for you to do is a good preventive

5 maintenance program to replace those solid state parts before

6 the failure occurs.

7 MR. BURZYNSKI: The problem is not so much with

8 failure of the component. It's while you're in --

9 MR. LIAW: Before it fails.

10 MR. BURZYNSKI: Well, the experience has been that

11 you get a spurious signal on a channel while you have another

12 channel in the trip condition during the test and you make up

13 the logic. So, they're you're looking at minimizing the time

14 you're in the system with channels in the trip condition.

15 Like I said, we're going to evaluate the current

16 design changes we've made for effectiveness. We're looking at

17 the Owners' Group products that have come out, and the products

18 have come out in two areas. One is that the Owners' Group has

19 developed some specific product changes that could be

20 implemented to solve trip problems. We're evaluating those.

21 Secondly, they've also come up with engineering type

22 work that we're looking at for applicability, programs,

23 engineering basis for changing set points, for eliminating

24 trips, a number of activities are currently under review by the

25 staff, and of course we're participating and awaiting approval

1 for those.

2 MR. EBNETER: What were some of those products?

3 MR. BURZYNSKI: Without getting into too much detail,

4 since they are proprietary, the two big ones that were recently

5 approved by the NRC Staff, one involves adding a time delay on

6 the low level trip signal during low power conditions so that

7 it'll give the operator time to recover. Another one is an

8 electronic switching of the environmental error such that you

9 don't have to penalize your operating margin when a harsh

10 environment doesn't exist, doing that electronically.

11 MR. EBNETER: And those two have been approved by the

12 Staff?

13 MR. BURZYNSKI: They've just recently been approved

14 by the Staff, and what we're doing now is looking at those

15 products to see if they solve our types of problems, because

16 you know, each plant, while they're similar, they have

17 differences and those products work at either full power or low

18 power to solve different problems.

19 MR. MARINOS: Could you identify what Staff approved

20 that, because that's news to me?

21 MR. BURZYNSKI: I can give you the SER references?

22 MR. EBNETER: He's talking about NRR approval. I'm

23 sure he is. We didn't approve any.

24 MR. BURZYNSKI: I can get you the approval letter so

25 --

MR. EBNETER: Let me ask, are you the Westinghouse fella?

MR. PARIS: Yes.

MR. EBNETER: How many plants are implementing these? A large percentage?

MR. PARIS: Well, right now, the only one who has fully committed to doing it is Callaway. Others are evaluating it as --

MR. EBNETER: Are you familiar with the approval of this?

MR. PARIS: Yes, sir. Callaway will submit their specific plan submittal.

MR. EBNETER: Whose going to follow up on the staff on that?

MR. SMITH: Some of it's cut and dried in the fact that we have an ice condenser containment that we have, makes our situation not totally like Callaway's with independent --

MR. EBNETER: I'm not telling you to do it.

MR. BURZYNSKI: But we're looking at them, and we're at the stage now the Staff approval's there, people are looking at do these products solve my particular problems, can I implement them in my plant, what does it take to implement in terms of resources, rack space, outage time, that sort of thing.

MR. EBNETER: Whose going to do all this? Hosmer?

1 MR. BURZYNSKI: Okay, there are also other products
2 that are going through review. One is to eliminate the rate
3 trips, flux rate trips, positive and negative. That WCAP is
4 currently under staff review and that would be a product we
5 would look at.
6 And the last thing is monitoring the industry
7 activity for new ideas and they're we're primarily focused on
8 the advance feedwater designs. The Owners' Group is looking at
9 what the foreign people are doing in terms of let's say the
10 Belgians have a different design. We're looking at prototype
11 designs that Westinghouse is marketing that have transfer
12 schemes. And wanting to see how those work.
13 We're also, and TVA is participating in a research
14 project jointly with Westinghouse and EPRI to develop some
15 artificial intelligent advance neutral feedwater controllers.
16 So those are things that are down the road but it's
17 just indicative of our involvement in industry efforts to try
18 and develop better equipment.
19 MR. EBNETER: How about Cook and McGuire's?
20 MR. SMITH: They're pretty much in the same green as
21 us. They're evaluating these things right now. Again, they
22 have to go through the same process in McGuire that we have to
23 do. The member head injection system removal some of these
24 other changes so progressive modification of the implementation
25 program.

1 MR. EBNETER: How do these fit into your priority of
2 efforts?
3 MR. SMITH: These are high priority items.
4 MR. EBNETER: If I came down and looked at feed 2,
5 I'd find them on the side?
6 MR. HOSMER: Right now, we have two things scheduled.
7 One is the overhead injection removal that Steve's been talking
8 about. Secondly, right now we're focused on an idea we had
9 which is a motor driven larger start-up feed pump, and what we
10 intend to do is take these programs with operations and do a
11 cost benefit. And you can't do them all.
12 MR. HARMON: You've identified that you had some
13 margin of problem with the feed pump speed control circuits,
14 the regulator that you're using right now. You have something
15 in place to bring in an up-dated version digital controller?
16 MR. SMITH: The digital controller is being evaluated
17 at Westinghouse right now. As a matter of fact, it's a part of
18 a settlement with Westinghouse, some of the preliminary
19 electronics work is being looked at. That digital controller
20 is not the answer to all things, though. The current control
21 scheme for the 15 pump is adequate and you have a stabilized
22 feed control system, and that's what we're working towards.
23 MR. BYNUM: We're really looking more at the balance
24 than we are the pump speed itself.
25 MR. HARMON: I understand, but you have had problems

1 that contributed to the trips.

2 MR. SMITH: Those problems and the review of those

3 problems are what led us to looking at the design for an

4 electric motor driven feedwater pump with 30 percent flow

5 capability so we can get into automatic outside of that range.

6 MR. LIAW: Let me pick up on that one. Is there

7 anything in the human engineering area that you can improve?

8 There's a big big difference there.

9 MR. BURZYNSKI: Well, yes.

10 MR. LIAW: And my understanding was one of the

11 conclusions was the the original procedure or number of

12 operators controls were not adequate.

13 MR. SMITH: Address it again, okay. The larger the

14 plant, the more instrumentation the more controls from us.

15 From a human engineering standpoint, it's prudent to have a

16 third operator in the plant during transients.

17 MR. LIAW: Why not make it automatic.

18 MR. SMITH: Automatic what?

19 MR. LIAW: Control.

20 MR. BYNUM: You're talking about an automatic swap

21 over from the bypass?

22 MR. LIAW: That's how, I understand, the Japanese

23 plant did it.

