

ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

COMMONWEALTH EDISON COMPANY

Docket No. 50-454 OL
50-455 OL

(Byron Nuclear Power Station,
Units 1 and 2)

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6 (Byron Nuclear Power Station, : 50-455 OL
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9 Eighth Floor Courtroom
10 Winnebago County Courthouse
11 Rockford, Illinois

12 Thursday, 28 April 1983

13 Hearing in the above-entitled matter was
14 reconvened, pursuant to adjournment at 9:00 a.m.

15 BEFORE:

16 IVAN W. SMITH, Esq.
17 Administrative Law Judge

18 A. DIXON CALLIHAN,
19 Administrative Judge

20 RICHARD F. COLE,
21 Administrative Judge

22 APPEARANCES:

23 JOSEPH GALLO, Esq.
24 Isham, Lincoln & Beale
25 1120 Connecticut Avenue, N.W.
Suite 840
Washington, D.C. 20036

On behalf of the Licensee.

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STEVEN GOLDBERG, Esq.
Office of the Executive Legal Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555,

On behalf of the NRC Staff.

DAVID C. THOMAS, ESQ.
77 S. Wacker Drive
Chicago, Illinois 60606,

On behalf of the Intervenors
DAARE/SAFE and League of
Women Voters

FRANCIS X. DAVIS, Esq.
Westinghouse Electric Corporation
P. O. Box 355
Pittsburgh, Pennsylvania 15230

On behalf of Westinghouse
Electric Corporation.

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C O N T E N T S

<u>Witnesses:</u>	<u>Direct</u>	<u>V.Dire</u>	<u>Cross</u>	<u>Rec.</u>	<u>Red.</u>	<u>Boards</u>
Dale Bridenbaugh (resumed)	6405		6406			6498
John Blomgren	6512		6520			6520

E X H I B I T S

(None)

P R O C E E D I N G S

JUDGE SMITH: We are ready to proceed.

Whereupon,

DALE G. BRIDENBAUGH

was recalled to the stand and, having been previously duly sworn, was further examined and testified as follows:

JUDGE SMITH: Mr. Thomas.

MR. THOMAS: Thank you.

Your honor, at this time I would like the record to reflect that I have distributed to the Board and the parties copies of revised pages 6, 7, 8, 11, 12, 17, 19 and also an unnumbered page entitled "List of References."

We have done this, Your Honor, to reflect not only changes which were made yesterday by hand during the session that we had in response to certain objections and and so forth, but also to reflect certain changes that were necessary in the testimony as a result of the striking of Attachment B to the original testimony as followed.

If it is agreeable to the Board, I would like to have the witness just go through and indicate exactly what the changes are in these pages.

JUDGE SMITH: Do you think it should be on the record?

MR. THOMAS: I don't care. Just so that people here know what the changed portions are. I think it is

1 apparent from the different type, but I would just like
2 to have it clear. I don't care if it is in the record or
3 not. just so we know what we are talking about.

4 JUDGE SMITH: Let's make it off the record.

5 (Discussion off the record.)

6 JUDGE SMITH: On the record.

7 MR. THOMAS: Judge, at this point pursuant to
8 the changes which have been identified and the revised pages
9 of Mr. Bridenbaugh's testimony which have been submitted
10 this morning, I would again move to introduce Mr. Bridenbaugh's
11 testimony into the record as his direct testimony in this
12 proceeding.

13 JUDGE SMITH: Are there objections?

14 MR. GALLO: I take the witness believes the testimony
15 as revised is true and correct to the best of his knowledge
16 and belief.

17 MR. THOMAS: Do you want me to ask some foundation
18 questions?

19 MR. GALLO: Just that one.

20 FURTHER DIRECT EXAMINATION

21 BY MR. THOMAS:

22 Q Mr. Bridenbaugh, do you have a 23 page document ---
23 23 numbered pages in front of you entitled "Prepared Direct
24 Testimony of Dale G. Bridenbaugh?

25 A Yes, I do.

1-3

1 Q And do those 23 pages reflect the revised pages
2 which were filed this morning?

3 A Yes, they do.

4 Q And did you prepare those pages, all of these pages?

5 A I did.

6 Q And have you had an opportunity to review this?

7 A Yes.

8 Q Each one of these pages is a true and accurate
9 substance of your testimony here?

10 A Yes, it is.

11 MR. THOMAS: I have nothing further, Judge.

12 JUDGE SMITH: Do you have any objections now?

13 MR. GALLO: No objection at this time, but I
14 am not waiving of course the objections that were made
15 yesterday and denied by the Board.

16 JUDGE SMITH: All right, the testimony and the
17 attachments are received.

18 MR. THOMAS: The witness is available for cross.

19 (The testimony and attachments follow:)
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SUMMARY OF TESTIMONY BY DALE G. BRIDENBAUGH

STEAM GENERATORS

There is a substantial and continuing technical concern existing which needs to be reduced to assure the safe operation of the Byron steam generators. The generic steam generator concerns, indicated by the existence of an Unresolved Safety Issue (USI) specific to Westinghouse steam generators, are further exacerbated by a known and identified design deficiency present in the Model D Westinghouse steam generators (the cross flow tube vibration problem). This combination of problems argues against operation until, at the minimum, the Byron-unique problems have been researched and resolved. The additional risk imposed by the questionable adequacy of the regulatory basis for accident analysis adds further to the risk of Byron plant operation. Byron should not be permitted to operate until the NRC has resolved USI A-3 and has further determined what accident analyses should be required for the licensing of a Westinghouse PWR. The Model D tube vibration research program should be completed, appropriate modifications identified, and those modifications implemented at Byron prior to making the plant radioactive.

Attachments:

1. SECY 82-72, NRC Steam Generator Status Report, Feb., 1982.
2. Generic Letter 82-32, Dec. 9, 1982.
3. Summary of KRSKO Steam Generator Investigation, Oct. 29, 1982
4. NUREG-0886, Steam Generator Tube Experiences.
5. CECO Response to RLWV Interrogatory No. 4.

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PREPARED DIRECT TESTIMONY

OF DALE G. BRIDENBAUGH

REGARDING CONTENTION 22

I. INTRODUCTION

Q: What is your name and position?

A: My name is Dale G. Bridenbaugh. I am a Professional Nuclear Engineer, licensed by the State of California, technical consultant, co-founder and president of MHB Technical Associates, technical consultants on energy and environment, with offices at 1723 Hamilton Avenue, Suite K, San Jose, California.

Q: What are your qualifications and experience?

A: I have participated as an expert witness in licensing proceedings before the U.S. Nuclear Regulatory Commission (NRC); have served as a consultant to the NRC; have testified at the request of the Advisory Committee on Reactor Safeguards; have appeared before various committees of the U.S. Congress; and testified in various state licensing and regulatory proceedings. I received a Bachelor of Science in Mechanical Engineering from the South Dakota School of Mines and Technology in 1953. From June, 1953, until February, 1976, I worked as an engineer and manager with the General Electric Company on a wide variety of most of the aspects of power generation equipment design,

01 manufacture and operation. During the last 10 of those 22
02 years, I was in management positions in the General
03 Electric Nuclear Energy Division where I had the responsi-
04 bility for managing the monitoring of operation of nuclear
05 power plants, for the implementation of solutions to
06 nuclear plant operational problems, and for the develop-
07 ment of a master performance improvement plan aimed at
08 bringing about the long term improvement of power reactor
09 performance.

10 In my capacity as technical consultant with MHB Technical
11 Associates, I have provided technical advice to various
12 governmental bodies and individual groups on subjects
13 related to the design and operation of commercial nuclear
14 power plants. As examples of this work, in 1978 I served
15 as a consultant to the United States Nuclear Regulatory
16 Commission to review the NRC plan for research to improve
17 the safety of light water nuclear power plants. I have
18 served in various consulting capacities to the United
19 States General Accounting Office, the states of Cali-
20 fornia, Illinois, Massachusetts, New Jersey, Pennsylvania,
21 to Suffolk County, New York, and to the governments of
22 Sweden and Norway, all in the evaluation of nuclear plants
23 or programs. A statement of my qualifications and pro-
24 fessional experience is appended to this testimony as
25 Attachment A.

11 II. STATEMENT OF CONTENTION

12 Q: What is the purpose of your testimony?

13 A: The purpose of this testimony is to respond on behalf of
14 the Rockford League of Women Voters (RLWV) to Contention
15 22 as admitted by the Board as follows: 1/

16
17 An extremely serious problem occurring at
18 other plants such as Consumers' Palisades
19 plant and C.E.'s Zion plant, and likely
20 to occur at C.E.'s Byron plant, is pre-
21 sented by degradation of steam generator
22 tube integrity due to corrosion induced
23 wastage, cracking, reduction in tube
24 diameter, and vibration induced fatigue
25 cracks. This affects, and may destroy,
26 the capability of the degraded tubes to
27 maintain their integrity, both during
28 normal operation and under accident con-
29 ditions, such as a LOCA or a main stream
30 line break. The Commission Staff has
31 correctly regarded this problem as a
32 safety problem of a serious nature, as
33 evidenced both by NUREG-0410 and the
34 Black Fox testimony cited above. As a
35 result of this serious and unresolved
36 problem the findings required by 10
37 C.F.R. §§ 50.57(a)(3)(i) and 50.57(a)(6)
38 cannot be made.

39 The results of my review of some of the important matters
40 encompassed by this Contention are summarized in the
41 following paragraphs.

42 III. DISCUSSION OF ISSUES

43 III.A.: Background and Discussion

44 Q: Why is this issue one of importance in the licensing
45 process for Byron?

02 A: The essence of Contention 22 is that steam generator pro-
03 blems, primarily in the form of steam generator tube
04 degradation and failures have been developing at an
05 increasing rate over the past number of years and repre-
06 sent a risk to the future operation of pressurized water
07 reactors (PWR) that has not been adequately assessed nor
08 regulated. Such problems date back to the early and mid-
09 1970's with Westinghouse steam generators and the problem
10 has grown since then to encompass all three U.S. suppliers
11 of PWRs. These problems were identified by the NRC as a
12 technical safety concern as early as 1976 2/, and this
13 problem has been designated as an Unresolved Safety Issue
14 (USI) since 1978 with Westinghouse steam generator tube
15 degradation being specifically identified as USI A-3. 3/
16 In addition to the generic problem history, the Byron
17 steam generators are particularly vulnerable to future
18 problems being a new model line (D-4 and D-5) which has
19 demonstrated a unique design deficiency (preheater tube
20 vibration, described in more detail on page 10) in the
21 early operation of the first units of this model line to
22 go into service. All of these factors, coupled with the
23 questionable regulatory practice of refusing to consider
24 and analyze the accident consequences stemming from
25 multiple steam generator tube failures, makes placing the
Byron units in service without resolution of some or all

01 of these issues a questionable action and one that may
02 potentially represent an undue risk to the health and
03 safety of the public.

04 Q: What is the nature of the risk imposed by the increased
05 likelihood of steam generator tube failures?

06 A: The risk to the public can be segregated into three gen-
07 eral categories. First, there is an increased probability
08 that accidents will be initiated by tube failures occur-
09 ing during normal operation. Such accidents can result in
10 uncontrolled off-site releases of radioactivity. Second,
11 there is an increased likelihood that an accident sequence
12 that is not now considered in the safety analyses may
13 occur as a result of the degraded condition of steam gen-
14 erator tubes after some period of operation. This acci-
15 dent sequence could involve single or multiple tube
16 failures occurring in conjunction with other accident
17 sequences which can impose transient or abnormal loading
18 condition on the tubes, resulting in common mode or
19 systems interaction type failures that have not previously
20 been analyzed in the licensing review of PWRs.
21 The third category of risk is that associated with the
22 occupational radiation exposure that may be required to
23 maintain, modify, and/or repair degraded steam generator
24 tubes after the units go into service and the steam gener-
25 ators become highly contaminated with radioactive materi-
26 als.

01 All three of the above categories of risk have the
02 potential to negatively impact the health and safety of
03 the public due to the potential for increased radiation
04 dose to be borne by those citizens living in the vicinity
05 of the plant. While occupational radiation exposure may
06 not be considered as a public risk by some, it should be
07 recognized that both permanent and transient plant workers
08 are members of the public and their radiation exposures
09 contribute to the public risk burden.

10 Q: Has the existence of these problems been acknowledged by
11 the commercial nuclear establishment?

12 A: Yes it has. As indicated previously, the problem of steam
13 generator tube degradation in Westinghouse steam gener-
14 ators has been designated as an unresolved safety issue
15 (USI) for approximately four years and numerous research
16 programs have been initiated by utilities, utility groups,
17 and by the NRC and other governmental bodies. This issue
18 has been the subject of congressional committee review and
19 has been receiving increasing public attention since the
20 serious tube rupture event which occurred at the R. E.
21 Ginna plant (a Westinghouse design) on January 25, 1982.

22 The tube degradation issues considered in A-3, prior *to*
23 Ginna, included wastage, thinning, pitting, fretting,
24 secondary side intergranular attack and stress corrosion
cracking, primary side stress corrosion cracking, and
denting. * The Ginna event added to these problems a
need to more closely consider issues involving damage by
foreign material, deterioration of previously plugged tubes,
and interactive failure of adjacent tubes. This latter
issue in turn renewed questions about the need to consider
multiple tube failures, and concurrent tube rupture and
LOCA events in accident analysis for licensing.

* See NUREG-0886 and testimony of Louis Frank.

01 constituency of the SGOG has recently been reformatted
02 into SGOG II. SGOG II will focus primarily on corrosion
03 and mechanical damage assessment and consideration of the
04 limitations of fixes for existing plants.

05 Partially stemming from the SGOG investigation has
06 been identification by the NRC of twelve proposed steam
07 generator requirements. These proposed requirements, pre-
08 sented to the SGOG by NRC Staff on July 29, 1982, include
09 the following twelve actions:

10 Prevention and Detection of Loose Parts
11 and Foreign Objects

12 Stabilization and Monitoring of Degraded
13 Tubes

14 Tube In-service Inspection (ISI) Program

15 ~~Improved Eddy Current Techniques~~

16 ~~Primary to Secondary Leakage Limit~~

17 Secondary Water Chemistry Program

18 Condenser In-Service Inspection Program

19 Upper Inspection Ports

20 Reactor Coolant System Pressure Control
21 During a SG Tube Rupture

22 Safety Injection (SI) Signal Reset

23 Containment Isolation and Reset

24 Standard Technical Specifications (STS)
25 Limit for Coolant Iodine Activity
26

02 These and other potential steam generator actions have
03 been under review by Science Applications, Inc. (SAI) in a
04 "value-impact study" funded by the NRC. This study, which
05 unfortunately has not considered multiple steam generator
06 tube failures, became the subject of debate at an NRC
07 Commissioners briefing on November 18, 1982. A recent
08 generic letter (No. 82-32) from the NRC communicated to
09 all PWR plant licensees that the SAI draft report is
10 currently under Staff review and will be modified to con-
11 sider multiple steam generator tube ruptures in combina-
12 tion with other events, along with single tube rupture
13 scenarios. Presumably a decision will also then be made
14 on which of the proposed requirements will be imposed on
15 plant licensees. 5/ A copy of this letter is appended as
16 Attachment C.

16 Q: What is the significance of this reevaluation of proposed
17 requirements by the NRC?

18 A: The significance of this reevaluation is that there
19 appears to be a great deal of uncertainty within the NRC
20 as to how the impact of steam generator tube failures
21 should be evaluated and regulated in the future. Since
22 the situation is in a high state of flux at the present
23 time, this issue must be evaluated very carefully at Byron
24 and appropriate consideration be given to the impact of
25 such changes on the future operation of that plant.

01 Q: Are there any other indications of problems which apply
02 uniquely or specifically to the Byron steam generators?

03 A: Yes. The latest Westinghouse-designed reactors to go into
04 service have utilized the model D series of steam gener-
05 ators. Only four of these units are currently in service
06 with only one of the four being of the type (D-4 and D-5)
07 found at Byron. A common feature of the model D steam
08 generators is a preheater section with a cross tube flow
09 path of the feedwater at the main feedwater inlet.

10 All of the D model steam generators have experienced sig-
11 nificant tube vibration problems in the preheater section
12 and this problem has resulted in the initiation of re-
13 search programs aimed at understanding and correcting
14 these problems. The KRSKO Plant in Yugoslavia is the only
15 D-4 Westinghouse unit currently in service and it has only
16 limited operating experience to date. A summary of the
17 KRSKO steam generator investigation program was trans-
18 mitted to the Byron ASLB via NRC Counsels October 29, 1982
19 letter. This document contains a good summary of the
20 KRSKO problems and proposed modifications and is appended
21 hereto as Attachment D.

01 III.B. Potential Impact of Generic and Model D
02 Investigatory Programs on Byron Steam Generators

03 Q: Do the generic and the unique Model D steam generator
04 issues discussed in Section III.A of this testimony
05 pertain to Byron?