24 MR. WHITE: How what?

25 MR. LIAW: Japanese plant.

1 MR. SMITH: Right now, we're definitely going to take
2 a look at what's being done.
3 MR. LIAW: My understanding is that they just
4 recently converted and it improved the number of trips.
5 MR. HOSMER: B.D. I think the thing we need to do,
6 there is some long term recommendations and they had some
7 experiences, but what we want to do is look at all those from a
8 plant specific standpoint and see which of those have the
9 highest cost benefit. I'm not sure that that's the highest --
10 MR. LIAW: I'm not asking you or telling you to do
11 it. I just wanted to know if you looked at it.
12 MR. SMITH: We understand. It's appropriate to talk
13 about that right now, I believe, for review of the trips. And
14 this is the result.
15 MR. BURZYNSKI: The kinds of information that we're
16 looking at is what causes our trips. And when you look at it,
17 I've got here a picture for a four loop plant, but it's typical
18 of all Westinghouse plants, three trip signals dominate. Steam
19 generator low load level, steam flow feed flow mismatch, and
20 turbine trip. Those are the dominant trip signals for all
21 plants of the Westinghouse type.
22 And you can trace back the majority of those things
23 to feedwater. It's certainly level controls, feed flow
24 mismatch, it's feedwater control. And you look at problem
25 component failure, human error, we know that the human error

1 element of it is pretty much prevalent in the swap over from
2 bypass the main valves because that's a manual process, and
3 everybody's very interested in getting a bumpless automatic
4 transfer scheme. It's not widespread in the U.S., but it's
5 certainly where a lot of effort's focused.
6 MR. LIAW: I would argue with you. Every time that
7 something screws up, you say human error, but has anyone ever
8 looked at it --
9 MR. BURZYNSKI: No, no, no. That's not what I was
10 trying to say. In the Owners' Group, we look at both sides.
11 We try to assess whether it's a component problem, whether it's
12 a human error problem.
13 MR. LIAW: Let me tell you one more thing. Part of
14 the reason I asked that, I was asking Paul Harmon whether to go
15 to digital or not, what you get there is -- I think that's what
16 general terms adequate, but I think there's enough conclusion
17 for controlling -- I think you have enough experience world
18 wide to tell you that.
19 MR. SMITH: We think the experience indicates several
20 things. It indicates that there is a means to reduce this trip
21 function through a change in the trip function itself such as a
22 time delay when you're at low power, or the lowering of the
23 trip set point or the removal of the trip set point altogether,
24 that has an equal affect on reducing the number of trips as to
25 make the man machine interface more better.

1 MR. WHITE: It may have a greater, but we're looking
2 at the whole thing.
3 MR. BURZYNSKI: We're not saying that human error
4 caused this. We're saying that, yes, it's a difficult thing
5 for the operator to do to control steam generator level
6 manually. I will tell you, I believe the NRC participated on
7 some exercises on our simulator and it's a difficult thing to
8 do.
9 MR. LIAW: I understand that.
10 MR. EBNETER: We went right through it.
11 MR. WHITE: That's not what I understand.
12 MR. BURZYNSKI: The point of this is to give you a
13 perspective.
14 MR. WHITE: It is difficult.
15 MR. BURZYNSKI: If a Westinghouse reactor trips, you
16 can bet a lot of money that it was something generator at low
17 load level that got you the trip. If you're a betting man,
18 this data will tell you that that's the way to bet your money.
19 We looked at the differences amongst the Westinghouse
20 plants. And obviously, the two plants stand out as a better
21 performer than three or four of the plants. And you know part
22 of the reason there is less equipment. Certainly, there's less
23 components to fail, there's less components that you test.
24 MR. EBNETER: They're old maturing plants.
25 MR. BURZYNSKI: They're old maturing plants, and

1 they're particular turbine model shows a substantially better
2 performance rate than all other turbine models from
3 Westinghouse and other vendors. So there was something in that
4 design. It's also a two-stage low pressure where most of the
5 others are three-stage, so maybe it's simply a function of less
6 components.
7 We also looked at since you've got no difference
8 between three and four loop plants, it's harder to find out
9 what are your particular problems. One thing that jumped out
10 is that plants with turbine driven main feed pumps have a
11 substantial trip rate due to problems associated with that
12 piece of equipment. Motor driven pumps don't. All four loop
13 plants have turbine driven pumps. So this helps you focus in
14 on where to look at things.
15 The next cut involved looking at a specific peer
16 group. Now, remember, this is 1980 to '85 data, but in our
17 peer group, at that time Sequoyah's performance was average to
18 below average for feed pumps. So that told us that you know,
19 amongst the same people, we needed to improve our performance
20 and it was something to look at there. The types of things
21 that we'd done, we changed the range on the governor valve
22 stroke to reduce the sensitivity, to make it a more stable
23 performer. We modified the injection water trip set point and
24 added time delays to eliminate spurious signals.
25 And we modified the fire protection system near the

1 pumps to eliminate spurious actuations due to small steam
2 links. These were particular actions that we took when we
3 looked at the root cause of our turbine pump problems.
4 We haven't had a trip caused by this component since
5 we've restarted.
6 Another concept was looking at control valves. And
7 there in our peer group in the pre-shutdown phase, we were
8 below average performers and we took it upon ourselves to look
9 at things we could do to help improve Sequoyah performance. We
10 added the automatic --
11 MR. LIAW: Excuse me. What is this chart?
12 MR. BURZYNSKI: Okay. All these are Westinghouse
13 plants. They're identified by code, and it's a proprietary
14 code. These are people with Fisher control valves. This is
15 data from domestic plants. Because at the time, the data
16 collection only involved domestic plants.
17 MR. LIAW: Okay, thank you.
18 MR. BURZYNSKI: But what it tells you is what your
19 trip rate was relative to everybody else. And so there we are
20 on the wrong end of the average and we've taken some specific
21 actions.
22 We've added the automatic control to the bypass
23 valve, and now conform with the majority of Westinghouse plants
24 in that sense.
25 We looked at what our problems were with the valve,

1 and one of them had to do with air lines to regulator blowing
2 off because of vibrations and other problems, and we modified
3 the design to increase the flexibility so that the lines don't
4 break.
5 We've identified some specific preventive maintenance
6 activities to improve valve performance and insure consistent
7 performance. There we looked at packing because we identified
8 steam links as contributing to the failures of the diaphragms
9 so we got a special program to focus in on insuring the
10 packing's maintained.
11 We also have preventive maintenance activities to
12 insure a smooth steady stroke of the valve over the whole
13 travel so that your control action is consistent and stable.
14 And lastly, we require stroking just prior to placing
15 the valves in service to insure functionality.
16 The last cut sector we looked at was turbine
17 performance and there in the '80 to '85 time frame, Sequoyah
18 was a better than average performer. We attributed some of
19 that to TVA's valley wide turbine maintenance program, but
20 we've also focused on things that we could do that we've
21 learned from people to improve that performance. We were
22 better than average but we still felt that we could do more.
23 And during our 33-month shut down, we continued to
24 run the oil pumps and turning gear turbines as an alternative
25 to lay up to keep the system clean and functioning, and we also

1 required stroking of the throttle control interset and reheat
2 stop valves prior to start-up to make sure again valve
3 functionality right before we place them into service. That's
4 in addition to the normal maintenance. You don't want to put a
5 component into service that you aren't sure isn't ready to do
6 its job.
7 So those were some particular enhancements we made to
8 our programs.
9 MR. LIAW: What kind of control valve you got, GE or
10 Westinghouse?
11 MR. BURZYNSKI: Westinghouse. In fact, it's a
12 Westinghouse Model 44 high pressure three low pressure stage.
13 And we think that the efforts that were taken in the historical
14 problem areas have paid off in some sense because those
15 components were not the cause of the five trips we've had. So
16 we do think there is some benefit to participating in this
17 forum.
18 MR. EBNETER: So you're saying you didn't go far
19 enough?
20 MR. BURZYNSKI: Well, I think we're pushing it into
21 new areas. It was easy looking at the old data to identify
22 root causes. There were some very predominant ones that jumped
23 out. Now, you see the job's getting a little bit more
24 difficult because the things aren't stringing together as well.
25 It's incumbent upon us to have a good solid root cause analysis

1 program to get to the heart of the mat[illegible] [illegible]en more
2 important to have the Westinghouse tra[illegible] [illegible] there so that
3 we can benefit from other people's experience because
4 everybody's data set is becoming more limited as scram
5 improvement becomes a reality.
6 MR. BYNUM: I think the other thing, too, Stu, is
7 there are really not a lot of proven, in the field with a lot
8 of operating history data things to do from here. And we've
9 talked about bumpless transfers and that's obviously something
10 we're looking at as the automatic swap over, but if you look at
11 the number of plans that are actually out there running with
12 those kinds of systems, it's not many. And I came from one of
13 those plants, and those systems are complicated in themselves
14 which is a disadvantage to some extent, and they require a lot
15 of attention. It's not a well proven system. And you know I
16 think we certainly don't want to go off and get into another
17 prototypical system. We want to put something in there that we
18 know --
19 MR. LIAW: Excuse me, what are you talking about?
20 MR. BYNUM: Bumpless transfer.
21 MR. EBNETER: He's talking about advanced state of
22 the art. And I would agree with him that they certainly aren't
23 very successful right now with the old systems.
24 MR. BYNUM: And that's why we're working in the areas
25 that you've seen up here, that's the areas we're working in,

1 and we think it's that kind of effort that's going to pay off
2 while we find out where there is a prudent system that'll work.
3 MR. PATRICK: And can I comment on the success of the
4 new system and automatic bypass of 15 start-ups, one was a trip
5 attributed to operator error, so if that didn't happen, we'd
6 have a hundred percent start-up so that's an automatic bypass
7 has helped us, and as an operator, I appreciate it.
8 MR. WHITE: I don't think, I think I'd be careful of
9 implying that there hasn't been improvement. You know, I
10 talked to Chuck Mason yesterday and he had six trips in a 24-
11 hour period a few years ago. And so to say that --
12 MR. EBNETER: What did he do about it?
13 MR. WHITE: What's that?
14 MR. EBNETER: What did he do about it?
15 MR. WHITE: Well, obviously not enough was done.
16 What I'm saying is, a lot of improvements have been made. Are
17 we happy? No, we're not happy. And we'll continue to look at
18 a lot of things, but it's unfair to indicate we haven't
19 improved because --
20 MR. EBNETER: Well, we don't plan to let you set a
21 new record. What's the new record, 28?
22 MR. WHITE: We intend to set a record in the other
23 direction.
24 MR. EBNETER: Well, you've got a bad start on it.
25 MR. WHITE: Well, we could have had a better start

1 but we're not out of the running in terms of setting the
2 record. It depends on what we do from now on.
3 MR. EBNETER: So, Staff?
4 MR. MCCOY: I had some questions I wanted to ask. I
5 guess one's a confirmation on what I thought I heard.
6 With regard to trip number 5, you had an item for
7 revising your start-up procedures, and I guess what I
8 understood you to say was that you were going to standardize a
9 preferred method for all the operators to use? Does that
10 include training?
11 MR. SMITH: Yes, sir, yes, it does.
12 MR. MCCOY: And when do you expect to have that in
13 place?
14 MR. SMITH: The procedure's being revised right now.
15 The training will be completed, at least for the crews on
16 shift, prior to restarting for all crews assuming we can get it
17 done.
18 MR. MCCOY: And the second question I had concerned
19 trip number 3. This goes back to the missing diode. I
20 understand why your restart test program would not have picked
21 up the fact that those diodes were missing in that circuitry or
22 would not have looked at whether or not that function had been
23 adequately tested. But I guess we would have expected in your
24 pre-op program that that should have picked it up, and I'd like
25 to ask the question, if you looked at that, whether or not you

1 actually had done testing which would have shown whether or not
2 those diodes were missing?
3 MR. SMITH: The history of the testing is being
4 reviewed and of course it's been reviewed. The problem you're
5 faced with that particular bypass circuit, the only thing it
6 did was energize a solenoid valve that precluded the P-drake
7 valve from shutting. Every time you've got tests done
8 including pre-op, the valve was already shut unless you had
9 specifically instrumented the feed drake valve to find out
10 whether the solenoid valve or to find out if power was removed
11 from it, you just, you wouldn't know.
12 MR. MARINOS: There was no test, then, in spite of
13 the position of the valve, the circuitry, you should be able to
14 monitor the circuitry. If your diode is there, you should be
15 able to have a continuity check, or discontinuity for that
16 matter.
17 MR. HARMON: Something more than just the functional
18 test like you did when you shut down, a pre-start up or
19 preoperational test. You should have something in there.
20 MR. BYNUM: Like Steve said, you would have had to
21 have physically gone in and monitored the signals. You would
22 literally have had to take the circuit apart and put something
23 in there.
24 MR. SMITH: I've participated in three NTOL plant
25 start ups and re-starts, and the thing is during your start-up

1 test program and your pre-op program, you look for is what the
2 test says it's going to do which is energizing the slave relays
3 and they verified there.
4 MR. BYNUM: Not what the test precludes from
5 happening. There would be no need to test for that. I can't
6 think of anybody that would have tested for that.
7 MR. MCCOY: Can I take that as a given then that you
8 did not test for that?
9 MR. SMITH: We'll find out specifically.
10 MR. BYNUM: I would guess, based on my history with
11 doing pre-op testing too, that you would not, and it wouldn't
12 have been unusual.
13 MR. SMITH: We're still conducting a review to see if
14 some modification or some repair may have occurred that might
15 have displaced that diode.
16 MR. EBNETER: Anybody else on the Staff have any
17 questions? Pat? Mr. Harmon?
18 MR. HARMON: I had a question on the number 4 trip.
19 Is that a personnel error, is that the bottom line on that,
20 because we couldn't find it in your trip report? You had a
21 whole batch of things as far as problems, --
22 MR. SMITH: We did not label the root cause as
23 personnel error. We labeled the root cause as an operator who
24 was inexperienced. He was doing the things that he was taught.
25 He was doing the things that were procedurally correct.