06 A: Yes they do. Byron is a Westinghouse designed unit util-
07 izing Westinghouse Model D, U-tube steam generators, with
08 Inconel-600 tube material. Byron Unit 1 has Model D-4
09 steam generators and Byron Unit 2 has Model D-5s. The
10 main difference between D-4 and D-5 steam generators is
11 that the D-5 utilizes a slightly different heat treatment
12 process for the tube material and that the D-4 has carbon
13 steel tube support plates whereas the D-5 uses a stainless
14 material. The mechanical configuration of the D-4 and D-5
15 steam generators is basically identical. Accordingly, the
16 KRSKO tube vibration problems specifically apply to
17 Byron.

18 In addition, most of the degraded tube problems
19 identified in USI A-3, plus the specific issues identified
20 at pages 6 and 7 of my testimony potentially apply to the
21 Byron units.

22 Although CECO has committed to an
23 improved (all volatile treatment, AVT) water chemistry
program there is no assurance that AVT will eliminate the
earlier generic problems. AVT is intended to combat one

01 of the most significant tube degradation problems, dent-
02 ing. Denting is a phenomena which causes the deformation
03 of steam generator tubes where the tubes pass through the
04 support plates and is caused by the buildup of corrosion
05 products between the tube and the plate. While AVT and
06 other procedural controls were expected to control or
07 eliminate the denting phenomena, some operating units that
08 have used only AVT have already experienced denting.^{6/}
09 From a practical standpoint, steam generator tube degrada-
10 tion is a problem that will probably never be totally
11 resolved. [This is particularly true on Byron Unit 1,
12 which still has carbon steel tube support plates and
13 non-thermally treated tube material.

14
15
16 Q: Does the possible consideration of multiple tube failures
17 or failures in conjunction with other accident sequences,
18 as implied in Attachment C apply to Byron?

19 A: Yes. With regard to questions pertaining to the adequacy
20 of the accident analysis, the Byron FSAR indicates that
21 the worst-case tube failure event considered is the leak-
22 ing of a single tube. ^{9/} The failure analysis included in
23 the Byron FSAR includes no consideration of tube rupture
24 events in conjunction with other accident sequences.

01 Q: Have you seen any indication of physical (hardware)
02 changes or modifications that are under consideration that
03 may be required on the Byron steam generators?

04 A: Yes. The July 19, 1982 Affidavit filed on this docket by
05 Edward M. Burns of Westinghouse Electric Corporation con-
06 tains a fairly extensive discussion of the Model D steam
07 generator test program and also discusses nine different
08 design modifications that are being reviewed as possible
09 solutions for the tube vibration problem. These nine
10 solutions include:

- 11 1. Addition of impingement plate ribs with flow slots.
- 12 2. The addition of a flow diverter.
- 13 3. The addition of a center channel flow restrictor.
- 14 4. Expansion of tubes at the support plates.
- 15 5. Sleeving tubes.
- 16 6. Bypassing some flow through a baffle plate and/or the
17 inlet box cap plates.
- 18 7. Modification of the inlet nozzle flow limiter.
- 19 8. Flow distribution devices in the inlet passes.
- 20 9. Systems modifications which divert a portion of the
21 feedwater to the bypass line. 9/

22 Burns indicates that combinations of these nine possible
23 modifications are also being considered.

02 Q: Would performance of these modifications on the Byron
03 steam generators require direct physical access to and
04 modification of the Byron steam generators?

05 A: With the exception of proposed modification no. 9, all of
06 the modifications under consideration require direct
07 access and changes to either the primary or secondary side
08 of the steam generators. Modification no. 9 is a change
09 to the feedwater bypass piping and control system and is
10 not a direct change to the steam generator itself. If any
11 or all of these modifications are required at Byron,
12 "hands-on" contact work is required. If these changes are
13 deferred until after the plant goes into service, the
14 modifications could necessitate a substantial effort in
15 high radiation zones.

16 Q: In your opinion, will CECO ultimately be required to
17 modify the Byron steam generators?

18 A: It is a virtual certainty that modifications will be
19 required. The only questions are which modifications and
20 when will they be performed?

21 Q: What are the implications of delaying the modification
22 program until after startup of the Byron unit?

23 A: As previously stated, if the modification program is
24 delayed until after startup, the imposition of a signifi-
cant radiation dose burden will be required that could

01 otherwise be avoided if the problem is corrected before
02 startup. Steam generator maintenance and repair opera-
03 tions are currently a major source of occupational radia-
04 tion exposure at operating nuclear plants. The NRC repor-
05 ted to Congress in December that the exposure associated
06 with steam generator maintenance and repair has recently
07 ranged from 10% to 60% of the total facility radiation
08 dose per year. 10/ In addition, it can readily be seen
09 by looking at the annual reports issued by the NRC on
10 plant radiation exposure that PWR plant annual occupa-
11 tional radiation exposure (ORE) has been steadily increas-
12 ing for the past several years. For example, for the last
13 year reported (1980) the PWR average ORE was 578 man-rem
14 per reactor, up from 510 in 1979, 428 in 1978, and 396 in
15 1977. The PWRs with the highest ORE in 1980 were Surry
16 and San Onofre-1, both plants experiencing significant
17 steam-generator repair programs in 1980. 11/ San Onofre,
18 for example reported an ORE of 2387 man-rem in 1980, more
19 than four times the national average. There was also an
20 increase of individual over-exposures in 1980 (a total of
21 73) most of which occurred during the San Onofre-1 steam
22 generator work. 12/ Examples of ORE for typical
23 repair/replacement jobs is reported in NUREG-0886. 13/ A
24 copy of Table 6, which summarizes the reported data is
25 appended as Attachment E.

01 Q: Are there any regulations regarding the control and/or
02 minimization of radiation exposure incurred at operating
03 plants?

04 A: Yes there are. The standards for protection against radi-
05 ation are contained in 10 CFR Part 20. Specific require-
06 ments are contained in § 20.1(c) which states:

07 "...persons engaged in activities under licenses issued
08 by the Nuclear Regulatory Commission.....should, in addi-
09 tion to complying with the requirements set forth in this
10 part, make every reasonable effort to maintain radiation
11 exposures, and releases of radioactive materials in efflu-
12 ents to unrestricted areas, as low as is reasonably
13 achievable." 14/

14 Regulatory Guide 8.8 additionally contains guidance on
15 how the above ALARA principal is to be implemented in
16 operating plants. Under "Review of New or Modified
17 Designs and Equipment Selections", Reg. Guide 8.8 states
18 that: "Specifications for equipment should reflect the
19 objectives of the ALARA program including considerations
20 of reliability, serviceability, limitations of internal
21 accumulations of radioactive material, and other features
22 addressed in this Guide." 15/

23 CECO has committed to the principals of ALARA in the
24 Byron/Braidwood FSAR. A policy statement to this effect

is found at 12.1.1 in the FSAR and Section 12.1.2.5 on
2 equipment selection further states that consideration is
3 given to minimizing maintenance requirements in order to
4 comply with the ALARA policy. 16/ In my opinion, such
5 commitments would require that reasonable actions must be
6 taken in order to avoid a significant future modification
7 that would entail substantial radiation exposure. The
8 July 19, 1982 affidavit filed by Burns on behalf of CECO
9 indicates that the Westinghouse consideration of the tube
0 vibration issue will be completed in January 1983,
1 although responses to questions in the February
2 depositions in Pittsburg indicated the program was not yet
3 completed. While it is not clear that the program is completed,
4 CECO has advised that a specific Byron corrective action program
5 has now been selected. I assume that the detailed review
6 of this proposed fix is now underway for Byron. CECO apparently
7 agrees with my position that the modifications should be made
8 prior to operation and they have now committed to such modifi-
9 cations. I recommend this commitment be made a firm license
0 condition.

21 Q: What actions has CECO taken to overcome the generic tube
22 degradation problems, ~~described in the SECY 82-72 letter~~
23 ~~(Attachment B)?~~

24 A: CECO has described a number of design improvements which
25 have been implemented to varying degrees in Unit 1 and
26 Unit 2. CECO has additionally committed to the
27 utilization of AVT water treatment. However, the
*implementation of available improvements does not seem
adequate to assure that degradation has been eliminated.*

02 As stated earlier in this testimony, the AVT program is
03 expected to reduce, but not necessarily eliminate, the
04 tube denting problem. With regard to design improvements,
05 the affidavit by Daniel D. Malinowski filed on behalf of
06 Commonwealth Edison Company in this case 17/ describes
07 some of the design improvements in the D-4 and D-5 steam
08 generators. It states that the D-4 steam generator still
09 contains carbon steel support plates and that the
10 Quatrefoil support plate holes have been provided for in
11 the D-5 steam generator but not the D-4. 18/ This means
12 that all improvements available to help overcome the
13 denting phenomena have not been incorporated in the Byron
14 Unit 1 (D-4) steam generator.

15 Another item of concern is the incomplete nature of the
16 Byron water chemistry procedures. As indicated in an
17 earlier portion of this testimony, one of the twelve
18 proposed requirements issued by the NRC in July 1982 was
19 for improvements in the secondary water chemistry
20 program. CECO has taken the position that their
21 commitment to AVT is satisfactory for the licensing review
22 of this plant. In response to RLWV Interrogatories, CECO
23 has acknowledged that as of time of their response,
24 virtually none of the operating and chemistry procedures
25 pertaining to control of both primary and secondary water
26 conditions in the steam generators had yet been drafted.
27 A copy of CECO's Response to RLWV Interrogatory No. 4
28 (second set) is appended as Attachment F. While all of

01 these incomplete procedures may very well be completed
02 prior to issuance of the operating license, ~~complete~~
03 assurance ^{has not yet been} provided that those procedures will be
04 adequate to satisfy the critical needs of this troublesome
05 component. It appears that substantial deficiencies
06 remain, particularly in Unit 1.

07 Q: In spite of all of these potential problems, isn't it true
08 that all of these concerns develop relatively slowly and
09 are therefore detectable before serious problems develop?

10 A: That has generally been the industry view in the past.
11 However, the 1982 tube rupture event at R. E. Ginna Plant
12 and reevaluation of three previous tube rupture events at
13 the Surry, Prairie Island, and Point Beach Plants has
14 caused a reassessment of this viewpoint. All four of
15 these events demonstrated tube leakage rates far in excess
16 of the nominal 1 gallon per minute (gpm) assumed in the
17 Byron FSAR accident analysis. 19/ Leakage rates of from
18 125 to 336 gpm were reported at the three earlier events
19 and the Ginna rate reached as high as 760 gpm. 20/ The
20 Ginna tube rupture event is of even more significance as
21 ~~it is now the NRC position is~~ this event came close to
22 being a multiple tube failure due to the jet impingement
23 and vibratory mechanical damage caused to adjacent tubes
24 during that event. These uncertainties are further com-
25 pounded by weaknesses in the in-service inspection
26 capabilities available in the industry today.

02 Q: What are the inadequacies of the in-service inspection
03 program with regard to timely detection of steam generator
04 tube degradation?

05 A: In order to provide an adequate basis for assured safety,
06 it is necessary for the ISI program to give indication of
07 incipient failures on a timely enough basis so that oper-
08 ating periods will not extend beyond the predictive capa-
09 bilities of the program. The Ginna investigation, among
10 others, has revealed a discrepancy in the program current-
11 ly being implemented. First, it has been recognized for
12 some time that the Eddy-current testing utilized for tube
13 wall thickness measurement has reduced sensitivity in the
14 areas where the tubes pass through support plates or other
15 nearby structural members. This is, of course, precisely
16 the area where most defects have been observed. Second,
17 the post-Ginna investigation revealed that approximately
18 5% of the tubes that had previously been plugged had sig-
19 nificantly deteriorated and that one of them had frac-
20 tured. The resulting loose part had apparently caused the
21 rupture in the tube which was nearby. There are no cur-
22 rent provisions for routinely inspecting the condition of
23 tubes which have previously been plugged. Consideration
24 is being given to the utilization of additional inspection
ports so as to facilitate external tube inspections but no

generic decision has been made on this as yet.

02 Q: Would you please summarize your testimony?

03 A: There is a substantial and continuing technical concern
04 existing which needs to be reduced to assure the safe
05 operation of the Byron steam generators. The generic
06 steam generator concerns, indicated by the existence of an
07 USI specific to Westinghouse steam generators, are further
08 exacerbated by a known and identified design deficiency
09 present in the Model D Westinghouse steam generators (the
10 cross flow tube vibration problem). This combination of
11 problems argues against operation until, at the minimum,
12 the Byron-unique problems have been researched and resol-
13 ved. The additional risk imposed by the questionable ade-
14 quacy of the regulatory basis for accident analysis adds
15 further to the risk of Byron plant operation. I do not
16 believe that Byron should be permitted to operate until
17 the NRC has completed and made public their analysis of
18 the A-3 USI, has determined which of the twelve proposed
19 requirements (see page 8) should be implemented, and has
20 further determined what accident analyses should be
21 required for the licensing of a Westinghouse PWR. I also
22 believe that the Model D tube vibration research program
23 should be completed, appropriate modifications identified,
24 and those modifications implemented at Byron prior to
25 making the plant radioactive.

VI. Recommendations

02 Q: Would you please state your recommendations for this
03 plant?

04 A: Following are the steps that I believe should be completed
05 before deciding to issue an operating license at Byron:

- 06 1. Complete the Westinghouse Model D cross flow research
07 program and present it to the NRC and the public for
08 appropriate review.
- 09 2. Implement any applicable modifications resulting from
10 the cross flow research program at the Byron Plant.
- 11 3. Complete the drafting of the Byron operating and chem-
12 istry procedures and submit them to review by an inde-
13 pendent body. (This body should be other than the
14 NRC).
- 15 4. Define an interim in-service inspection program, sub-
16 ject to change as history becomes available and in-
17 spection techniques improve. This program should
18 address the issues of lack of sensitivity in tube
19 support plate locations and also should provide suit-
20 able coverage of uninspectable tubes (plugged tubes).
- 21 5. Perform accident analyses to cover the potential
22 effects of multiple tube failures and of multiple tube
23 failures occurring in conjunction with other accident
24 scenarios (such as transients and pipe break loss of
25 coolant accidents).

- 02 6. Complete work on the open USI A-3, including
03 determination of which of the proposed requirements
04 are to be imposed on Westinghouse steam generators.
05 7. Implement the generic requirements at Byron.
06 8. Develop emergency response guidelines to mitigate
07 these additional accident scenarios and incorporate
08 them in the Byron procedures to insure the protection
09 against such currently unanalyzed accidents.

09 Q: Does this complete your testimony?

10 A: Yes it does.

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- 3 NUREG-0410, "Identification of Unresolved Safety Issues Relating to Nuclear Power Plants: Report to Congress, U.S. NRC, January 1979.
- ~~4 NUREG-0270, February 18, 1982, Policy Issue (Information) for the Commissioners from Williams J. Dirks, EDO, subject of overall steam generator program with an attached steam generator status report.~~
- 5 December 9, 1982, Generic Letter (82-32) from Darrell G. Eisenhut to All Pressurized Water Reactor Licensees.
- 6 Nuclear News, December 1982, page 50.
- ~~7 Steam Generator Status Report, February, 1982, U.S. NRC, p. 7, (see Attachment 8)~~
- 8 Byron/Briadwood Stations Final Safety Analysis Report, 15.6.3, and Table 15.6-2.
- 9 Affidavit of Edward M. Burns concerning DAARE/SAFE Contention 9c, July 19, 1982, p. 7.
- 10 Testimony of Gus C. Lainas, NRC, Before the Sub-committee on Oversight in Investigations, Committee on Interior and Insular Affairs, United States House of Representatives on Steam Generator Experience, December 13, 1982, p. 4.
- 11 NUREG-0713, Vol. 2, Operational Radiation Exposure at Commercial Nuclear Power Reactors, 1980, U.S. NRC, December 1981, page 12.
- 12 Id, page 28 & 29.
- 13 NUREG-0886, Steam Generator Tube Experience, U.S. NRC, February 1982, pages 44 & 45.
- 14 Code of Federal Regulations 20.1(c).

- 15 Regulatory Guide 8.8, Information Relevant to Insuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as Is Reasonably Achievable, Revision 3, June 1978, p. 8.8-6.
- 16 Byron/Braidwood Stations Final Safety Analysis Report, Section 12, Radiation Protection, pp. 12.1-1 and 12.1-9.
- 17 Affidavit of Daniel D. Malinowski concerning DAARE/SAFE Contention 9c, July 19, 1982.
- 18 Id Malinowski Affidavit, pp. 5-6.
- 19 Final Safety Analysis Report, Table 15.6-2.
- 20 NUREG-0909, NRC Report on the January 25, 1982 Steam Generator Tube Rupture at R. E. Ginna Nuclear Power Plant, April 1982, p. 3-44.