1 MR. HARMON: I'm not here to hang the operator. All
2 I wanted to get was a bottom line in how that's --
3 MR. SMITH: We feel that the real root cause was the
4 management system that didn't insure the third operator was in
5 the control room. And that's the major corrective action that
6 we've made.
7 Plus, in reviewing the fifth trip, assuring that we
8 have consistency in the operation of the feedwater system
9 itself during low power operation. I'm like Mr. Liaw. I don't
10 blame everything on the operators.
11 MR. HARMON: Do you have something in place? What
12 you're saying is now the shift supervisors collectively have
13 the duty to say there's a threshold here. It's obvious when
14 there's one big item that's going to keep them from starting
15 up. But now we're talking about a whole bunch of small items.
16 There's got to be some threshold established saying with this
17 much doubt, I don't think that we should be doing ahead.
18 MR. WHITE: But before there wasn't a system where a
19 guy could go look to see that. He had little disjointed parts.
20 That's the work control center.
21 MR. HARMON: Yes, sir. I understand.
22 MR. WHITE: Now, we require that guy before he goes
23 on watch, he goes to the control center, he sees that system.
24 MR. HARMON: That's what I'm asking is there
25 something that establishes the threshold because you're still

1 talking about small pieces. It's not going to be on big chunk.
2 That's obvious. It's going to be an accumulation of small
3 things.
4 MR. WHITE: It's going to be experience and judgment.
5 I can't set a rule that says if you've got 15 or 16, it's good,
6 and if you've got 17, it's bad.
7 MR. HARMON: When he comes out and makes that
8 determination, are you going to listen to him?
9 MR. WHITE: Yes, sir.
10 MR. BYNUM: That's affirmative. We wouldn't do it if
11 we didn't trust him.
12 MR. WHITE: Be careful. There'll be oversight.
13 There may be a time. I don't guarantee there may be a time
14 when he might come to me and say I'm ready to go, and I might
15 say, no, you're not. I'm not going to guarantee that that
16 won't happen. I hope it doesn't because I think we have the
17 same standards, but, you know, I can't guarantee that.
18 MR. SMITH: There's no two people with the same
19 training would set the same level of acceptability, and you
20 know that. You've been an operator. The operator that
21 identifies a concern, it's our intent that the program we've
22 set up to make that concern known in a broader scope than it
23 has in the past. The fact that the work control group is
24 staffed and supervised by an SRO on our plant, that the unit
25 manager whose sole responsibility is to prioritize work

1 activities as an SRO in direct communication with the shift
2 supervisor the fact that the shift supervisor has to sign on
3 to the shift work list and say, yes, these are the correct
4 things and these are all the things that need to get worked. we
5 feel that those will combine to give us more assurance that
6 aggregate problems, problems that one by themselves don't mean
7 much, that the aggregate affect will be recognized and that
8 each supervisor will establish a level within an aggregate
9 affect and not work to the detriment of the plant.
10 MR. HARMON: Well, the reason I asked the question is
11 again back to the, when you talk to the shift supervisor and
12 the operations staff in general, it's their impression or it
13 was their impression, and I hope that's changed, the the people
14 who made the determination as to whether or not that plant was
15 okay to start-up was made at the war room and at your level.
16 MR. WHITE: Let me tell you, that's not true.
17 MR. SMITH: I think that statement was made by one
18 individual and that occurred after a trip, not before. And I
19 think that was a little sour grapes.
20 MR. PATRICK: Let me comment on that a little bit and
21 maybe help a little bit.
22 If a shift supervisor comes to me or one of my staff,
23 and says, I don't think we're ready --
24 MR. HARMON: I didn't say that they didn't think that
25 they couldn't stop it. What I'm saying is it was their

1 attitude or their impression that that was done at the war room
2 level and at Mr. Smith's level. And it's okay, so I guess it's
3 okay with me, too.
4 MR. PATRICK: What should happen, okay, one
5 supervisor comes to me and says, I don't think we ought to
6 start up because of the work activity or the maintenance
7 activity, that happens, he'll come to me, we will address his
8 concerns and he will convince us it's okay, prior to leaving.
9 It's not we're convincing him.
10 MR. HARMON: You're still not listening to what I'm
11 saying. I didn't say that an operator tried to stop a start-
12 up. That has nothing to do with the statement I made. What
13 I'm saying is the operations people are under the impression or
14 under the general impression that the decisions to start-up is
15 not made at their level, it's made at the war room level.
16 MR. PATRICK: That's not true.
17 MR. WHITE: Well, let me tell you, I've talked to a
18 lot of those operators and let me tell you, when you really get
19 into discussions, they will tell you that that is not so. They
20 feel more in charge of their destiny than they ever have at
21 Sequ yah. And I keep getting that information.
22 Now, whether you can find an operator that might say
23 it, I don't know. But I would say the thrust, I would just say
24 unequivocally that it just isn't right.
25 MR. BYNUM: I agree.

1 MR. PATRICK: I agree.

2 MR. WHITE: I get just the opposite. What I get is,
3 is frankly, is you now have given the operators control of this
4 plant. You have given control back to the operators. In the
5 past where people wouldn't listen, where making megawatts was
6 the only judge, now we're looking at the plant and whether what
7 we're doing is right or not. So I just think it's wrong.

8 MR. SMITH: I'd also like to point out that a year
9 ago, the war room did not exist at Sequoyah. And the common
10 thread through the operators was there was no way to express
11 their concern about equipment. They do not feel in charge of
12 the plant. They felt that events were out of their hands.

13 The war room was established specifically,
14 specifically to bring all organizations into one meeting into a
15 forum where the operators and they're in attendance in the POD
16 meeting every day, could air their concerns about equipment.

17 And you know, from observation in the war room -- at
18 least you should know -- when they're concerns are aired, they
19 receive prompt corrective attention.

20 MR. BYNUM: I don't know how many times, you know, I
21 spend most of my time in the war room, and I don't know how
22 many times I've been sitting down there, and Stu, I think
23 you've been in there too, when the shift supervisor's is called
24 down there because he wanted to get something done, and he knew
25 he could call one place and get it fixed.

1 MR. EBNETER: I guess you've heard though we do have
2 some concern about operator input.
3 Anybody else have anything?
4 MR. RICHARDSON: Talking about the maintenance
5 backlog. What have you got to do now before you're ready to
6 start up?
7 MR. EBNETER: I might address that later.
8 MR. PADOVAN: My name is Mark Padovan of AEOD, and I
9 did a preliminary review of the 5072 reports that have come in
10 since the beginning of the year about January through the end
11 of May. And while we certainly didn't have time to do an in-
12 depth analysis of this, only had about a day to do a crash job,
13 I think that perhaps we might have a common thread here that
14 might be worth further consideration.
15 And that's that the operator awareness and operator
16 understanding and just general control of plant evolutions, it
17 just might not be up to par. Now, bear with me, if you would,
18 while I go through some examples here. In that time period
19 that I mentioned here, there were three instances of ESF
20 actuation, two instances where you had inadvertent entries into
21 Tech Spec 303 where that involved inoperable ECCS pumps.
22 You had two instances where there was loss of fire
23 water pumps and an instance of a loss of an RHR pump. Now,
24 regarding these ESF actuations, specifically, two back to back
25 on February 17th, had to do with opening SIVs to warm steam

1 lines. And that suggested there wasn't an understanding of the
2 effect of opening those MSIVs or learning from that experience.
3 Also on the 28th, you tripped your high steam flow
4 bystables when you're in a low key-up condition, the operator
5 was unaware that PSM actuation would occur.
6 On the subject of inoperability of ECCS pumps, on the
7 10th of March, you had the inner Tech Spec 303 because two ____
8 _____ pumps were inoperable. Pump 2b was out of service for
9 maintenance and testing. At that time, pump 2a was placed in a
10 pull to lock position. So the operator did not realize that
11 pulling the hand switch in a pull to lock position would make
12 the pump inoperable and I think that's pretty basic operating
13 knowledge they should have had there.
14 Now, on April 7th, you had the inner Tech Spec 303
15 because the centrifugal and the RHR pump were found in a pull
16 to lock position, failure to learn anything from that. AGain,
17 poor basic knowledge.
18 Regarding the fire water pumps here, on March 20th,
19 all the fire water pumps were out of service. Got a statement
20 on that. Two unit 2 fire water pumps had the hand switch in a
21 stop position because of design problems, and for surveillance
22 testing, the other two fire water pumps are taken out of
23 service.
24 MR. SMITH: Could I interject right there, please?
25 What you're reciting from is the required seven-day report. It

1 has nothing to do with the operability of those pumps. The two
2 pumps that were in the off position had to do with electrical
3 loading. And it's been understood for six months and a
4 modification's in progress to correct that. It has nothing to
5 do with operator knowledge of the operation of that plant. It
6 has to do with material conditions that were known and
7 understood.
8 MR. PADOVAN: Also with operator knowledge was
9 overall control of the plant.
10 MR. SMITH: He had control. He put them --
11 MR. EBNETER: Let's go through the list, and then
12 we'll hear the analysis.
13 MR. PADOVAN: On March 23rd, from our records, it
14 indicates that the exact same repeat, exactly the same. All
15 pumps were taken out of service.
16 And the last thing here that we show on our records
17 is on the 23rd of May, you had a loss of RHR pump due to loss
18 of pump suction. Now, again, I'm not suggesting that we
19 necessarily can draw conclusions from this, you know, it's just
20 a preliminary review. But I'd like to imply here that perhaps
21 further evaluation of this, you know, operator awareness and
22 understanding and control, might be appropriate until you're
23 really confident that you have those bases covered.
24 MR. EBNETER: Let me comment on those.
25 What was your name?

1 MR. PADOVAN: Mark Padovan.

2 MR. EBNETER: Padovan, he's from AEOD. And do you

3 work on the indicator program too, Mark?

4 MR. PADOVAN: No, I don't.

5 MR. EBNETER: But you put in for it, though?

6 MR. PADOVAN: Review of the LERs.

7 MR. EBNETER: What you've heard is a summary of the

8 events that occurred since we started heat-up, and those were

9 mostly ECCS actuated. You add those up with the five trips

10 we've had, your performance indicators when it comes out on a

11 performance indicator review is very very poor. That's what

12 the gentleman was telling you.

13 Now, as these events occurred, you did take

14 corrective actions. And we think that they've been effective.

15 We have seen some positive results, but besides the trips

16 again, you know, we'll just add on to those other events that

17 occurred. And that's what you are hearing is a summary of what

18 occurred before, and I think what Mr. Padovan was telling you

19 that it didn't sound good to him sitting up here reviewing all

20 these events.

21 So, Steve mentioned maintenance. Let me summarize a

22 couple things.

23 I guess what I've heard from you today in the short

24 term and before you start up, you're going to make some control

25 room operational changes. Right?

1 MR. PATRICK: Yes, sir.

2 MR. WHITE: By that, you mean the procedural changes?

3 MR. EBNETER: Procedural changes and help at the

4 board and interactions. Operator inputs to plant start-ups.

5 Those types of things. That's a short term item.

6 I've also heard that you're going to do procedure up-

7 grades th t may be related to some of the control room changes.

8 My understa ing in talking with the Staff is that you are

9 reviewing the maintenance backlog also.

10 Is that true? I understand that --

11 MR. WHITE: Reviewing, I think would be more

12 appropriate, we're working it off.

13 MR. EBNETER: That's what I want to know. And I want

14 the Staff to understand totally what you're doing. If the

15 Staff isn't, I want you to make arrangements to work -- Mr.

16 Harmon, I want you to make sure you understand what's on there.

17 And I want Frank McCoy to have a look at that whole process

18 before you start the unit again. I want the Staff to look at

19 what is it, 23 items you've said, Steve, that had to be done?

20 MR. SMITH: We've identified 123 items.

21 MR. EBNETER: 123.

22 MR. WHITE: We didn't say we could do 123, did we?

23 MR. SMITH: They're all done with the exception of

24 two items.

25 MR. EBNETER: I want you to review that with the

1 Staff and the criteria used to make that selection, and some
2 objective evidence that they've been accomplished. Those are
3 short term.
4 The long term, I understand you are doing product
5 design evaluations with Westinghouse and with the Staff. Mark,
6 you are with the SCR where those were approved, and some
7 engineering design changes.
8 Is there anything else we've missed?
9 MR. RICHARDSON: Performance indicators.
10 MR. EBNETER: Oh, yes, yes. I do want something on
11 performance indicators, Mr. White, and I would like you to
12 write me something on the set of performance indicators for
13 Sequoyah.
14 MR. WHITE: When is your week's meeting scheduled
15 for?
16 MR. HARDING: It's not, we don't have a date
17 scheduled. We have one where you will be represented and we
18 have another one where there hasn't been.
19 MR. WHITE: Can we schedule it right now while we're
20 on the subject?
21 MR. DONOHEW: The problem is the fact that the
22 individual who would go. I think we could set something up for
23 ourselves.
24 MR. EBNETER: When can we have a meeting on those?
25 MR. HARDING: Any time.

1 MR. EBNETER: Did I hear a date, Jack?

2 MR. DONOHEW: Okay. You want to have it in a week?

3 MR. WHITE: I'll leave him here today, if you'd like,

4 and just not take him back.

5 MR. EBNETER: Well, you know, we've been fooling with

6 that.

7 MR. WHITE: I know it.

8 MR. EBNETER: So let's get something on the record

9 and get it done.

10 MR. DONOHEW: Mark and I will talk after the meeting,

11 and we'll pick a time.

12 MR. EBNETER: One other thing I wanted to comment on

13 was the post-trip reviews. The Staff made some comments to me

14 that, particularly the ones to Mr. Smith, where you didn't

15 arrive at any conclusion. And I asked the Staff well, how they

16 knew the corrective action was appropriate if there was no

17 identifiable cause. And well, they said they just felt it was

18 good. And I think you arrived verbally that it was good.

19 But they also pointed out there was several other

20 omissions in that one. The general comment I got from Staff

21 was that the first three post-trip reviews were significantly

22 better than the last two.

23 Is that a fair statement? Isn't that what you told

24 me?