LIST OF ATTACHMENTS

Attachment

- A Resume of Dale G. Bridenbaugh
- ~~B~~ ~~Survey 11-1-72~~
~~Steam Generator Status Report~~
~~February, 1982~~
- C Generic Letter (82-32)
December 9, 1982
- D Summary of KRSKO Steam Generator
Investigation Program
- E NUREG-0886, Table 6
- F CECO's November 17, 1982 Response to
Rockford League of Women Voter's
Interrogatory No. 4

ATTACHMENT A

RESUME OF DALE G. BRIDENBAUGH

PROFESSIONAL QUALIFICATIONS OF DALE G. BRIDENBAUGH

DALE G. BRIDENBAUGH
1723 Hamilton Avenue
Suite K
San Jose, CA 95125
(408) 266-2716

EXPERIENCE:

1976 - PRESENT

President - MHB Technical Associates, San Jose, California.
Co-founder and partner of technical consulting firm. Specialists in energy consulting to governmental and other groups interested in evaluation of nuclear plant safety and licensing. Consultant in this capacity to state agencies in California, New York, Illinois, New Jersey, Pennsylvania, Oklahoma and Minnesota and to the Norwegian Nuclear Power Committee, Swedish Nuclear Inspectorate, and various other organizations and environmental groups. Performed extensive safety analysis for Swedish Energy Commission and contributed to the Union of Concerned Scientist's Review of WASH-1400. Consultant to the U.S. NRC - LWR Safety Improvement Program, performed Cost Analysis of Spent Fuel Disposal for the Natural Resources Defense Council, and contributed to the Department of Energy LWR Safety Improvement Program for Sandia Laboratories. Served as expert witness in NRC and state utility commission hearings.

1976 - (FEBRUARY - AUGUST)

Consultant, Project Survival, Palo Alto, California.

Volunteer work on Nuclear Safeguards Initiative campaigns in California, Oregon, Washington, Arizona, and Colorado. Numerous presentations on nuclear power and alternative energy options to civic, government, and college groups. Also resource person for public service presentations on radio and television.

1973 - 1976

Manager, Performance Evaluation and Improvement, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed seventeen technical and seven clerical personnel with responsibility for establishment and management of systems to monitor and measure Boiling Water Reactor equipment and system operational performance. Integrated General Electric resources in customer plant modifications, coordinated correction of causes of forced outages and of efforts to improve reliability and performance of BWR systems.

1973 - 1976 (Contd)

Responsible for development of Division Master Performance Improvement Plan as well as for numerous Staff special assignments on long-range studies. Was on special assignment for the management of two different ad hoc projects formed to resolve unique technical problems.

1972 - 1973

Manager, Product Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed group of twenty-one technical and four clerical personnel. Prime responsibility was to direct interface and liaison personnel involved in corrective actions required under contract warranties. Also in charge of refueling and service planning, performance analysis, and service communication functions supporting all completed commercial nuclear power reactors supplied by General Electric, both domestic and overseas (Spain, Germany, Italy, Japan, India, and Switzerland).

1968 - 1972

Manager, Product Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed sixteen technical and six clerical personnel with the responsibility for all customer contact, planning and execution of work required after the customer acceptance of department-supplied plants and/or equipment. This included quotation, sale and delivery of spare and renewal parts. Sales volume of parts increased from \$1,000,000 in 1968 to over \$3,000,000 in 1972.

1966 - 1968

Manager, Complaint and Warranty Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed group of six persons with the responsibility for customer contacts, planning and execution of work required after customer acceptance of department-supplied plants and/or equipment--both domestic and overseas.

1963 - 1966

Field Engineering Supervisor, General Electric Company, Installation and Service Engineering Department, Los Angeles, California.

Supervised approximately eight field representatives with responsibility for General Electric steam and gas turbine installation and maintenance work in Southern California, Arizona, and Southern Nevada. During this period was responsible for the installation of eight different central station steam turbine generator units, plus much maintenance activity. Work included customer contact, preparation of quotations, and contract negotiations.

1956 - 1963

Field Engineer, General Electric Company, Installation and Service Engineering Department, Chicago, Illinois.

Supervised installation and maintenance of steam turbines of all sizes. Supervised crews of from ten to more than one hundred men, depending on the job. Worked primarily with large utilities but had significant work with steel, petroleum and other process industries. Had four years of experience at construction, startup, trouble-shooting and refueling of the first large-scale commercial nuclear power unit.

1955 - 1956

Engineering Training Program, General Electric Company, Erie, Pennsylvania, and Schenectady, New York.

Training assignments in plant facilities design and in steam turbine testing at two General Electric Factory locations.

1953 - 1955

United States Army - Ordnance School, Aberdeen, Maryland.

Instructor - Heavy Artillery Repair. Taught classroom and shop disassembly of artillery pieces.

1953

Engineering Training Program, General Electric Company, Evendale, Ohio.

Training assignment with Aircraft Gas Turbine Department.

EDUCATION & AFFILIATIONS:

BSME - 1953, South Dakota School of Mines and Technology, Rapid City, South Dakota, Upper 1/4 of class.

Professional Nuclear Engineer - California. Certificate No. 0973.

Member - American Nuclear Society.

Various Company Training Courses during career including Professional Business Management, Kepner Tregoe Decision Making, Effective Presentation, and numerous technical seminars.

HONORS & AWARDS:

Sigma Tau - Honorary Engineering Fraternity.

General Managers Award, General Electric Company.

PERSONAL DATA:

Born November 20, 1931, Miller, South Dakota.

Married, three children

6'2", 190 lbs., health - excellent

Honorable discharge from United States Army

Hobbies: Skiing, hiking, work with Cub and Boy
Scout Groups.

PUBLICATIONS & TESTIMONY:

1. Operating and Maintenance Experience, presented at Twelfth Annual Seminar for Electric Utility Executives, Pebble Beach, California, October 1972, published in General Electric NEDC-10697, December 1972.
2. Maintenance and In-Service Inspection, presented at IAEA Symposium on Experience From Operating and Fueling of Nuclear Power Plants, Bridenbaugh, Lloyd & Turner, Vienna, Austria, October, 1973.
3. Operating and Maintenance Experience, presented at Thirteenth Annual Seminar for Electric Utility Executives, Pebble Beach, California, November, 1973, published in General Electric NEDO-20222, January, 1974.
4. Improving Plant Availability, presented at Thirteenth Annual Seminar for Electric Utility Executives, Pebble Beach, California, November 1973, published in General Electric NEDO-20222, January, 1974.
5. Application of Plant Outage Experience to Improve Plant Performance, Bridenbaugh and Burdsall, American Power Conference, Chicago, Illinois, April 14, 1974.
6. Nuclear Valve Testing Cuts Cost, Time, Electrical World, October, 15, 1974.
7. The Risks of Nuclear Power Reactors: A Review of the NRC Reactor Safety Study WASH-1400, Kendall, Hubbard, Minor & Bridenbaugh, et al, for the Union of Concerned Scientists, August, 1977.

8. Swedish Reactor Safety Study: Barsebäck Risk Assessment, MHB Technical Associates, January, 1978. (Published by the Swedish Department of Industry as Document DsI 1978:1)
9. Testimony of D.G. Bridenbaugh, R.B. Hubbard, G.C. Minor to the California State Assembly Committee on Resources, Land Use, and Energy, March 8, 1976.
10. Testimony of D.G. Bridenbaugh, R.B. Hubbard, and G.C. Minor before the United States Congress, Joint Committee on Atomic Energy, February 18, 1976, Washington, DC (Published by the Union of Concerned Scientists, Cambridge, Massachusetts.)
11. Testimony by D.G. Bridenbaugh before the California Energy Commission, entitled, Initiation of Catastrophic Accidents at Diablo Canyon, Hearings on Emergency Planning, Avila Beach, California, November 4, 1976.
12. Testimony by D.G. Bridenbaugh before the U.S. Nuclear Regulatory Commission, subject: Diablo Canyon Nuclear Plant Performance, Atomic Safety and Licensing Board Hearings, December, 1976.
13. Testimony by D.G. Bridenbaugh before the California Energy Commission, subject: Interim Spent Fuel Storage Considerations, March 10, 1977.
14. Testimony by D.G. Bridenbaugh before the New York State Public Service Commission Siting Board Hearings concerning the Jamesport Nuclear Power Station, subject: Effect of Technical and Safety Deficiencies on Nuclear Plant Cost and Reliability, April, 1977.
15. Testimony by D.G. Bridenbaugh before the California State Energy Commission, subject: Decommissioning of Pressurized Water Reactors, Sundesert Nuclear Plant Hearings, June 9, 1977.
16. Testimony by D.G. Bridenbaugh before the California State Energy Commission, subject: Economic Relationships of Decommissioning, Sundesert Nuclear Plant, for the Natural Resources Defense Council, July 15, 1977.
17. Testimony by D.G. Bridenbaugh before the Vermont State Board of Health, subject: Operation of Vermont Yankee Nuclear Plant and Its Impact on Public Health and Safety, October 6, 1977.
18. Testimony by D.G. Bridenbaugh before the U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, subject: Deficiencies in Safety Evaluation of Non-Seismic Issues, Lack of a Definitive Finding of Safety, Diablo Canyon Nuclear Units October 18, 1977, Avila Beach, California.

19. Testimony by D.G. Bridenbaugh before the Norwegian Commission on Nuclear Power, subject: Reactor Safety/Risk, October 26, 1977.
20. Testimony by D.G. Bridenbaugh before the Louisiana State Legislature Committee on Natural Resources, subject: Nuclear Power Plant Deficiencies Impacting on Safety & Reliability, Baton Rouge, Louisiana, February 13, 1978.
21. Spent Fuel Disposal Costs, report prepared by D.G. Bridenbaugh for the Natural Resources Defense Council (NRDC), August 31, 1978.
22. Testimony by D.G. Bridenbaugh, G.C. Minor, and R.B. Hubbard before the Atomic Safety and Licensing Board, in the matter of the Black Fox Nuclear Power Station Construction Permit Hearings, September 25, 1978, Tulsa, Oklahoma.
23. Testimony of D.G. Bridenbaugh and R.B. Hubbard before the Louisiana Public Service Commission, Nuclear Plant and Power Generation Costs, November 19, 1978, Baton Route, Louisiana.
24. Testimony by D.G. Bridenbaugh before the City Council and Electric Utility Commission of Austin, Texas, Design, Construction, and Operating Experience of Nuclear Generating Facilities, December 5, 1978, Austin, Texas.
25. Testimony by D.G. Bridenbaugh for the Commonwealth of Massachusetts, Department of Public Utilities, Impact of Unresolved Safety Issues, Generic Deficiencies, and Three Mile Island-Initiated Modifications on Power Generation Cost at the Proposed Pilgrim-2 Nuclear Plant, June 8, 1979.
26. Improving the Safety of LWR Power Plants, MHB Technical Associates, prepared for U.S. Dept. of Energy, Sandia Laboratories, September 28, 1979.
27. BWR Pipe and Nozzle Cracks, MHB Technical Associates, for the Swedish Nuclear Power Inspectorate (SKI), October, 1979.
28. Uncertainty in Nuclear Risk Assessment Methodology. MHB Technical Associates, for the Swedish Nuclear Power Inspectorate (SKI), January, 1980.
29. Testimony of D.G. Bridenbaugh and G.C. Minor before the Atomic Safety and Licensing Board, in the matter of Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station following TMI-2 accident, subject: Operator Training and Human Factors Engineering, for the California Energy Commission, February 11, 1980.
30. Italian Reactor Safety Study: Caorso Risk Assessment, MHB Technical Associates, for Friends of the Earth, Italy, March, 1980.

31. Decontamination of Krypton-85 from Three Mile Island Nuclear Plant, H. Kendall, R. Pollard, & D.G. Bridenbaugh, et al, The Union of Concerned Scientists, delivered to the Governor of Pennsylvania, May 15, 1980.
32. Testimony by D.G. Bridenbaugh before the New Jersey Board of Public Utilities, on behalf of New Jersey Public Advocate's Office, Division of Rate Counsel, Analysis of 1979 Salem-1 Refueling Outage, August, 1980.
33. Minnesota Nuclear Plants Gaseous Emissions Study, MHB Technical Associates, for Minnesota Pollution Control Agency, September, 1980.
34. Position Statement, Proposed Rulemaking on the Storage and Disposal of Nuclear Waste, Joint Cross-Statement of Position of the New England Coalition on Nuclear Pollution and the Natural Resources Defense Council, September, 1980.
35. Testimony by D.G. Bridenbaugh and Gregory C. Minor, before the New York State Public Service Commission, In the Matter of Long Island Lighting Company Temporary Rate Case, prepared for the Shoreham Opponents Coalition, September 22, 1980, Shoreham Nuclear Plant Construction Schedule.
36. Supplemental Testimony by D.G. Bridenbaugh before the New Jersey Board of Public Utilities, on behalf of New Jersey Public Advocate's Office, Division of Rate Counsel, Analysis of Salem-1 Refueling Outage, December, 1980.
37. Testimony by D.G. Bridenbaugh and Gregory C. Minor, before the New Jersey Board of Public Utilities, on behalf of New Jersey Department of the Public Advocate, Division of Rate Counsel, Oyster Creek 1980 Refueling Outage Investigation, February, 1981.
38. Economic Assessment: Ownership Interest in Palo Verde Nuclear Station, MHB Technical Associates, for The City of Riverside, September 11, 1981.
39. Testimony of D.G. Bridenbaugh before the Public Utilities Commission of Ohio, in the matter of the Regulation of the Electric Fuel Component Contained Within the Rate Schedules of the Toledo Edison Company and Related Matters, subject: Davis-Besse Nuclear Power Station 1980-81 Outage Review, October, 1981.
40. Supplemental Testimony of D.G. Bridenbaugh before the Public Utilities Commission of Ohio, in the matter of the Regulation of the Electric Fuel Component Contained within the Rate Schedules of the Toledo Edison Company and Related Matters, subject: Davis-Besse Nuclear Power Station 1980-81 Outage Review, November, 1981.

41. Systems Interaction and Single Failure Criterion, Phase 2 Report, MHB Technical Associates for the Swedish Nuclear Power Inspectorate (SKI), January, 1982.
42. Testimony of D. G. Bridenbaugh and Gregory C. Minor on behalf of Governor Edmund G. Brown Jr., before the Atomic Safety and Licensing Board, regarding Contention 10, Pressurizer Heaters, January 11, 1982.
43. Testimony of D. G. Bridenbaugh and Gregory C. Minor on behalf of Governor Edmund G. Brown Jr., before the Atomic Safety and Licensing Board, regarding Contention 12, Block and Pilot Operated Relief Valves, January 11, 1982.
44. Testimony of D. G. Bridenbaugh before the Commonwealth of Massachusetts, Department of Public Utilities, on behalf of the Massachusetts Attorney General, Pilgrim Nuclear Power Station, 1981-82 Outage Investigation, March 11, 1982.
45. Testimony of D. G. Bridenbaugh before the Pennsylvania Public Utility Commission, on behalf of the Pennsylvania Office of Consumer Advocate, Beaver Valley Outage, March, 1982.
46. Interim testimony of D. G. Bridenbaugh before the Illinois Commerce Commission, on behalf of the Illinois Attorney General's Office, Expected Lifetimes and Performance of Nuclear Power Plants, March, 1982.
47. Testimony of D. G. Bridenbaugh and G. C. Minor before the Atomic Safety and Licensing Board, on behalf of Suffolk County, in the matter of Long Island Lighting Company, Shoreham Nuclear Power Station, Unit 1, regarding Suffolk County Contention 11, Passive Mechanical Valve Failures, April 13, 1982.
48. Testimony of D. G. Bridenbaugh and R. B. Hubbard, in the Matter of Jersey Central Power and Light Company For An Increase in Rates for Electrical Service, on behalf of New Jersey Department of the Public Advocate, Division of Rate Counsel, Three Mile Island Units 1 & 2, Cleanup and Modification Programs, May, 1982.
49. Testimony of D. G. Bridenbaugh and G. C. Minor on behalf of Suffolk County, before the Atomic Safety and Licensing Board, in the matter of Long Island Lighting Company, Shoreham Nuclear Power Station, Unit 1, regarding Suffolk County Contention 22, SRV Test Program, May 25, 1982.

50. Testimony of D. G. Bridenbaugh and G. C. Minor on behalf of Suffolk County, before the Atomic Safety and Licensing Board, in the matter of Long Island Lighting Company, Shoreham Nuclear Power Station, Unit 1, regarding Suffolk County Contention 28(a)(vi) and SOC Contention 7A(6), Reduction of SRV Challenges, June 14, 1982.
51. Testimony of D. G. Bridenbaugh before the Illinois Commerce Commission, on behalf of the Illinois Attorney General's Office, Expected Lifetimes and Performance of Nuclear Power Plants, June 18, 1982.

ATTACHMENT C

GENERIC LETTER (82-32)

DECEMBER 9, 1982



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

... 1982

TO ALL PRESSURIZED WATER REACTOR PLANT LICENSEES

Gentlemen:

SUBJECT: POTENTIAL STEAM GENERATOR RELATED GENERIC REQUIREMENTS
(GENERIC LETTER NO. 82-32)

The NRC staff has identified potential steam generator related generic requirements and is currently subjecting them to a value impact analysis. A major element of the staff's value impact will be an analysis being prepared by our contractor, Science Applications, Inc. A copy of this draft report is provided for your information and use. This report is currently under staff review and will be modified to consider multiple steam generator tube ruptures in combination with other events along with single tube rupture scenarios.

Any comments you may care to make, either individually or through Owners Groups, on the SAI report and on the probability and consequences of multiple tube rupture scenarios would be considered in the staff's final value impact analysis if they can be provided within 30 days of the date of this letter.

Sincerely,

Darrell G. Eisenhut
Darrell G. Eisenhut, Director
Division of Licensing

Enclosure:
SAI Report

8208190263

ATTACHMENT D

SUMMARY OF

KRSKC STEAM GENERATOR INVESTIGATION PROGRAM



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 29, 1982

Ivan W. Smith, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr. A. Dixon Callihan
Administrative Judge
Union Carbide Corporation
P.O. Box Y
Oak Ridge, Tennessee 37830

Dr. Richard F. Cole
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

In the Matter of
COMMONWEALTH EDISON COMPANY
(Byron Station, Units 1 and 2)
Docket Nos. 50-454 and 50-455

Dear Administrative Judges:

Enclosed for the information of the Board and parties is a copy of the final report of the International Atomic Energy Agency Advisory Mission regarding KRSKO steam generator modifications which, in draft form, was the subject of NRC memoranda attached to DAARE/SAFE's October 8, 1982 response to the Applicant's motion for clarification of the Board's summary disposition ruling.

Sincerely,

A handwritten signature in cursive script, appearing to read "Steven C. Goldberg".

Steven C. Goldberg
Counsel for NRC Staff

Enclosure as stated

cc: (w/ encl.) Service List



INTERNATIONAL ATOMIC ENERGY AGENCY

WP/5/1937
2 July 1932
Distr.: LIMITED
Original: ENGLISH

NUCLEAR POWER SAFETY

REPORT TO THE GOVERNMENT OF YUGOSLAVIA

TA REPORT No. 1937

Nuclear Power Safety

Advisory Services
Steam Generator Vibration Problems

(YUG/9/010)

Report to the Government of Yugoslavia

7 - 12 June 1982

ADVISORY MISSION TO YUGOSLAVIA

7 - 12 June, 1982

J.M. Izquierdo
I. Jung
L.G. Larsson
R.L. Tedesco
L.I. Tirén

Junta de Energia Nuclear Spain
Consultant, Sweden
Nuclear Power Inspectorate, Sweden
Nuclear Regulatory Commission, USA
IAEA

PREAMBLE

The Director General of the IAEA would like to place on record his understanding that, upon completion of its work, the Mission may make to the Yugoslav authorities and to the organization responsible for the operation of the nuclear power plant such recommendations as the Mission considers desirable regarding the measures that should be taken for ensuring the safe operation of the plant. The Mission's recommendations will be made on its own expertise and will not engage the IAEA in any way or imply any commitment on the part of the IAEA.

1982-07-07

SUMMARY

At the request of the Permanent Mission of Yugoslavia to the IAEA an advisory mission including five persons was sent to Yugoslavia during the period 7-12 June, 1982. The purpose was to discuss steam generator vibration problems at the Krško nuclear power plant with the licensing authority and plant management and to give advice on associated plant modifications.

After a few months' of initial operation at power the Krško plant has recently been shut down. Modifications are under way to permit further operation up to 100% power with a limitation on feedwater flow through the main steam generator nozzle. The aim of the flow limitation is to reduce steam generator tube vibration to acceptable levels at full power.

During the Mission's stay in Yugoslavia they formulated a set of recommendations to the Krško authorities. This includes recommending that the basis for the flow limitation be better developed in quantitative terms ; independent design review of plant modifications be completed on a timely basis ; operating programme be established to specify permissible operating modes during a pre-established limited operating time period ; comprehensive start-up testing programme be established and operator training be conducted prior to resumed operation ; and adherence to quality assurance requirements be ensured with regard to proper design verification and construction adequacy prior to operation of the plant as modified. The basis for these and other recommendations are discussed in the present report.

Advisory Mission to Yugoslavia

7 - 12 June, 1982

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1. INTRODUCTION
 2. MISSION OBJECTIVES
 3. BACKGROUND AND CURRENT SITUATION
 4. MISSION RECOMMENDATIONS AND DISCUSSION
- Appendix I Summary of Mission activities
- Appendix II Swedish experience of steam generator tube vibrations
and testing programme (I. Jung)
- Appendix III List of participants in discussions with the IAEA
Mission

1. INTRODUCTION

In a letter dated 27 April 1982 the Permanent Mission of the Socialist Federal Republic of Yugoslavia to the IAEA requested the assistance of an Agency team of experts to discuss steam generator vibration problems in the Krško nuclear power plant.

In response to the request, the Agency sent a mission to Yugoslavia during the period 7 - 12 June, 1982, consisting of the following four experts :-

J.M. Izquierdo PWR Startup Group Leader
Evaluation Division,
Junta de Energia Nuclear, Spain

I. Jung Professor Emeritus
Steam Technology,
Royal Institute of Technology,
Stockolm, Sweden
Consultant to the Swedish State Power Board

L.G. Larsson, Director, Office of Inspection
Nuclear Power Inspectorate,
Sweden

R. L. Tedesco Assistant Director for Licensing
Division of Licénsing,
US Nuclear Regulatory Commission
Washington, USA

Mr. L.I. Tirén from the Nuclear Safety Division of the IAEA also participated as the Scientific Secretary for the Mission.

During its stay in Yugoslavia the Mission mainly interacted with staff of the following organizations :-

- Republic Committee of Energy of the Socialist Republic of Slovenia, RKE SRS (acting as the regulatory body for the Krško nuclear power plant).
- Institute "Jožef Stefan", IJS (technical advisory body to the Republic Committee)
- Nuklearna Elektrarna Krško, NEK (Krško nuclear power plant utility)
- Westinghouse Electric Corporation (vendor of Krško nuclear power plant)

The present report gives a summary of the work including recommendations of the IAEA Mission.

The Agency is obliged to the Governments of Spain, Sweden and the United States for their prompt response to the Agency's request for consultation. The effective arrangements made by the Yugoslavian authorities for the Mission are also gratefully acknowledged.

2. MISSION OBJECTIVES

Steam generator tube vibration is a concern in the operation of recent Westinghouse designed nuclear power plants, including the Krško plant. This concern has led to a proposal at Krško to modify the feedwater system before continuation of the start-up programme. The purpose of the Mission was to discuss the current situation, particularly with regard to safety, with members of authorities and Krško plant staff. In particular, the Mission was asked to give comments and advice on :

- proposed feedwater system modification, including changes in the control system
- resumed operation of Krško with regard to the steam generator tube vibration problem
- necessary documentation, evaluation and review to accept further operation of the plant as modified.

3. BACKGROUND AND CURRENT SITUATION

3.1 STEAM GENERATORS

The Krško nuclear power plant is a two-loop PWR plant of 664 MW gross electric power output. The main contractor is Westinghouse Electric Corporation. The plant has two main coolant loops each equipped with type D4 steam generators. It is the first plant with this type of steam generators to go into operation.

The D4 type includes a preheater section with cross-flow characteristics. The concern with regard to tube vibration stems from the fact that fluid induced vibrations have been experienced in preheat type steam generators used in PWR plants in Spain (Almaraz 1), Sweden (Ringshals 3) and the U.S.A (McGuire 1). As a result of these vibrations, significant tube wear in the tube-to-baffle plate intersections has been experienced in the Ringshals 3 and Almaraz 1 steam generators. These plants, however, have steam generators of somewhat different designs (Almaraz and Ringshals type D3, McGuire type D2) but are also preheater type. The most important difference is in the area of initial distribution of feedwater through the main nozzle. In the D2 and D3 types, the inlet flow is distributed upwards and downwards into the preheater tube area via an impingement plate. In the D4 type, on the other hand, all the incoming flow is directed downwards towards the bottom part of the preheater section. Common to all these steam generators, however, is the flow perpendicular to the tubes, directed by baffle plates in the preheater area (see figure 1 and 2).

MODEL D STEAM GENERATOR

FIGURE 1

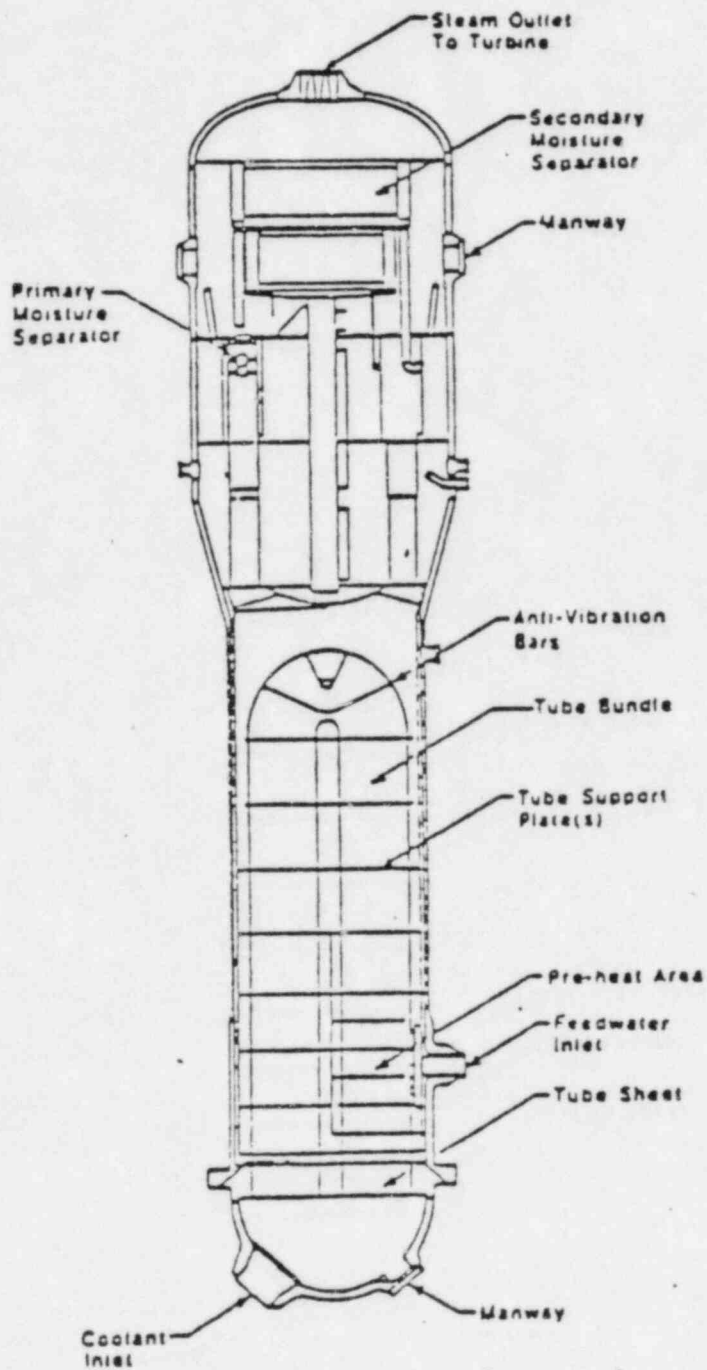
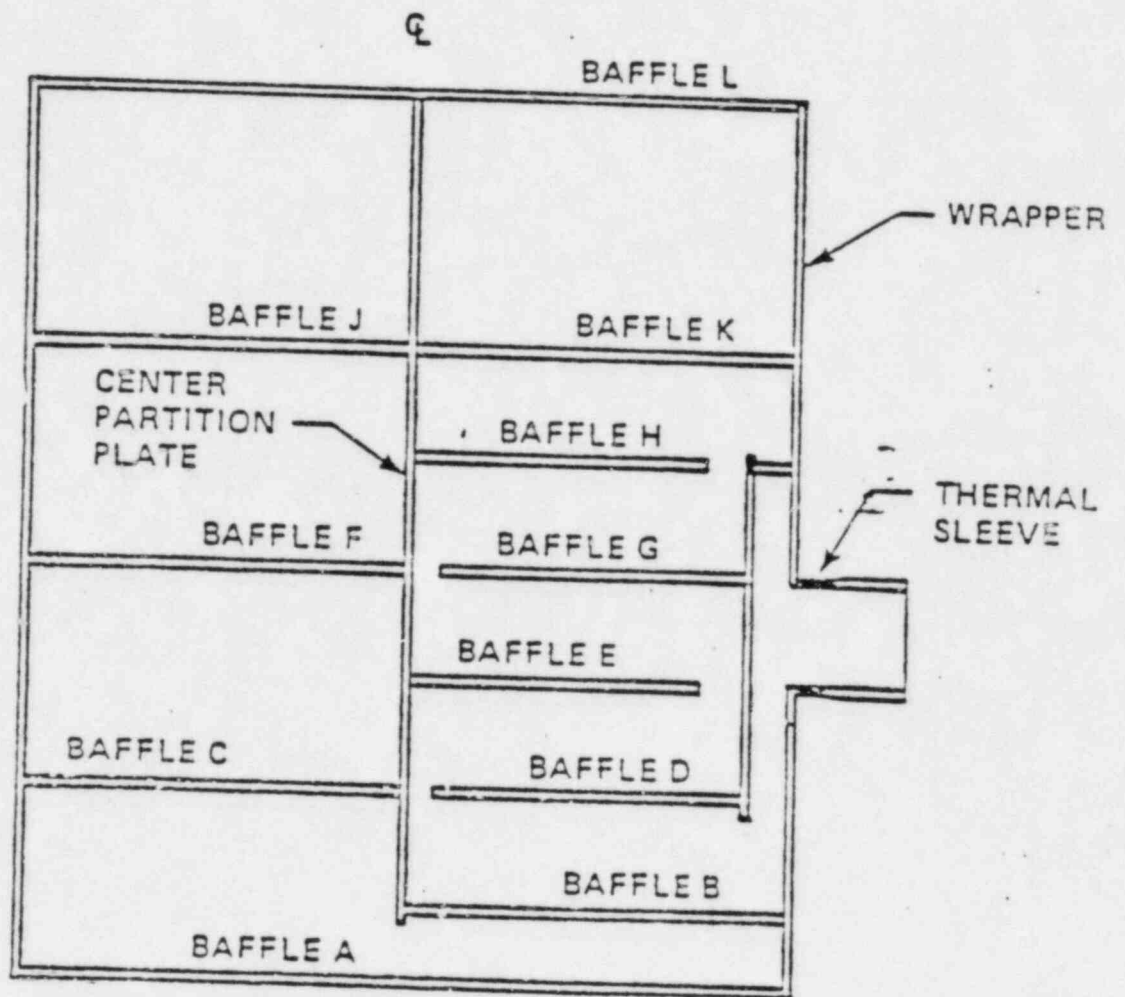


FIGURE 2

MODEL D4 LOWER SHELL INTERNALS



3.2 KRSKO OPERATING EXPERIENCE

The plant was synchronized to the external grid for the first time on 2 October 1981, and load testing at 75% power was successfully completed on 23 December. In order to study possible tube vibration, accelerometers were installed on four steam generator tubes in the preheater area in January 1982. The plant was subsequently operated at varying power levels from February to May, 1982. The operation included approximately 1500 hours at 70% and short intervals at 100% power. In the earlier full power runs, all the feedwater was introduced through the main nozzle. However, in the April and May runs at 100% power the main feedwater line was throttled to 70% flow and the additional 30% flow was fed through the auxiliary nozzle. This mode of operation was achieved by operating all three main feedwater pumps to overcome the increased flow resistance.

Accelerometer recordings made by the vendor during operation indicated steam generator tube vibrations increasing with feedwater flow. The measurements were compared with similar observations at Almaraz and Ringhals. As a result, the vendor determined that some modification to the Krško plant was necessary to permit the plant to be operated at full power. The plant was shut down on May 14, 1982, and eddy current tests (ECT) were performed on steam generator tubes. The Mission was informed that no significant indication of tube wear had been found as a result of these tests.

At the time of the Mission's stay in Yugoslavia, one of the accessible instrumented steam generator tubes was cut and pulled out for further examination. The tube location was row 49, column 56, which was considered a critical location with respect to vibrations. The Mission experts were also given the opportunity to inspect the tube visually. There were some marks visible on the tube, at the locations of tube-to-baffle plate intersections, but any depth of wear appeared to be far below the level detectable with ECT.