25 MR. MCCOY: Yes, sir.

1 MR. EBNETER: So I think you ought to look at that
2 and make sure that the quality of these post-trip reviews is
3 not going down hill.
4 Anything else? Jane? Jim?
5 (No response.)
6 MR. EBNETER: That's all I have.
7 (Whereupon, at 3:00 p.m., the meeting was concluded.)
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PRESENTATION OUTLINE

I. GENERAL DISCUSSION: AN OVERVIEW OF TOPICS TO BE ADDRESSED

II. RESTART: A DISCUSSION OF SEQUOYAH UNIT 2 RESTART AFTER INITIAL PERMISSION GRANTED BY THE NRC

III. BRIEF DISCUSSION OF FEEDWATER SYSTEM

IV. BALANCE OF PLANT PREPARATION FOR RESTART

V. REVIEW TRIPS: REVIEW OF FIVE TRIPS FROM MAY 19, 1988 TO JUNE 9, 1988

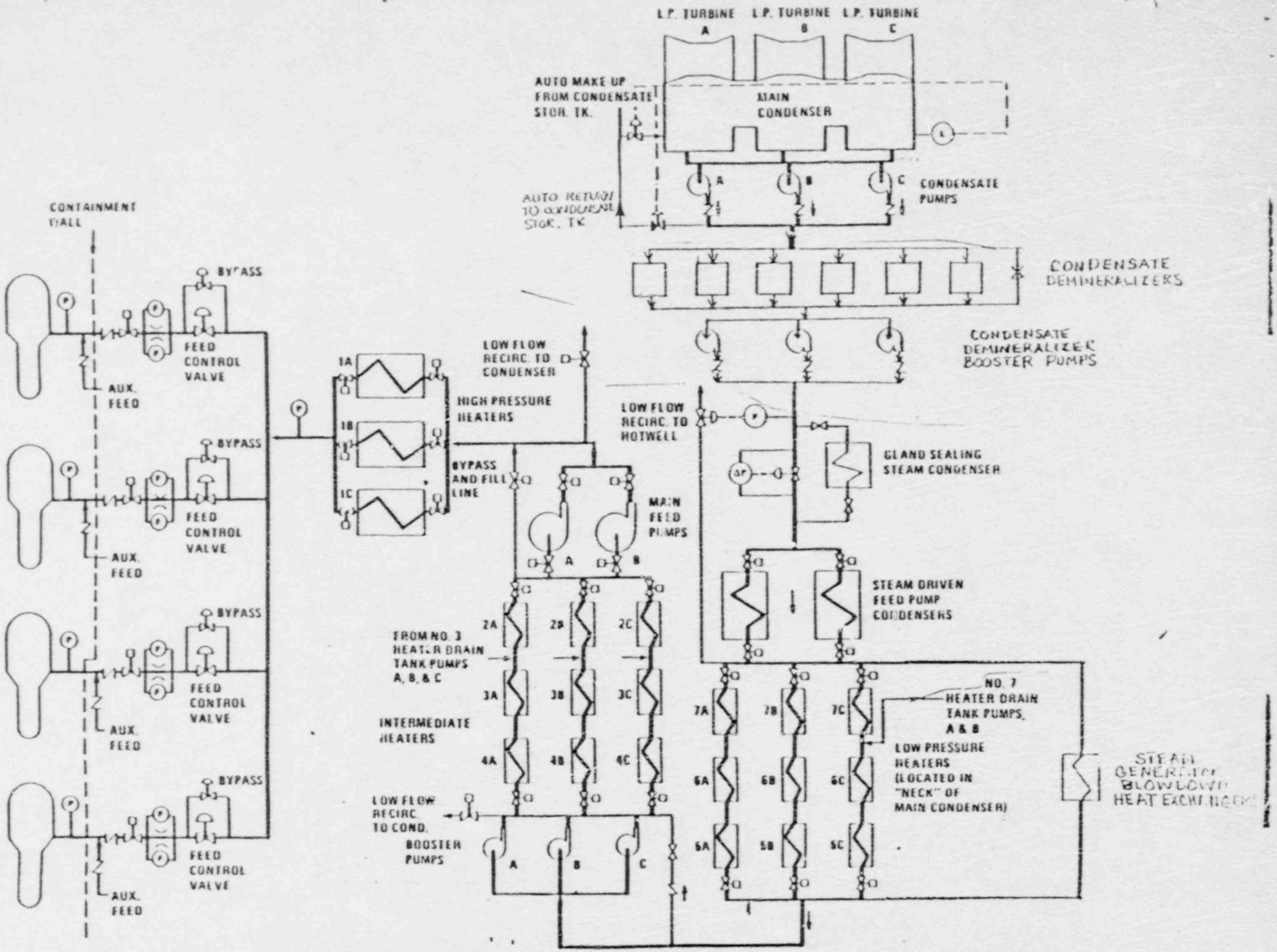
VI. ROOT CAUSE EVALUATION OF THE FIVE TRIPS