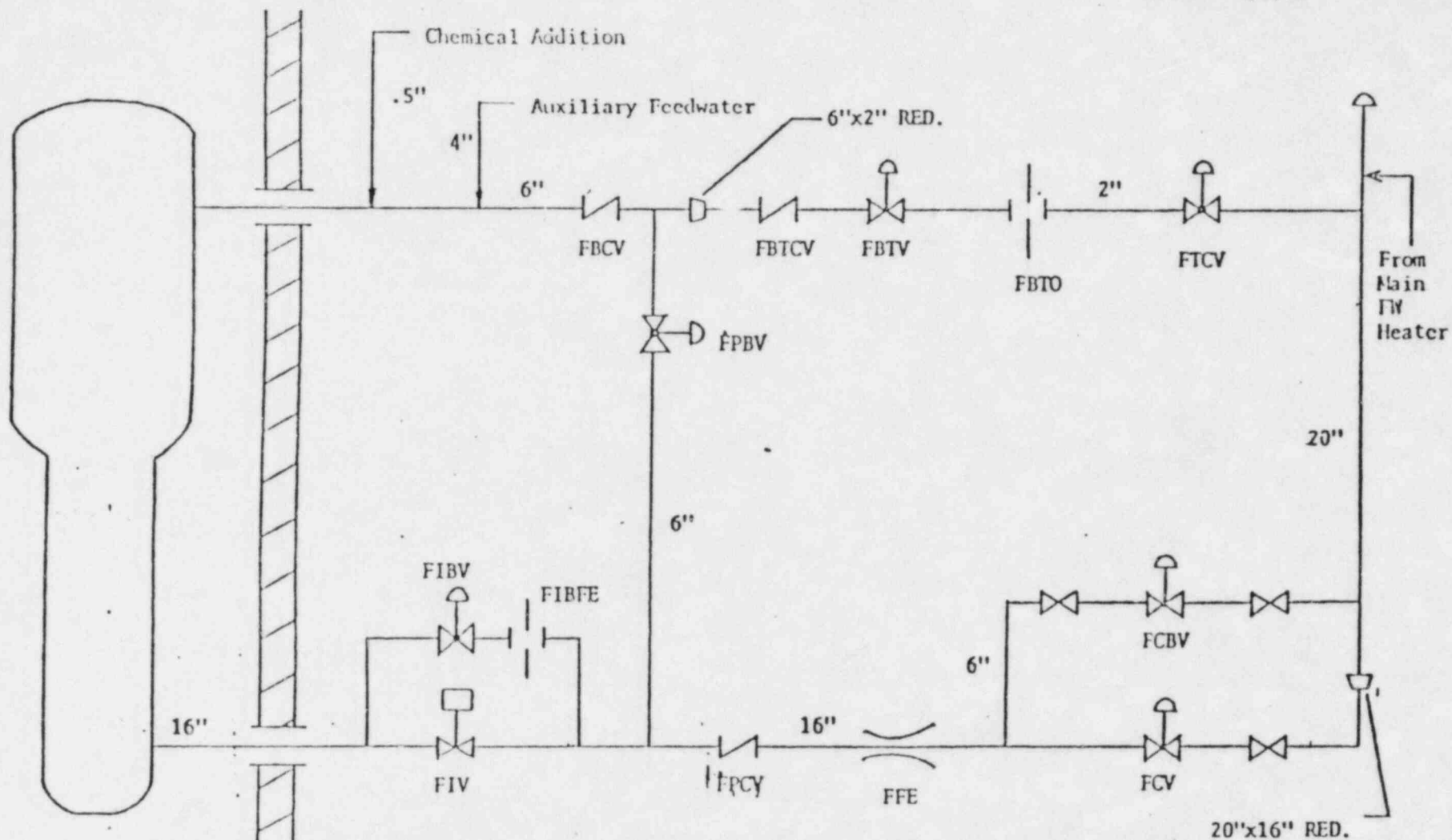
3.3. PROPOSED MODIFICATION AND PLANS FOR RESUMED OPERATION

Based on the experience of observed tube vibrations in Krško and comparison with similar data from other plants the vendor concluded that steady state feedwater flow through the main nozzle should be limited to 70% of nominal flow at full power. The vendor then developed a proposal to modify the plant to keep within this flow limit while retaining the possibility to reach 100% power. The basic change is to redirect 30% of the feedwater flow at full power from the main nozzle to the top auxiliary nozzle of the steam generators. This entails a substantial modification of the feedwater system, including new piping and valving (see figures 3 and 4) as well as major changes of the feedwater and steam generator control systems.

The proposed modification is being implemented and the necessary hardware changes are now under way. Operation of the plant as modified is planned to be resumed in July 1982.

KRSKO FEEDWATER BYPASS SYSTEM: PRESENT ARRANGEMENT

Issue: 4/1/82



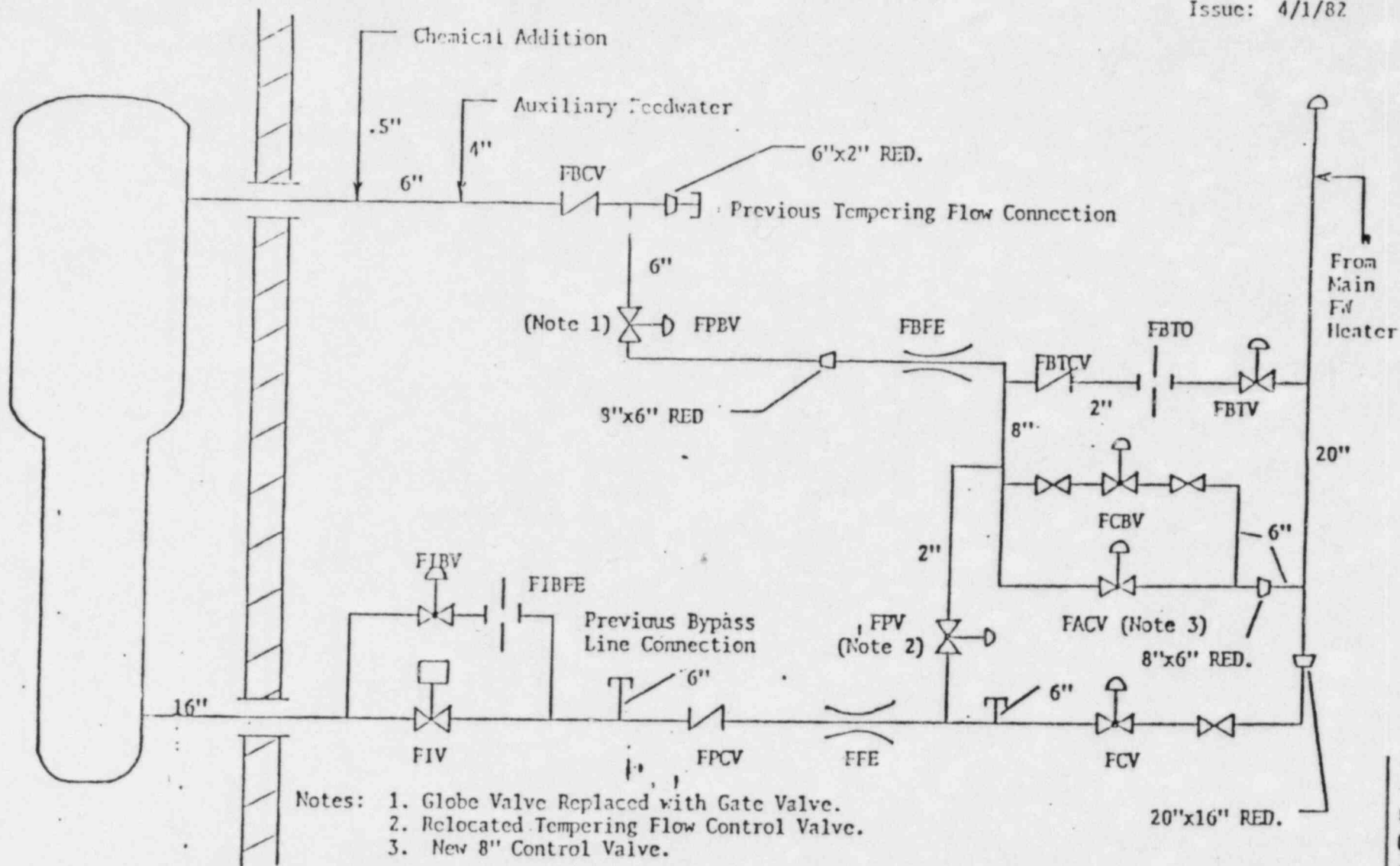
- FIV - Feedwater Isolation Valve
- FIBV - Feedwater Isolation Bypass Valve
- FIBFE - Feedwater Isolation Bypass Flow Element
- FPCV - Feedwater Preheater Check Valve
- FCV - Feedwater Control Valve
- FCBV - Feedwater Control Bypass Valve

- FBCV - Feedwater Bypass Check Valve
- FBTCV - Feedwater Bypass Tempering Check Valve
- FBTV - Feedwater Bypass Tempering Valve
- FBTO - Feedwater Bypass Tempering Orifice
- FTCV - Feedwater Tempering Control Valve

FIGURE 3

KRISO FEEDWATER BYPASS SYSTEM : FINISHED ARRANGEMENT

Issue: 4/1/82



- Notes: 1. Globe Valve Replaced with Gate Valve.
 2. Relocated Tempering Flow Control Valve.
 3. New 8" Control Valve.

FPCV - FW Preheater Check Valve
 FIV - FW Isolation Valve
 FIBV - FW Isolation Bypass Valve
 FCV - FW Control Valve
 FCBV - FW Control Bypass Valve

FBFE - FW Bypass Flow Element
 FFE - FW Flow Element
 FIBFE - FW Isolation Bypass Flow Element
 FBTV - FW Bypass Tempering Valve
 FBCV - FW Bypass Check Valve
 FPEV - FW Preheater Bypass Valve

FIBFE - FW Isolation Bypass Flow Element
 FBTO - FW Bypass Tempering Orifice
 FBTCV - FW Bypass Tempering Check Valve
 FPV - FW Purge Valve
 FACV - FW Aux. Control Valve

FIGURE 4

The authorities and Krško plant management recognize that operation of the plant as modified will be on a trial basis. While there is hope that the modification now being undertaken will be adequate as a final solution to the problem, proof to this effect has still to be awaited. Renewed start-up tests, operating experience with the modified control system and, in particular, future ECT, will have to be evaluated carefully as a basis for future conclusions in this respect.

The Mission received no detailed operating plan, and no definite limit was given on operating time before the next ECT. However, the plant technical director indicated that new ECT is envisaged to be performed in the autumn of 1982.

3.4 ASSISTANCE GIVEN TO KRSKO AUTHORITIES

The Republic Committee of Energy of the Slovenian Republic is advised by the Institute Jožef Stefan and the Engineering Bureau Electroproject in safety matters for the Krško plant. Other institutions also give advice to the authorities of the Republic of Croatia. In addition, the IAEA has, through the years, provided frequent assistance to the Yugoslav authorities on many different aspects of the Krško project. Other organizations are involved in specific areas of consultation. For example, the Krško utility, NEK, employs the NUS Corporation, USA, as a consultant.

The Yugoslav authorities have recently requested assistance by the US NRC in evaluating safety aspects of the steam generator related modification to the plant. During the Mission's stay in Yugoslavia, interim comments from the US NRC were received. The comments were based on documents provided by a Yugoslav delegation at a 25 May, 1982 visit to the NRC. The Mission was given the opportunity to read the NRC comments and found them reflecting an in-depth approach taken by the US NRC in reviewing the matter. This development, in conjunction with the reviews made by the other organizations, gives assurance that the Yugoslav authorities will continue to receive adequate guidance in safety matters related to the current steam generator problem.

4. RECOMMENDATIONS AND DISCUSSION

The present section of the report is a revised version of draft recommendations and discussion handed over to the Yugoslav authorities during the Mission's stay in Yugoslavia.

The Mission had the benefit of reviewing various design studies covering the proposed modification to the D-4 Krško steam generators. In addition, the Mission met with representatives of the licensing authority, the utility and the vendor to further discuss the proposed design modifications. On the basis of its study, the Mission developed a

number of recommendations that are set forth in this section of the report. It believes that due consideration should be given to these recommendations and appropriate actions taken prior to plant start-up following modifications that will be made in the feedwater system. It is to be noted that the recommendations presented relate to the Krško plant and do not necessarily apply to other similar plants without further evaluation.

Recommendation No. 1

The Mission recommends that the basis used to establish the 70% main feedwater flow through the steam generator preheater section should be better developed in more quantitative terms, i.e. relating feedwater flow rates to vibration frequencies, amplitudes and, in particular, wear rates.

Discussion

Westinghouse representatives at the meeting held on June 8, 1982, at the Krško site discussed some recent test results obtained from internal instrumentation installed on the D-4 Krško steam generators.

The data presented to the Mission showed minor vibration effects at a power level of 50%. The acceleration spectrum broadened and amplitudes increased with increased power and feedwater flow rates. The data extended to the case of 100% power and flow rate. These measurements, correlated with similar data from other plants, form the basis for the assumption that no damaging tube vibrations will occur in the Krško steam generators operating with a feedwater flow through the main nozzle in the 70% range. This is also the basis for the proposed feedwater system modifications. However, the vendor has not yet determined whether a correlation of tube wear with the Krško test data can be made.

The Mission believes that a more deterministic correlation should be made to better ensure the acceptability of the proposed 70% flow limit. In addition, estimates of margin should be developed to establish conservative permissible upper limits for the proposed initial operating programme. Additional test results are necessary to qualify the acceptance of extended operation at the proposed 70% main feedwater flow limit. Such results would also be useful in developing future tube plugging limits in accordance with US NRC Regulatory Guide 1.121.

A review should be made to ensure that the tubes chosen for vibration measurements constitute a conservative sample so that no detrimental vibration exists in other tubes. In addition, consideration should be given to the completeness of the model tests performed with D-4 type steam generators.

Regardless of the lack of criteria, it is, however, the opinion of the Mission that the Krško plant, from steam generator tube wear point of view, can be safely operated for limited periods, pending further confirmatory studies and ECT at the proposed operating conditions.

Recommendation No. 2

The proposed modification of the feedwater system is extensive. The Mission recommends that the independent design reviews of this modification be completed on a timely basis. The review should include mechanical and thermo-hydraulic aspects as well as those relating to control and protection system modifications.

Discussion

The Mission notes that, in addition to the design review made by the Institut Jožef Stefan, the authorities now receive assistance by the US NRC in this matter. The independent review should deal with selected design aspects to provide added assurance of the overall adequacy of the proposed modifications.

With regard to the steam generators, the Mission identified the concern of vibration of the intermediate deck plate due to the increased auxiliary nozzle flow injection.

Reduced flow through the preheater section (from 100% to 70% flow) may lead to increased steam formation at the bottom part of the preheater. The Mission was informed that the vendor did not expect any water hammer hazard to develop as a result of increased steam generation. A criterion was quoted under which no net steam formation should occur in the four first passes of the preheater. This criterion would also be met at the reduced flow operation.

The reduced flow could also result in sludge deposition at steam generator tube-to-baffle plate intersections. Again, the vendor's evaluation showed that sufficient flow velocities are maintained to prevent sludge deposition.

However, it is the Mission's opinion that these concerns justify careful monitoring during initial start-up and subsequent plant operation.

Results from model tests in Sweden have shown extremely high and instable flow velocities after the main feedwater restrictor nozzle in the D-3 type steam generator. For this reason, the Mission would recommend for future possible action that the exchange of this restrictor by a multi-venturi nozzle restrictor be considered for Krško as a means to reduce the velocities and to provide a more uniform flow distribution into the downcomer channel. This should ensure a steady flow entrance to the preheater tube-bank.

It is the Mission's view that the design review may be made in conjunction with initial plant operation but should be completed as a prerequisite for acceptance of the modification as a permanent solution.

Recommendation no. 3

The Mission recommends that careful consideration be given to ensure that there would be no adverse interactions between the control and safety features of the feedwater system.

Discussion

The proposed modifications include changes to the reactor protection system, the feedwater control system and the auxiliary control system. The effects of such changes with regard to possible adverse system interactions should be fully understood, especially under transient and accident modes and at various flow conditions. Of particular concern would be the effect of the proposed changes on overcooling transients, transients involving switch-overs (e.g. load rejections), and other such events included in Chapter 15 FSAR analyses. Further, no adverse failures in the control system should preclude the operation of any required safety function.

The set-point study should be revised to take into account control system modifications.

The proposed modification includes deletion of the steam/feedwater flow mismatch trip. Westinghouse informed the Mission that no credit has been taken for this trip in the safety analysis of the plant. The Mission was also informed by telephone on June 10, 1982, that the US NRC has accepted the deletion of this trip as a generic change.

Recommendation no. 4

The Mission recommends that an operating program be established to specify permissible operating modes at various main feedwater flow rates through the main nozzle and allowed short term operation at rates above 70%. The initial operating program should include a definite operating time limit at 70% flow until the next ECT is to be performed.

Discussion

At the meeting held on June 8, 1982, it was not apparent that operating limits had been fully evaluated. Permissible operation at 70% flow for a specified time period prior to the next ECT inspection should be established prior to plant restart. In addition, off-normal conditions wherein flow in the preheater could exceed 70% should be evaluated. This includes consideration of a maximum limit, and permissible times for anyone event or number of events where 70% flow would be exceeded.

The merits of a passive device versus the present flow alarm for limiting the flow should be evaluated especially with regard to excess feedwater transients.

Recommendation no. 5

The Mission recommends that, prior to operation in the proposed mode, a comprehensive start-up testing programme should be established. Test during the start-up phase should be performed to confirm predictions. In addition, operator training should be conducted prior to operation in the proposed mode, to account properly for the modified operating procedures.

Discussion

Clearly the proposed changes to the operation of Krško involve new demands on the part of the operator to properly respond to plant changes. This is especially true in the ranges where flow changes and flow-split occurs. Westinghouse should provide technical bases for system operations to establish the start-up test programme. The results of previous tests should be re-evaluated. Subsequently, proper detailed operating procedures should be prepared, reviewed and approved prior to plant start-up for the new operating modes. In addition, control system stability and the possible change in the potential for adverse water hammer in the preheater and auxiliary piping of the feedwater system should be investigated and procedures verified to deal with such events.

Recommendation no. 6

The Mission recommends that the new operating characteristics in the preheater section with the revised flow-split be evaluated to assure that no adverse changes will occur in thermal and hydraulic design basis for the D-4 steam generator.

Discussion

Further studies are needed regarding the flow distribution in the D-4 steam generator. Better understanding appears to be needed about the flow through the auxiliary feedwater nozzle and how it may affect main feedwater flow at various power levels. The consequences of using the auxiliary feedwater piping and nozzle should be evaluated using conservative assumptions of auxiliary feedwater flow and temperatures considering critical system malfunction.

Those portions of the transient and accident analysis, contained in Chapter 15 of FSAR, which are affected by the modifications should be identified. The safety analysis should be revised as necessary and should then be reviewed independently.

It must be understood that the modifications will result in a small decrease in plant thermal efficiency. In this context, the Mission was informed about plans to increase primary coolant average temperature by approximately 1.5°F in order to improve thermal efficiency. The Mission is concerned that such a change may have implications which have not been clarified in the area of safety margins and should therefore not be attempted until consequences of other modifications have been reviewed, and operation of the plant as modified has progressed satisfactorily.

Recommendation No. 7

The Mission recommends that, as additional information becomes available from the Krško and other ongoing related programmes, the proposed modification and operating program should be reevaluated and programmatic changes be made as appropriate.

Discussion

As in any program of the type being investigated at Krško, due attention must be given to the utilization of any new understanding or information that may become available. Apparently, the vendor will be in a position to provide additional information, due to his involvement with other similar plants. This information would serve to help the utility to better assess the full impact of steam generator vibration problems on the operation of the Krško nuclear power plant. Every effort should be made to provide such information as it becomes available.

In addition, the licensing authority is encouraged to continue establishing good contacts with the authorities in the countries with D-2, D-3 and D-4 steam generators.

Recommendation No. 8

The Mission recognizes the wide-spread impact of the modifications on the Krško plant. Accordingly, careful attention must be given to the quality assurance (QA) aspects associated with all the changes being made to ensure that the modifications have been carried out in accordance with the stated objectives for plant operation.

Discussion

Recent experience at other nuclear facilities involving plant design and construction activities have shown the need for establishing an adequate Quality Assurance programme to ensure that proper design verification and plant modifications are carried out according to stated objectives in the FSAR as amended. Similar concern is applicable to the modifications being proposed at the Krško plant for the feedwater system. The utility should ensure the adequacy of their QA programme so that the proposed changes are implemented in the intended manner. This involves such activities as design control and plant walk-down to ensure proper implementation of the required changes prior to operation. In addition, QA for operation should be included to cover appropriate operation aspects.

APPENDIX I

SUMMARY OF MISSION ACTIVITIES

Sunday, 6.6

The Scientific Secretary for the Mission met with Dr. Milan Copic of the Republic Committee of Energy of the SR of Slovenia. The objectives of the Mission were discussed and major items for the agenda were identified.

Monday, 7.6

Initial presentations and discussions were held at the Krško plant with the Mission and representatives of the Republic Committee of Energy, the Institut Jožef Stefan, and the Krško utility, NEK. The present situation at the plant was explained and the major problems of the steam generators and plant modification were outlined by the NEK Technical Director. A flexible agenda for the Mission's work was agreed upon.

Information material in the form of the FSAR with amendments and other documents was provided to the Mission.

A short tour of the plant was made.

Tuesday, 8.6

Additional documents were provided to the Mission, including a series of questions raised by the Krško utility and vendor responses regarding the steam generator vibration problem and the proposed feedwater system modification. Written comments made by the Institute Jožef Stefan were also given to the Mission for information.

The day was mainly spent by the Mission in examining the documents received as a basis for their findings and conclusions.

The Mission made a visual inspection of a steam generator tube pulled out for further detailed examination by vendor and utility experts.

Wednesday, 9.6

In the morning, presentations were given by representatives of the vendor. The presentations included an account of steam generator tube vibration measurements, a description of the feedwater system modification, and a more detailed presentation of proposed changes to the control and protection system. The Mission was given ample time to put questions to the vendor experts.

Based on the information given, the Mission members discussed among themselves their views on the current problems. These discussions continued for the remaining part of the day. A set of Mission findings and responses to the concerns expressed by the licensing authority and the Krško utility was drafted.

Thursday, 10.6

The initial Mission draft findings were handed over to the licensing authority and Krško utility representatives for their comments. A discussion on the draft was held, with participation from the Republic Committee of Energy, the Institut Jožef Stefan, the Krško utility and the NUS consultant firm.

The Mission then spent the remaining part of the day in formulating and supplementing their draft recommendations. The new draft was given to the Republic Committee of Energy representative at the end of the day.

Friday, 11.6

In the morning, a presentation was given by Professor Ingvar Jung. This was made on the request of the Republic Committee of Energy and dealt with the current steam generator tube wear problem at the Ringhals 3 plant as well as related research, tests and development in Sweden. The Swedish State Power Board (Ringhals utility) and Westinghouse are conducting tests on a full scale model of a section of a Ringhals steam generator (see Appendix II of this report).

The new Mission draft recommendations were then discussed with the Yugoslav representatives, including additional explanations by the Mission.

Three of the Mission members left Yugoslavia on this day.

Saturday, 12.6

The remaining Mission members continued discussing the draft recommendations, mostly with regard to editing items, and also the structure of the final report to the Government of Yugoslavia.

APPENDIX II

SWEDISH EXPERIENCE OF STEAM GENERATOR TUBE
VIBRATIONS AND TESTING PROGRAMME

by

I. Jung

The following Appendix is a summary of a presentation given at Krsko on 11 June, 1982. The views expressed here are those of the author, Professor Ingvar Jung.

1. DIFFERENCE BETWEEN D3 AND D4 TYPE GENERATORS

The situation at Ringhals 3 and 4 (R3 and R4) steam generators of D3 type is much more complicated and grave than at the two D4 generators at Krsko. In the D3 type generators the flow from the restrictor nozzles goes straight into the tube bank between baffle plates 6 and 7 and the tubes are only unsufficiently protected by two holed circular impingement plates. At R3, there are indications of vibrations of dangerous amplitudes already at 40% feed of the 600 Kg/s nominal full load value.

In the D4-generators the feedwater flow from the main inlet is passing down through a downcomer channel to the bottom baffle plates. The tube bank in the preheater section is shielded from the jet forces and the instable flow from the flow restrictor nozzles by a tight impingement plate. At Krsko, tests were presented to the Mission indicating that no vibrations of importance occur in the tubes at feed flows to the main inlet below 60-70% of the full continuous flow 550 Kg/s. With a top feed of 30% and with the 4-nozzle flow restrictors exchanged by a multi-nozzle restrictor with venturi diffusors of sensible design the tube bundles should then be outside vibration risk zones.

2. HISTORY OF R3 AND R4 D3-STEAM GENERATORS

R3 was started in the spring 1981 and had worked at power levels greater than 90% for about 3000 H when tube failures and tube leakages were found in October 1981. The unit was stopped and some 1750 tubes were eddy current tested. 230 tubes had indications of severe wear in the contact areas with the baffle plates in the preheater section. 31 tubes had wear diminishing the tube wall thickness to less than 40% in the three first tube rows with maximum wear in the plates 6 and 7 but spread from plate 5 to plate 9. These 31 tubes were plugged and R3 was started up again with only 40% load. After 1500 hours the unit was stopped and the generators again inspected by ECT. In one generator signs of increased wear have been found in June 1982.

Findings

At full flow, the 4-nozzle flow restrictor exhibits flow velocities of 30 m/s in the throat section and 15 m/s at the outlet of the restrictor insert. Flow measurements show that the velocities after

the insert are very unstable with pressure fluctuations (total pressures) of approximately ± 0.7 bar. The two circular, holed impingement plates arranged before the tube banks between baffle plates 6 and 7 (intended to distribute the flow from the feed inlet) are completely insufficient to protect the tubes (with a free span of 550 mm) from the impact of the jets and to spread the flow uniformly. Velocities into the tube bank in the section between plates 6 and 7 are found to be very unstable and ununiform. Velocities from plus 10 m/s to minus 2 m/s were measured in the entrance space before the first tube row. With completely uniform flow into row 1, the horizontal velocity should be 0.7 m/s before the tubes, and about 2.3 m/s in the gap area. Even under stable flow conditions, these velocities are in the zone of vibration danger, according to Connel criteria, especially with regard to the first two to three tube rows.

Proposal for design changes and repair

The following design changes are under consideration and are tested at full scale experiments at Aelvkarleby as well as in model air and water tests at Aelvkarleby and in Finspaang, Sweden.

- A. To exchange the 4-nozzle flow restrictors by a multi-nozzle design with venturi diffusers reducing and rectifying the outlet feed velocity to the minimum possible (corresponding to the feed inlet area).
- B1. To introduce vane diffusers in the feed outlet between baffles 6 and 7 in order to distribute the flow uniformly to the tube bank ;
- B2. To install hole plate restrictors and rectifiers in the feed outlet as in B1 ;
- B3. To install internal manifolds (sprinklers) consisting of double hole plates made of sections covering most of the tube bank entrance area ;
- B4. To take out the two first tube rows and insert solid bars in the preheater section in order to secure a stable and uniform flow to all rows from row no. 3 ;
- B5. To install a five row dummy grid of solid bars through the feed inlet between plates 6 and 7. The tubes in the middle of row 1 have to be taken out to give place for the U-form restrictor-rectifier grid bundle.
- C. - To fasten the first two tube rows in the middle of the span between plates 6 and 7 by springs or fingers between the tubes.
- D1. To introduce 30% top feed like the arrangement now installed at Krsko ;

- D2. To open windows between the baffle plates to by-pass a portion of the feed flow through the preheater section, vertically upstream and downstream.

My personal opinion is that the solution will be a combination of measures A1, B3 or B5 and D1 for Ringhals 4 and A1, B4, B3 or B5 and D1 for Ringhals 3.

APPENDIX III

List of Participants in discussions with the IAEA Mission

J. Aralica	Technical Director, Operation	NEK
N. Bernot		IBE
P. Bilčar	Superintendent, Erections	NEK
V. Bradač	Manager, Quality Assurance	IE
J. Brguljan	Manager, Quality Assurance	NEK
M. Copic	Chairman, Advisory Board of Reactor Safety	RKE SRS
I. Durdek	Chief of QA/QC Engineering	NEK
A. Fabijančić	Planning and Scheduling Department	NEK
V. Fatur		RKE SRS
D. Feretić	Technical Director	NEK
L.G. Fitzgerald	Vice-President Intern.Operations	NUS

M. Gregorić		IJS
D. Horwat	QA Consultant	IMK
V. Janoschek		UNSD
M. Jeran		IBE
P.V. Judd	Consultant	NUS
B. Mavko	Coordinator, Nuclear Safety	IJS
Z. Pavlović	Manager, Licensing and design	NEK
D. Tankosić		NEK
P. Tosaš		IRB
J. Valčić		RKEIRZ SRH
B. Vojnović		IRB

Westinghouse attendees at presentation (1982-06-09)

J. Alba	Nuclear Technology Division - Systems Engineering	
E.M. Burns	Nuclear Technology Division - Nuclear Safety & Licensing	
D. Comoletti		

ATTACHMENT E

NUREG-0886, TABLE 6

Steam Generator Tube Experience

Manuscript Completed: December 1981
Date Published: February 1982

C. Y. Cheng
Task Leader

Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555



Table 6. Occupational exposure related to steam generator maintenance, replacement and repair from selected PWRs (1974-1981) (dose in man-rem)

Plant	1981		1980		1979			1978			1977			1976	1975
Oconee 1, 2, 3	(2)	(3)	(1)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)		(1)
Maintenance	25	18	58	16	276	23	14	26	32	34	28	2	6		
Repair/replacement	155	8	87	--	52	12	--	82	37	21	47	25	7		
Total	206		161		377			232			115				44
Related outage time															
Robinson 2															
Maintenance			212		97										
Repair/replacement			91		--										120
Total	322		303		97		194		None		121				130
Related outage time	90d		96d		21d*						21d*				250
															56d*
															21d*
San Onofre 1		81-80 [†]													
Maintenance		42						65			75				
Repair/replacement		3451						--			250				
Total		3493**						65			325				
Related outage time		273d													
Indian Point 2, 3	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(3)	(3)						
Maintenance	39	--	99	65	120	--	346	25							
Repair/replacement	4	157	10	90	15	22	--	41							
Total	200		264		157		412				31				
Related outage time															
Point Beach 1															
Maintenance															
Repair/replacement															
Total			269		235		62		125		45				
Related outage time			24d												
Surry 1, 2	(1)		(1)		(2)										
Maintenance															
Repair/replacement															
Total	1430***		329***		2140***		788		1058*		1287			638	100
Related outage time		289d			331d										

See footnotes, last page of table.

Table 6. (continued)

Plant	1981	1980	1979	1978	1977	1976	1975	1974
Turkey Point 3, 4	(3) (3)	(3) (1)						
Maintenance	75	92						
Repair/replacement	239 ^{**} 68	46						
Total	382	425	335	335	450	600		200
Related outage time	71d	103d	42d	17d	70d	40d		

*Estimated.

** Tube sleeving effort

*** S/G replacement

†Data for 1980-1981.

NOTE: Figures are rounded off to nearest whole number.

Outage time is reported in days (d).

Unit numbers (1), (2), (3), (4).

Of the 12 units covered in Table 6, nine are designed by Westinghouse, and three by Babcock and Wilcox

ATTACHMENT F

CECO'S NOVEMBER 17, 1982 RESPONSE TO

ROCKFORD LEAGUE OF WOMEN VOTER'S

INTERROGATORY NO. 4

Interrogatory No. 4

- (c) provide copies of all operating procedures concerning steam generators, water quality and chemistry control and any other operating procedures which are significant to the control of the operation of the steam generators within the design limitations, including but not limited to pressure, temperature, fatigue and corrosive limits, and if any of the above procedures are not yet available but are expected to be produced prior to operation of the Byron Plant, provide the titles of these procedures;

RESPONSE:

(c) The following is a listing of the Byron Operating and Chemistry Procedures or documents which concern the steam generators, their water quality, and chemistry control. For each procedure, the status of its development is provided. Procedures listed as "identified" have not been drafted. The titles of the procedures are as follows:

1. Operating Procedures

Procedure Number	Procedure Name	Approved	In Draft	Identified
BOA SEC-8	S/G Hi Conductivity/Operating Limitations			X
BOG CD-3	Placing S/G in Wet Lay-up	X		
BOP PS-3	S/G Blowdown Sample			X
BOP PS-5	S/G Monitoring			X
BOP SD-1	Start-up of S/G Blowdown			X
BOP SD-2	Shutdown of S/G Blowdown			X
BOP AF-3	Placing the S/G in Wet Lay-up	X		
BOP CF-8	Main Feed System Chemical Feed			X
BOS 7.2.1-1	S/G Press/Temp Limitations with Primary or Secondary Coolant less than 70' F			X
BOS 4.5.0-1a	S/G Inoperable			X
BOS 4.7-1a	RCS Chemistry Surveillance			X
BOS 7.2.1-1a	S/G Press/Temp Limit Exceeded			X
BVS 4.5.0-1	ASME Surv. Requirements for S/G's			X
BVS 4.5.1-1	S/G Inspection Shutdown			X
BVS 4.5.2-1	S/G Tube Inspection			X
BVS 4.5.3-1	S/G Inspection Frequencies			X
BVS 4.10-11	S/G Eddy Current Examination			X

The following are titles of operating procedures which will be written following the submittal of the Westinghouse recommendations for the D-Model Steam Generators and other operating procedures which will be developed for the condensate polisher system.