VII. WESTINGHOUSE OWNERS GROUPS' TRIP REDUCTION AND ASSESSMENT PROGRAM

VIII. CONCLUSIONS/SUMMARY

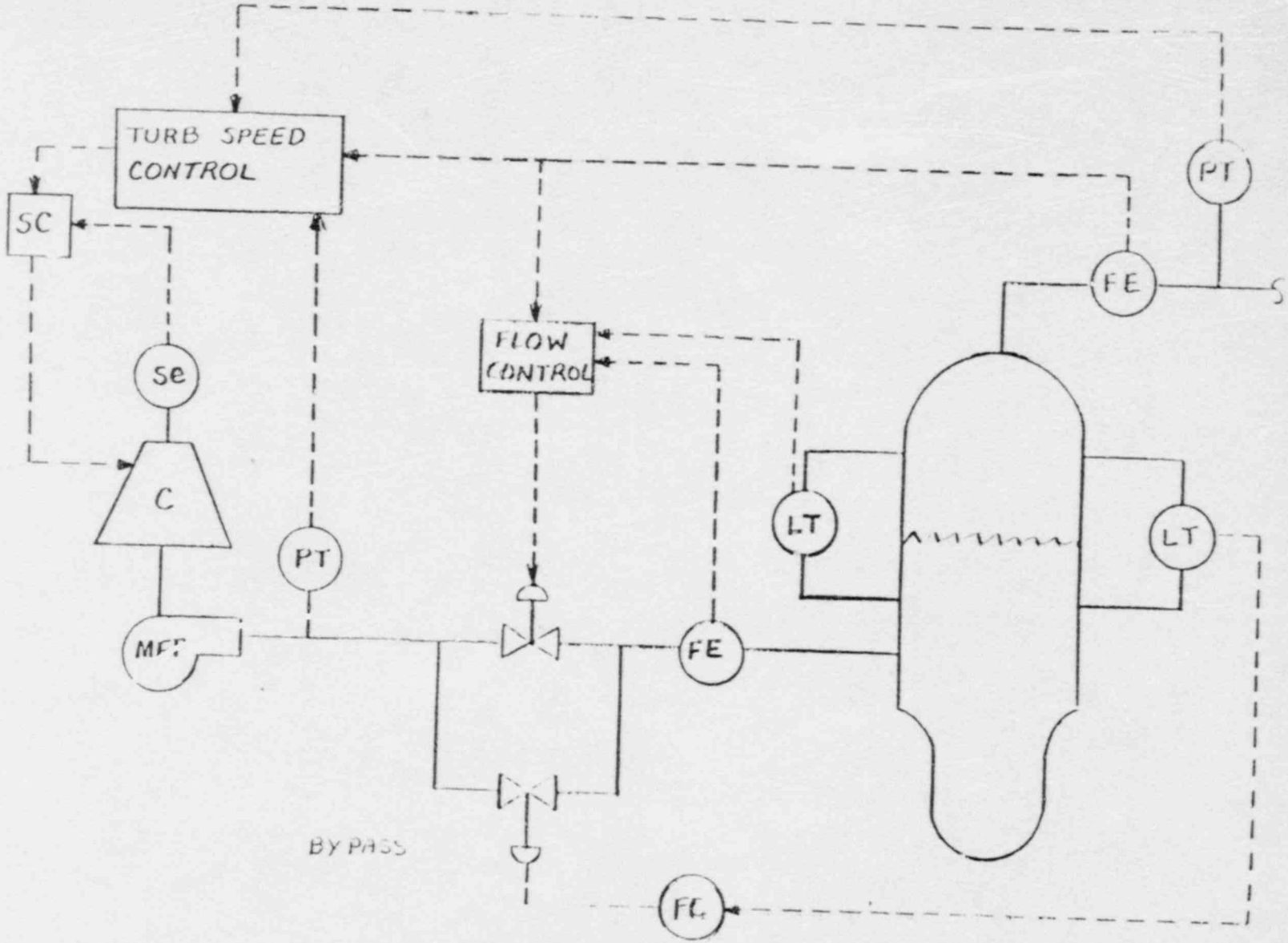
UNIT 2 RESTART

- RESTART MAY 13, 1988
- PLANT OPERATED AT OR NEAR 100% POWER FOR 6 DAYS
- BETWEEN THEN AND NOW (5 REACTOR TRIPS)
- 3 TRIPS GREATER THAN 70% POWER
- 2 TRIPS AT LESS THAN 25% POWER
- 4 OF 5 TRIPS ASSOCIATED WITH THE BALANCE OF PLANT



Condensate and Feedwater System

FEEDWATER CONTROL



COMPARISON WITH INDUSTRY

- PIPING AND INSTRUMENTATION CONFIGURATION IS TYPICAL
- 3-ELEMENT CONTROLLER IS TYPICAL
- CONTROL AND PROTECTION SETPOINTS ARE TYPICAL
- ALL W 4-LOOP PLANTS HAVE TURBINE-DRIVEN MAIN FEEDPUMPS
- MAJORITY DO NOT HAVE AUTOMATIC BYPASS TO MAIN TRANSFER
- MOST HAVE AUTOMATIC BYPASS CONTROL VALVES
- MINORITY HAVE MOTOR DRIVEN STARTUP FEEDPUMPS

UNIT 2

BALANCE OF PLANT PREPARATION FOR RESTART

- EVALUATED EQUIPMENT CONDITIONS
  - ASSESSED PLANT MATERIAL CONDITIONS
  - EVALUATED EXTENDED LAY UP EFFECTS ON EQUIPMENT
  - IDENTIFIED PROBLEM HISTORIES WITH EQUIPMENT
  - PERFORMED CORRECTIVE MAINTENANCE AND PREVENTIVE MAINTENANCE
- OPERATIONS REVIEWED OUTSTANDING WORK ITEMS
  - ASSIGNED PRIORITIES
- GROOMED BALANCE OF PLANT FOR OPERATION
- APPROXIMATELY 1000 WRs PERFORMED FROM JANUARY 1, 1987 TO JANUARY 1, 1988

ADMINISTRATIVE IMPROVEMENTS (U-2 RESTART)

- STARTUP TRAINING FOR DEDICATED CREWS
  - INCLUDED 8 HOURS OF FEEDWATER TRAINING
  - OBSERVED BY NRC, INPO, AND AT LEAST 2 GROUPS ESTABLISHED BY TVA
- SHIFT OPERATIONS ADVISORS
- TREND ANALYSIS PROGRAM FOR REPORTABLE OCCURRENCES
- OPERATOR TRAINING IN COMMUNICATION
- PROCEDURALIZED TRIP AND OTHER EVENT INVESTIGATIONS
  - INVESTIGATION PROGRAM IS CONTROLLED BY PLANT PROCEDURE
  - THE INVESTIGATION OF ROOT CAUSE IS DONE WITH SQA186 USING MORT/HPES TECHNIQUES
  - DURING INVESTIGATION INTERVIEWS ARE CONDUCTED, CHARTS/PRINTOUTS GATHERED AND EQUIPMENT MALFUNCTIONS EVALUATED

  ^ prior to release

  - MANAGEMENT REVIEW AND APPROVAL OF REPORT, CONCLUSIONS AND RECOMMENDATIONS

HISTORICAL MODIFICATIONS TO FEEDWATER

- MODIFIED BYPASS VALVE CONTROLLERS TO AUTOMATIC JANUARY, 1985
- CHANGED CONTROL OF MFPT HP CONTROL VALVE
- MODIFIED MFPT FIRE PROTECTION
- MODIFIED FW REG VALVE AIR SUPPLY LINES

REACTOR TRIP #1, MAY 19, 1988

HISTORICAL TRIP #58
TIME: 1413 EDT
POWER LEVEL: 71.7%

EVENT DESCRIPTION

- LOW STEAM GENERATOR LEVEL BISTABLE PLACED IN TRIPPED POSITION BECAUSE OF A DISCOVERED EQ PROBLEM
- STOPPED UP SIGHT GLASS ON THE #3 HEATER DRAIN TANK
- UNNECESSARY MANIPULATION OF LEVEL IN TANK
- BOP TRANSIENT, REACTOR TRIP OCCURRED STEAM FLOW/ FEED FLOW MISMATCH

CORRECTIVE ACTION

- REVIEW, FORMALIZE, AND IMPLEMENT PLANT TROUBLESHOOTING PROCEDURE
- REVIEW THIS EVENT WITH OPS AND INSTRUMENT MAINTENANCE PERSONNEL
- RESEARCH IN-PLANT VERSUS CONTROL ROOM COMMUNICATION

CAUSAL FACTORS

- LACK OF GOOD JUDGEMENT: DID NOT QUESTION THE UNEXPECTED
- UNCLEAR PROCEDURE: SQM2 DID NOT REQUIRE MCR NOTIFICATION OF WORK ACTIVITIES FOR GENERIC WRs
- COMMUNICATIONS: PERSONNEL DID NOT NOTIFY MCR OF #3 HDT LEVEL CONTROLLER MANIPULATIONS
- EXISTING UNIDENTIFIED CONDITIONS: SIGHT GLASS PLUGGED

REACTOR TRIP #2, MAY 23, 1988

HISTORICAL TRIP #59
TIME: 0028 EDT
POWER LEVEL: 70%

EVENT DESCRIPTION

- SI-246 WAS BEING PERFORMED
- SI-246 INSTRUCTIONS WERE NOT FOLLOWED CORRECTLY
- 2-FT-68-71B WAS VALVED OUT INCORRECTLY, ONE OF THE OTHER TWO XMITTERS ON COMMON SENSELINE WAS AFFECTED
- 2/3 LOGIC MADE UP, REACTOR TRIP OCCURRED