2. Chemistry Program Descriptions

Procedure Number	Procedure Name	Approved	In Draft	Identified
BPD 100-3	Flushing		X	
BPD 100-4	Secondary Chemistry Monitoring		X	
BPD 100-5	Hot Functionals		X	
BPD 100-7	Circulating Water Chemistry			X
BPD 100-8	Failed Fuel			X
BPD 200-1	Quality Control		X	
BPD 200-7	Data Management		X	
BPD 300-3	NRC Requirements			X

3. Chemistry System Descriptions

<u>Procedure Number</u>	<u>Procedure Name</u>	<u>Approved</u>	<u>In Draft</u>	<u>Identified</u>
BCD 200-1	Condensate		X	
BCD 200-2	Feedwater		X	
BCD 200-3	Heater Drain		X	
BCD 200-4	Main Steam		X	
BCD 200-5	S/G Blowdown		X	
BCD 200-6	Condensate Polishing			X
BCD 300-2	Auxiliary Feedwater		X	
BCD 300-3	Auxiliary Steam		X	
BCD 300-5	Chemical Feed		X	
BCD 300-7	Circulating Water		X	
BCD 300-10	Make-up Demineralizers		X	
BCD 300-14	Process Sampling			X

4. Chemistry Procedures

<u>Procedure Number</u>	<u>Procedure Name</u>	<u>Approved</u>	<u>In Draft</u>	<u>Identified</u>
BCP 300-9	S/G Tube Leak Detection		X	
BCP 300-10	Secondary System Air Inleakage			X
BCP 300-11	Condenser Tube Leak Detection			X
BCP 400-T22	Chemical Addition Log	X		
BCP 400-T35	Chemical Addition to the Secondary Side			X
BCP 400-T37	Secondary Side Chemistry Data			X
BCP 700-1	Limitations and Actions			X

CROSS-EXAMINATION

1

BY MR. GALLO:

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Q Mr. Bridenbaugh, how many years did you work
at the General Electric Company?

4

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A Approximately 22.

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Q During that time did you ever have occasion to
become involved or to work on the design of a Westinghouse

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(Continued next page.)

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1 steam generator?

2 A No, I did not.

3 Q Did you ever have the occasion to become involved
4 or to work on the fabrication of a Westinghouse steam
5 generator?

6 A No.

7 Q How about maintenance activities with respect to
8 such a Westinghouse steam generator?

9 A No, not when I was at G.E.

10 Q Did you ever have any kind of experience with
11 respect to a Westinghouse steam generator while you worked
12 at the General Electric Company?

13 A Yes, I think I can say that I did.

14 Q On a Westinghouse steam generator?

15 A Yes. Did you say did I have any experience
16 related to Westinghouse steam generators. That is how I
17 understood your question, and let me explain why I think
18 I did. Part of my duties while I was at G.E. during the
19 latter few years was a job as manager of Performance
20 Evaluation and Improvement. In the course of that work
21 I was responsible at G.E. for not only tracking the generic
22 problems, that were plaguing the boiling water reactors
23 built by G.E., but also keeping track of the generic
24 problems that were plaguing the industry as a whole.

25 So for a number of years I was keeping quite close

1 watch over the failures that were causing all reactors,
2 including Westinghouse reactors to not operate, and some
3 of those included Westinghouse steam generators.

4 Q When was it that you were doing this? During what
5 years were you doing this tracking?

6 A I was at G.E. San Jose Nuclear Division from 1966
7 through 1976, and the primary time at which I was keeping
8 track of operating experience was the period of 1970 through
9 '76.

10 Q What information did you utilize to keep track
11 of Westinghouse steam generator problems during the years
12 that you mentioed, '70 to '76?

13 A It varied from time to time, as I am sure you
14 are aware. The reporting requirements for operating reactors
15 has changed considerably in the past 10 or 15 years. In
16 the earlier period of time there was ---

17 Q You are talking '70 to '76?

18 A Well, I am talking in the past 15 years from
19 now back through 1968 I guess.

20 Q What I want to know is what information you used
21 during the years of 1970 to 1976 when you were tracking
22 Westinghouse steam generator problems?

23 A It was information that was available in the
24 Public Document Rooms. It was information that was reported
25 by the Edison Electric Institute. It was information that

1 was made generally available in engineering conferences,
2 public information that was available and information that
3 G.E. obtained from the local installation and service
4 engineering people who were keeping track of plant performance
5 at all utilities.

6 Q Did you ever receive any information directly from
7 Westinghouse?

8 A No, I did not, other than papers at a conference
9 and that sort of thing.

10 Q Did you ever receive any information from some
11 utility owner of a nuclear plant with Westinghouse steam
12 generators?

13 A That is a pretty broad question, Mr. Gallo. I am
14 sure I did. You are speaking of information specific to
15 steam generators?

16 Q Yes, that is right.

17 A I obviously received information from the
18 utilities on Westinghouse plants.

19 Q Let me ask the question again. Did you ever
20 receive any information on Westinghouse steam generators
21 from utility owners who had nuclear power reactors which
22 Westinghouse provided the steam generators for those
23 facilities?

24 A Yes. I can think of at least one occasion when
25 I did.

1 Q Can you please explain?

2 A I did quite a bit of work in Italy on a boiler
3 water reactor provided by G.E. to the Italian utility whose
4 name changed a couple of times. At about that same period
5 of time the same Italian organization had a Westinghouse
6 design plant which had a number of problems in, as I recall,
7 in the late '60s and early '70s and I had quite close contact
8 with the people responsible for the nuclear program and
9 I had a number of conversations with them and received informa-
10 tion on the problems that were experienced at that time.

11 Q Was that information concerning the Westinghouse
12 steam generator?

13 A It was not information concerning the technical
14 problems. It was information I would say concerning
15 Westinghouse's response to problems in general and the
16 working relationships and the problems they were having
17 with resolving those particular problems at that operating
18 plant because of that relationship.

19 Q Then it did not involve information concerning a
20 Westinghouse steam gnerator; is that correct?

21 A I said it did not involve detailed technical
22 information. I think it is certainly applicable to
23 Westinghouse steam generators.

24 Q Do you recall what it did involve as it applied
25 to Westinghouse steam generators?

1 A I am sorry, I did not hear what you said.

2 Q Do you recall what it did involve with respect
3 to a Westinghouse steam generator at that Italian facility?

4 A My recollection was like this, and I will explain
5 why I think it involves steam generators. It involved the
6 problems that the utility had in getting a fix completed
7 at the plant which at that particular fix did not involve
8 a steam generator. It involved reactor internals as I recall,
9 but the information that was given to me told me of the
10 difficulty that the utility had in getting Westinghouse
11 to act on this particular problem.

12 I think that is relevant to the steam generator
13 issues because it is indicative in my mind of the response
14 or responsibility of Westinghouse to problems in the plants
15 after the plants go into service.

16 Q This is some sort of management problem you are
17 referring to rather than a technical problem; is that correct?

18 A Management of technical resources, yes, sir.

19 Q Is this the only occasion then during the years
20 of '70 to '76 where you were the recipient of information
21 from either a foreign or domestic utility with respect to
22 Westinghouse steam generators?

23 A I am sure it is not the only occasion, but it is
24 the most vivid one that I recall.
25

1 Q It is the only one that you can recall at this time?

2 A Well, Mr. Gallo, I can recall during those years
3 in the course of my duties at G.E. meeting with South Cal.
4 Edison at San Onofre Unit 1 and spending quite a bit of
5 time with the utility and plant operator discussing their
6 particular problems.

7 I don't recall whether we discussed steam generators
8 in any great detail at that time, but I know that all of
9 the different concerns that the plant operator had were
10 discussed and in my opinion quite openly with me. I have
11 had similar conversations with a number of other utilities
12 and to be perfectly frank, I have no make a record of those.
13 I could go back and try and reconstruct others if it is
14 important.

15 Q Were you during those years a signatory to a
16 Westinghouse proprietary agreement?

17 A No, I was not.

18 Q I assume you did not get any Westinghouse proprietary
19 information during these years?

20 A Well, if I did, I returned it to Westinghouse.
21 The reason I hedge on that perhaps a little bit is at the
22 same time when I was at G.E. I also had some responsibilities
23 in the supply of reload fuel. I recall getting some proprie-
24 tary prints from a utility relating to competitors' fuel
25

1 which I returned, but I do not remember which utility it
2 was.

3 Q But this information had nothing to do with
4 Westinghouse steam generators, did it?

5 A Not as I recall.

6 Q Did you have available to you the operating
7 experience of plants during the years 1970 through 1976,
8 plants that had Westinghouse and triple S systems and
9 Westinghouse steam generators?

10 A Did I have at that time?

11 Q Yes, '70 to '76.

12 A To the extent that the information was available
13 either in the public record or through the information
14 gathering system formal and informal that General Electric
15 had, yes.

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2 Q Essentially you acquainted yourself, if I under-
3 stand your testimony, you acquainted yourself with respect
4 to Westinghouse steam generator matters during the years
5 of 1970-76 based on documentation that was generally available
6 to the public from the NRC or other sources, is that correct?

7 MR. THOMAS: I am going to object to that. He
8 has been asking questions and the witness has indicated the
9 extent of his familiarity from various sources.

10 MR. GALLO: I have elicited a number of answers
11 to my questions from the witness and I now am trying to
12 ascertain that I indeed have a correct understanding of
13 his testimony. I think it is a proper question.

14 MR. THOMAS: I think there are portions of informa-
15 tion that he elicited that were left out of the summary
16 type of question which is the problem.

17 MR. GALLO: If that is true, the witness will
18 correct me.

19 JUDGE SMITH: Please correct him if that is the
20 case.

21 THE WITNESS: I will do my best, Judge.

22 I don't recall exactly what your question was,
23 Mr. Gallo, but I think I have the drift of it.

24 MR. GALLO: I will ask it again.

25 BY MR. GALLO:

Q My question was during the years of 1970 to '76

1 when you were tracking, among other things, problems
2 involving Westinghouse steam generators, is it my under-
3 standing of your testimony that generally the information
4 that you relied upon during this time was information generally
5 available to the public through the NRC and other sources?

6 A I would say in response to your question that is
7 generally correct. However, and I think this is an important
8 however, we must keep in mind that during that period of
9 time I was involved in G.E.'s Nuclear Division and I happened
10 to be functionally located for some of that period of time
11 within the Marketing Department.

12 One of the particular things that G.E. was most
13 interested in and one of the things that I was working on
14 to some degree was comparing the performance of G.E. BWRs
15 to pressurized water reactors, including Westinghouse,
16 Combustion Engineering and B&W.

17 The interest in that comparison was of course
18 motivated to some degree to try and make sure that boiling
19 water reactors at least equalled the performance of PWRs
20 and we attempting to have them perform better so that we
21 could get a better share of the market.

22 In the courses of doing that, it was of course
23 within G.E. quite important that a close track of competitors'
24 equipment performance be obtained. So while you can say
25 that the information we obtained was through the normal

1 public channels, I think you have to also recognize that
2 it was through the normal public channels as a result of
3 a quite concerted effort by a number of organizations within
4 G.E.

5 Q Was this information engineering data and technical
6 information on the Westinghouse steam generators or was
7 it just information on the available of plants which happened
8 to operate with Westinghouse steam generators?

9 A I would say it included both.

10 Q And this was information on Westinghouse steam
11 generators that you were getting?

12 A Among other information, yes. Let me say that
13 G.E. considered steam generators to be the Achilles heel,
14 if you will, of a depressurized water reactor. So we
15 were quite interested in that.

16 In the presentations that were made to utilities
17 we frequently discussed that particular component, because
18 that is a component that is not present in most boiling
19 water reactors.

20 Q When did you leave the General Electric Company?

21 A 1976.

22 Q Have you had occasion since that time to become
23 involved in the design activities of a Westinghouse steam
24 generator?

25 A I have not designed a Westinghouse steam generator,

1 no, sir.

2 Q How about since 1976, have you become involved
3 in the fabrication activities of a Westinghouse steam
4 generator?

5 A No, I have not, not in fabrication per se.

6 Q How about the maintenance activities of a Westinghouse
7 steam generator?

8 A I have in the course of the work that I have been
9 doing as a consultant, I have followed very closely the
10 continuing performance of Westinghouse steam generators
11 and other steam generators for that matter. Much of my
12 background is in the maintenance and the maintenance manage-
13 ment and planning and I have been very interested in that
14 and I have continued to follow that and to keep abreast
15 of the problems and the new developments as I can.

16 Q Have you done any maintenance planning for a
17 Westinghouse steam generator since 1976?

18 A I have not done maintenance planning for a
19 utility since 1976 on a Westinghouse steam generator. However,
20 I have done fairly detailed reviews of such planning
21 activities on a number of plants, one of which is a
22 Westinghouse designed plant, Salem Unit 1 owned and operated
23 Public Service Electric Gas in New Jersey.

24 I was employed on a consulting basis by the Public
25 Advocates Office in the State of New Jersey to investigate

1 the maintenance planning activities of the first refueling
2 outage of Salem 1 to go over the critical path schedule,
3 the different maintenance tasks that were conducted at that
4 plant at that time to identify the reasons for the outage
5 extensions and to report the results of that activity to
6 my client.

7 In the course of doing that we had full and
8 complete discovery arrangement with the utility. I met
9 with the utility a number of times and obtained complete
10 copies of their maintenance schedule, maintenance work list
11 and obtained a lot of information in the courses of that
12 job.

13 Q When was this?

14 A The particular outage in question began in March,
15 as I recall, of 1979 and extended through the end of that
16 year. The time that I was doing this analysis, if you will,
17 of that outage for the State of New Jersey, was in 1980
18 and extended as I recall in 1981.

19 Q Did the utility perform maintenance on the steam
20 generators during this outage?

21 A They certainly performed inspection on steam
22 generators. My recollection is that there were no unique
23 maintenance activities performed.

24 Q Then in fact in your review of the Salem maintenance
25 planning procedures you did not review any maintenance

1 procedures associated with Westinghouse steam generators;
2 is that correct?

3 A I cannot accept that as a blanket statement,
4 Mr. Gallo. There were a lot of different activities. I am
5 talking about the steam generators that were were involved
6 in that outage. The steam generators work was on the
7 maintenance schedule. In the course of the investigation
8 it turned out that was not a critical path activity and
9 I did not focus on that to any degree.

10 Q You say that an inspection was done of the
11 steam generators at Salem.

12 A Yes, sir, that is my recollection.

13 Q What kind of inspection?

14 A My recollection is that it was eddy current inspection.

15 Q Did you participate in that inspection?

16 A No, I did not.

17 Q Did you review the results of that inspection?

18 A No, I did not.

19 Q Was your role in working for your client in New
20 Jersey one of providing advice on health and safety matters?

21 A No, it was not. This was a case that involved
22 the utility's management of the outage and how well they
23 had performed in preplanning and the conduct of the work
24 that was being carried out at the outage.

25 Q Were your consulting services then in the nature

1 of advice on economic matters in connection with the rate
2 case?

3 A Some of it was, yes, the economic results of the
4 utility's management and conduct of the outage work.

5 Q I feel compelled to ask you this question. Have
6 you ever visited the Byron site?

7 A No, but I have seen it. I have not been asked,
8 sir.

9 Q You will perhaps have the opportunity later today.
10 Have you had occasion to review the FSAR in this case with
11 respect to those sections applicable to steam generator
12 tube degradation and steam generator tube accident matters?

13 A Yes, I have.

14 Q How about the staff safety evaluation report?

15 A Yes, I have. I have access to that. I have a
16 copy of that, too.

17 Q Have you looked at it and read it?

18 A Yes.

19 Q You said that while you were at G.E. you followed,
20 at least during '70 and '76 Westinghouse steam generator
21 matters. Did you continue that activity after you left
22 G.E.?

23 A Yes. I have continued it. I would have to say
24 that the amount of time that I have had to specifically
25 concentrate on steam generators has probably been less,

1 or the amount of time that I have had to focus on operating
2 performance and problems, day-to-day problems in the field
3 is somewhat less. But I have as I indicated, had a number
4 of consulting activities since leaving G.E. that involved
5 plants which include Westinghouse PWRs.