CORRECTIVE ACTION

- EVALUATE POSSIBILITY OF PERFORMING SI-246 PRIOR TO 35 PERCENT POWER
- PROVIDE THE NECESSARY MANAGEMENT ATTENTION TOWARD COMPLIANCE WITH PROCEDURES
- REVIEW PAST RX TRIPS TO DETERMINE IF SIMILAR SITUATIONS OCCURRED AND BRIEF IMs AND OPERATORS ON THE EVENT
- REVIEW ALL IM SIs TO DETERMINE IF A SIMILAR SITUATION COULD OCCUR

CASUAL FACTORS

- FAILURE TO FOLLOW PROCEDURES: UTILIZED DRAIN VALVE INSTEAD OF TEST TEE
- PROCEDURE PERFORMED AT INAPPROPRIATE POWER LEVEL

REACTOR TRIP #3, JUNE 6, 1988

HISTORICAL TRIP #60
TIME: 1415 EDT
POWER LEVEL: 97.8%

EVENT DESCRIPTION

- SI-618 BEING PERFORMED
- IMs ON STEP 13.9, DEPRESSED AND RELEASED SAFEGUARDS TEST SWITCH S801
- RX TRIP RESULTING FROM #4 REG VALVE CLOSURE DUE TO MISSING DIODE IN SAFEGUARDS TEST CABINET

CORRECTIVE ACTION

- REVIEW AND REVISE SURVEILLANCE SCHEDULES TO ENSURE PROPER PERFORMANCE
- PERFORM A MAINTENANCE SEARCH TO DETERMINE CAUSE OF MISSING DIODE AND REPLACE MISSING DIODE
- TROUBLESHOOT AND REPAIR FOUR BOP SIDE VALVES
- INSTALL CLEAR PLASTIC COVER OVER LOCAL VACUUM BREAKER CONTROL SWITCH AND EVALUATE OTHER LOCAL SWITCHES IN TB AND INSTALL CLEAR PLASTIC COVERS WHEN NECESSARY
- EVALUATE THE DESIGN THAT ALLOWS LOCAL HANDSWITCH TO OVERRIDE THE MCR HANDSWITCH
- RE-EMPHASIZE FACE-TO-FACE COMMUNICATIONS

CAUSAL FACTORS

- EXISTING UNIDENTIFIED CONDITION: MISSING DIODE IN SAFEGUARDS TEST CABINET
- PROCEDURE SCHEDULING: SI-618 INAPPROPRIATELY SCHEDULED

REACTOR TRIP #4, JUNE 8, 1988

HISTORICAL TRIP #61
TIME: 1319 EDT
POWER LEVEL: 15.5%

EVENT DESCRIPTION

- UNIT 2 AT 15% REACTOR POWER
- OPERATOR ERROR RESULTED IN A LOW-LOW STEAM GENERATOR REACTOR TRIP

CORRECTIVE ACTION

- MODIFY THE SEQUOYAH SIMULATOR DURING OUTAGE TO MORE CLOSELY SIMULATE MFP RESPONSE
- THIRD EXPERIENCED OPERATOR IN HORSESHOE DURING TRANSIENTS INCLUDING STARTUP

CAUSAL FACTORS

- BOP MAINTENANCE: PROBLEM WITH "A" MFP CONTROLS LEAKING GOVERNOR VALVE ON "B" MFP
- NO DEDICATED COACHING FOR BOP UO FOR STARTUP
- TRAINING: MAIN FEED PUMP SIMULATOR MODELING EXHIBITS DIFFERENT CHARACTERISTICS THAN PLANT FEEDWATER TRANSIENT

REACTOR TRIP #5, JUNE 9, 1988

HISTORICAL TRIP #62
TIME: 0512 EDT
POWER LEVEL: 19.7%

EVENT DESCRIPTION

- REACTOR 19% POWER
- PROBLEM WITH GLAND SEALING STEAM SUPPLY CAUSED #7 HEATER DRAIN TANK TO PRESSURIZE
- THE A AND B LOW PRESSURE HEATER STRING ISOLATED ON HIGH LEVEL
- REDUCTION IN FEED WATER FLOW RESULTED IN A REACTOR TRIP

CORRECTIVE ACTION

- EVALUATE AND PERFORM NECESSARY WORK REQUESTS FOR UNIT 2 BALANCE OF PLANT
- REVISE EXISTING PROCEDURES FOR STARTUP
- GIVE THE BOP OPERATOR THE LEAD IN DIRECTING THE OTHER OPERATORS DURING STARTUP
- DEVELOP PLANS FOR COORDINATION AMONG OPERATORS PRIOR TO PLANT MANEUVERS

CAUSAL FACTORS

- BALANCE OF PLANT MAINTENANCE: OPERATORS HAVING TO USE BACKUP METHODS TO CONTROL BOP PARAMETERS

ROOT CAUSE CODE MATRIX

	REACTOR TRIP 1 5/19/88	REACTOR TRIP 2 5/23/88	REACTOR TRIP 3 6/6/88	REACTOR TRIP 4 6/8/88	REACTOR TRIP 5 6/9/88
PERSONNEL CARELESSNESS		X			
LATE COMMUNICATIONS	X				
DESIGN NOT TO SPECIFICATIONS					X
EQUIPMENT REPEATED FAILURE, PREVIOUS CORRECTIVE ACTION INADEQUATE				X	X
STANDARDS, POLICIES, ADMINISTRATIVE CONTROLS NOT USED		X			
UNFORESEEN FAILURE	X		X		
INADEQUATE TRAINING FACILITIES				X	
SITUATION NOT COVERED IN PROCEDURE	X				
PERSONNEL OVERSIGHT LACK OF DIRECTION	X			X	
MANAGEMENT SYSTEM CORRECTIVE ACTION NOT YET IMPLEMENTED	X				

COMMON ROOT CAUSE EVALUATION

A. REVIEW OF REACTOR TRIPS

- 5 TRIPS EVALUATED BY ROOT CAUSE AND SYMPTOMATIC EVALUATION
- NO COMMON ROOT CAUSE WAS FOUND

B. COMMON FACTORS

- TRIPS 4 AND 5 WERE COMMON IN THE FACT THAT SECONDARY PLANT EQUIPMENT PROBLEMS WERE INVOLVED
- MORE IN-DEPTH MAINTENANCE MAY HAVE PREVENTED TRIP 5
- 3 OF 5 TRIPS WERE THE RESULT OF S/G LOW-LOW LEVEL
- 4 OF 5 TRIPS INVOLVED FEEDWATER TRANSIENTS

WOG TRAP

Active Involvement Before Plant Shutdown

- Data assessment
- Technical specification optimization
- Design improvements

WOG TRAP

Assessment of Present Status of Recommendations

- Implementation of preventive maintenance programs for problem components
- Evaluation of current design changes for effectiveness
- Evaluation of recommended design improvements
- Monitoring industry activities for new ideas