6 Q Did these activities include health and safety
7 aspects of Westinghouse steam generators?

8 A Yes.

9 Q Can you name one?

10 A Yes. Diablo Canyon is a plant that I have had
11 on ongoing relationship with since 1976. I have testified
12 in that hearing on a number of matters -- not in that hearing
13 but in the series of hearings related to Diablo Canyon.

14 Q You testified in some hearings on Diablo Canyon?

15 A Yes, sir.

16 Q Were these NRC hearings?

17 A Yes.

18 Q NRC licensing hearings?

19 A Yes.

20 Q Involving the operating license for Diablo Canyon?

21 A Yes.

22 Q What issue did you testify on?

23 A I have testified on a number of issues. The first
24 testimony that I submitted in the Diablo Canyon Case was,
25 as I recall, back in the environmental hearings and the

1 issue that I testified on at that time, which I recall was
2 in December of 1976, was to look at the experience of
3 pressurized water reactors similar to Diablo Canyon, which
4 is of course similar to Byron, and to forecast the capacity
5 factor that would be expected to be achieved throughout
6 the life of the plant and I submitted testimony on that
7 fact.

8 Steam generators of course is an issue that can
9 heavily influence capacity factor.

10 Q Did you testify on the issue of steam generator
11 tube integrity?

12 A Only as it relates to the capacity factor testimony
13 that I just mentioned.

14 Q Did you testify in the context of health and
15 safety issues?

16 A Well, as I said ---

17 Q Yes, or no, Did you or didn't you?

18 MR. THOMAS: I object.

19 JUDGE SMITH: It seems to me the capacity factor
20 is necessarily subsumes the health and safety.

21 MR. GALLO: That is not my understanding of it.

22 JUDGE SMITH: That is mine and that is adequate.

23 MR. GALLO: Let's explore that.

24 BY MR. GALLO:

25 Q You say that you submitted testimony on the

1 capacity factor.

2 A Yes, sir.

3 Q Does that kind of testimony involve health and
4 safety issues or does it involve whether or not the reactor
5 is running for whatever reason?

6 A The testimony that I submitted I think, as I said,
7 was in the environmental portion of the hearing and its
8 primary focus was what the expected output of the plant
9 would be. My understanding of its place in the whole
10 licensing of the plant goes into the cost-benefit analysis
11 of the plant.

12 Q Is that an economic cost benefit analysis?

13 A That is the economic aspect of what I would
14 describe as technical problems which can be health and
15 safety factors, but it is an economic bottom line sort of
16 thing.

17 Q Was there an issue in that case, if you know,
18 involving steam generator tube degradation as a safety
19 issue?

20 A I don't recall, Mr. Gallo, if that was ever
21 identified as a contention as such. I did not participate
22 specifically in such contention if there was one.

23 Q I thought I heard you say during your testimony
24 that the steam generators at Dibalo Canyon were like the
25 steam generators at Byron. Did I hear you correctly on

1 on that?

2 A I do not think I said it in those words. What
3 I said was that Diablo Canyon is a Westinghouse designed
4 plant similar to Byron.

5 Q Do you know whether or not the steam generators
6 are D5s and D5s?

7 A I am reasonably certain they are not D4s and D5s.
8 I would like to add that perhaps I oversimplified my response
9 to the question on the steam generator contention issue
10 at Diablo. There is of course a very extensive seismic
11 contention subject involving the Diablo Canyon case and
12 the steam generators get quite heavily involved in that
13 consideration.

14 Q You mentioed since '76 you have spent some amount
15 of time in following Westinghouse steam generator matters.
16 Could you give me some notion of how much time?

17 MR. THOMAS: Can we lay a little more foundation,
18 percentage or hours?

19 MR. GALLO: I will leave it to the witness to
20 equate the best way he can state it. I will settle for
21 hours, percnetage of time or whatever the witness can best
22 recollect.

23 MR. THOMAS: All right.

24 THE WITNESS: I would estimate that the time
25 that I have spent from '76 to the present has been spent

1 20 percent or thereabouts on generic issues involving the
2 nuclear plants and perhaps 25 percent looking specifically
3 at nuclear plants that are pressurized water reactors. So
4 of that approximately 50 percent of my time, some percentage
5 of it has been involved with looking at the problems of
6 steam generators and the impact of steam generator problems
7 on outage management, operating performance, safety of
8 plants and so on.

9 I had been involved with about five or six, as
10 I can recall, pressurized water reactors to some fairly
11 significant degree.

12 BY MR. GALLO:

13 Q Did your involvement pertain to Westinghouse
14 steam generator matters?

15 A Some of them it did, yes.

16 Q In any of those were they health and safety
17 matters or was it economic matters?

18 A Both.

19 Q And we already talked about Diablo Canyon. Name
20 me another PWR involvement that you participated in involving
21 an health and safety matter involving a Westinghouse steam
22 generator besides Diablo Canyon?

23 A I mentioned the Salem analysis that I performed
24 and that involved economic and ---

25 Q Anything besides those two cases?

1 A I am getting to that.

2 Q All right, I am sorry.

3 A I did a study for the State of Minnesota which
4 covered the Prairie Island plant and looked at the capability
5 of the instrumentation. I participated in the study. It
6 was not exclusively mine, but my firm did a study for the
7 State of Minnesota which included looking at the Prairie
8 Island plant and the instrumentation and data recording
9 facilities for measuring and monitoring radiation releases.

10 The reason I brought one up was that I recall
11 that we were looking at the capability of instrumentation
12 to measure radiation that would be released by the safety
13 relief valves on the second side of the steam generator.
14 So I think that is a related activity.

15 I think I mentioned yesterday in passing that
16 I had done some work in California looking at safety issues
17 related to the proposed Sun Desert plant in Southern
18 California. My recollection is that is or was to have been
19 and Westinghouse design facility, and some of the issues
20 I looked at were related to steam generators.

end 2

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1 Q Does that complete your answer?

2 A I am still thinking, Mr. Gallo.

3 MR. GALLO. All right.

4 JUDGE SMITH: Mr. Gallo, how long do you intend
5 to stay on this subject?

6 MR. GALLO: Well, he has named three items. He
7 has mentioned Prairie Island and I would like to see just
8 what he did with respect to steam generators on Prairie
9 Island.

10 JUDGE SMITH: I think you are taking too much
11 time.

12 MR. GALLO: I am asking questions as far as I
13 can.

14 JUDGE SMITH: We will give you ten minutes to
15 complete the expertise on pressurized water reactors.

16 BY MR. GALLO:

17 Q Don't take too long, Mr. Bridenbaugh. I have
18 ten minutes.

19 A I will try to help you out as much as I can. One
20 issue I overlooked when I was responding to your question
21 on Salem I, which is I think fairly significant, is that
22 a very significant part of that outage while related to
23 cracking and the feedwater nozzle on the steam generators
24 at Salem I, and while not related to tube degradation, it
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1 certainly is related to steam generators I think. If I
2 think of any other directly related experience, I will
3 bring it up. I have worked on the Beaver Valley plant in
4 Pennsylvania, for example, for the State of Pennsylvania
5 and I have worked on one PWR in the State of Ohio.

6 Q Have you ever devised a water chemistry program
7 for the secondary side of a Westinghouse steam generator?

8 A No, sir.

9 Q Have you ever conducted eddy current testing on
10 the secondary side of a Westinghouse steam generator?

11 A Not personally, no.

12 Q Have you ever conducted eddy current testing of
13 anything?

14 A Not personally.

15 Q Can you read the results of eddy current testing
16 of a CRT?

17 A I don't know. I have never tried.

18 Q Have you ever participated or developed a calcula-
19 tion required under the NRC staff's regulatory guide
20 concerning tube plugging criteria?

21 A I am sorry, would you repeat that question?

22 Q Yes. I believe the regulatory guide 1.121 sets
23 forth methods for establishing plugging criteria for
24 any vendor's steam generator? Have you ever participated
25 in or conducted that kind of activity?

1 A I have no evaluated a particular steam generator
2 to see if tubes should be plugged, if that is your question.

3 Q Is this the first case that you have testified
4 in with respect to steam generator tube degradation itself
5 as a health and safety issue?

6 A I think it is. Specifically as you have stated
7 the question, I have testified on the steam generator issues,
8 as I said, in the Diablo Canyon case.

9 Q That, as we know, was in an environmental context.

10 A In the context of the impact of that on plant
11 operation.

12 Q Have you ever been a consultant to the NRC staff?

13 A Yes.

14 Q Did it involve steam generator tube degradation
15 issues and health and safety issues involving Westinghouse
16 steam generator tube degradation?

17 A It did not uniquely involve that. I think my
18 consultant work for the staff as described in my resume,
19 which is an attachment to the testimony, what was involved
20 there was looking at the overall safety research program
21 of the NRC and giving my opinion and advice and guidance
22 on where the research program should focus and other areas
23 that should be looked at.

24 Q Did you give any advice on resolving unresolved
25 safety question A-3?

1 A As I recall, I am not sure whether A-3 had been
2 identified as such at the time I did that work. I think
3 it had just been formulated. I did give them advice on
4 the resolution of unresolved safety issues per se, and I
5 told them that I thought it was quite important that those
6 safety issues be expeditiously tackled and resolved because
7 they had been had been hanging around for a long time.

8 Q Did that advice include advice on Westinghouse
9 steam generator tube integrity matters?

10 A My recollection is that that had been identified
11 at that time as a generic safety issue and my advice
12 included that, yes.

13 Q What did you tell me?

14 A I told them to get busy and resolve it because
15 those issues had been plaguing the industry for a long
16 time and needed to be cleaned up.

17 Q Did you give them any specific engineering
18 information or suggestions for resolution of the issue?

19 A Not specifically the tube degradation, as I
20 recall.

21 MR. GALLO: I would like the record to show
22 that I am five minutes ahead of time. I am shifting
23 issues.

24 JUDGE SMITH: We appreciate it.
25

1 BY MR. GALLO:

2 Q On page 5 of your testimony, Mr. Bridenbaugh, you
3 indicate at the top of page 5, beginning at line 7, that
4 there is an increased probability that accidents will be
5 initiated by tube failures occurring during normal operation.
6 Do you see that?

7 A Yes, I do.

8 Q What do you mean by increased probability, increased
9 as compared to what factors?

10 A What I include in that statement is that looking
11 at steam generator performance as a whole that over the
12 past ten years that there has been an increase beyond
13 expectation certainly of the rate at which tube degradation
14 has occurred and that because of that there is an increased
15 probability that tubes will fail during service and cause
16 releases to the environment such as at Ginna and Prairie
17 Island, Surry and Point Beach.

18 Q Do you mean an increase of tube corrosion problems
19 over the years? Is that what you mean?

20 A I include in an increased probability the increased
21 incident of tube degradation which relates to corrosion
22 that you just mentioned, but I also include in that statement
23 the vibratory problems that the model D steam generators
24 specifically have been experiencing, too.

25 Q How have you determined that this trend has occurred?

1 Have you conducted some sort of survey?

2 A No. I did not do a statistical analysis. I think
3 it is evident if you look at the reports, the
4 identification of steam generator degradation as an
5 unresolved safety issue that this increased probability has
6 occurred.

7 Q And this is what, based on some intuitive
8 judgment? If you conducted on survey, how did you form this
9 opinion?

10 A It is based on the data that is reported by the
11 utilities to the NRC, data that is reported in NRC reports
12 and data that is reported by Electric Power Research
13 Institute and any number of other agencies.

14 Q You mentioned Electric Power Research Institute.
15 Were you in the courtroom when Mr. McCracken testified on
16 April 15?

17 A No, I was not, but I have looked at the
18 transcript.

19 Q Mr. McCracken had occasion at page 4795 to
20 provide testimony with respect to a graph that was bound
21 into the transcript at that page. I will show you the
22 transcript.

23 (The document was handed to the witness.)

24 Mr. McCracken testified that the source of his
25 document was from the Electric Power Research Institute and

1 that he personally had reviewed the data himself. On that
2 basis it was admitted into evidence. Does this graph show
3 the trend of an increasing probability that you discuss in
4 your testimony?

5 MR. THOMAS: Excuse me. I am going to object. As
6 I recall, Mr. McCracken identified that as relating to only
7 the denting problem. I believe that the subject we are
8 talking about now is tube degradation or tube failures
9 from all causes. So I think it is somewhat misleading.

10 MR. GOLDBERG: May I be heard on that, Judge?

11 MR. GALLO: I would like to show it to counsel.

12 (The document was handed to counsel.)

13 MR. THOMAS: I would agree. There is a category
14 on that graph which states other problems. I don't think
15 that Mr. McCracken was ever questioned or ever indicated,
16 you know, exactly what that was to refer to, as I still
17 recall the testimony, that graph was introduced in the
18 context of a discussion regarding denting and to illustrate
19 that.

20 MR. GOLDBERG: Judge, may I be heard on that
21 since staff sponsored that graph through Mr. McCracken?

22 The graph, as I recall, represents the trend of
23 steam generator tube plugging. It does not differentiate it
24 from the causes which may have necessitated tube plugging.
25 That is, it identified certain degradation causes and

1 eliminates no other degradation causes. As I recall, the
2 context of the examination was to elicit the trend in terms
3 of severity of the tube degradation problem as a whole.

4 MR. GALLO: That is a fact the transcript
5 reflects.

6 JUDGE SMITH: Do you agree, Mr. Thomas?

7 MR. THOMAS: My recollection is, as I stated,
8 Judge. I do remember asking Mr. McCracken about whether it
9 was percentage if tubes plugged and that sort of thing.
10 Whatever it is, it is.

11 JUDGE SMITH: Yes. After you have had an
12 opportunity during the break to look at the transcript, if
13 you do not agree, then we will raise the issue again. In
14 the meantime, your objection is overruled.

15 MR. GALLO: I will ask a new question.

16 BY MR. GALLO:

17 Q Does this graph sponsored by Mr. McCracken
18 reflect the increasing trend and the probability of tube
19 degradation as indicated in your testimony?

20 A I think it does, but you have to do it by
21 implication or knowledge of what this graph is representing
22 and perhaps what I should say is by what the graph does not
23 show, and the statement in my testimony does not start in
24 1973 as this graph does.

25 what I am saying in my testimony is that if you

1 look at the experience over time of steam generators, there
2 is a big blip here in the identification of steam generator
3 tube problems that occurred in the mid-1970s that is shown
4 in Mr. McCracken's graph or whosever it is.

5 I am talking about the increased probability
6 above what was expected and what was designed for on steam
7 generators going back into the 1960s. The other thing that
8 this graph of course does not show is the data since 1980
9 which would specifically apply to Byron, and that is the
10 vibration problems in the preheater.

11 MR. THOMAS: Before you place another question, I
12 think for the record to be clear we need information on
13 what the big blip on the graph is. It is going to be
14 totally unclear from the record unless we indicate a little
15 more.

16 JUDGE SMITH: It was the denting blip?

17 MR. GALLO: For the year 1973.

18 BY MR. GALLO:

19 Q Is that what you were referring to, Mr.
20 Eridenbaugh.

21 A Yes. There is a big increase in the percent of
22 tubes plugged in 1973. There are also fairly substantial
23 increases in 1976 and 1977. I think the '76 and '77 blips,
24 as I read the graph, are related to denting and the 1973
25 blip appears to be primarily related to wastage.

1 Denting appears to be the predominant cause of
2 tubes being plugged in the period of 1976 through 1980.

3 Q For the years '72 through 1980, the years
4 covered on this graph, does it show the increasing trend
5 that you reflect in your testimony?

6 A If I look only at the data presented by this
7 graph, it would appear to be show a decreasing trend in the
8 percent of tubes plugged over that period of time. However,
9 I think you have to be careful on how you would draw a line
10 through that limited bit of data because it covers a lot of
11 different steam generators. The times that tubes are
12 plugged skew the graph from one year to the next and you
13 don't really know when the problem directly begins to
14 occur.

15 All I am saying is that there are limitations to
16 the data and I would not place too much reliability on the
17 line that I attempted to project through that data.

18 Q Let me ask you this question. I think you
19 indicated in your testimony that beyond 1980 you think the
20 graph, if extended, would show an increase of the flow and
21 these vibration problems.

22 A I did not say that. What I said is the graph
23 does not include data in 1981 and '82 and '83 obviously,
24 and that there is included in my statement in my testimony
25 the recognition that preheater tube vibration was a new

1 problem that in my mind represented an additional risk at
2 the Byron unit and one that would increase the probability
3 that tube failures would occur at that plant.

4 MR. THOMAS: Judge, I am also objecting to the
5 use of the graph because the graph deals with tube plugging
6 and the testimony that he is being questioned about now
7 talks about an increased probability of accidents initiated
8 by tube failures. So I think we are dealing in some sense
9 with apples and oranges.

10 JUDGE SMITH: Isn't there correlation between
11 tube plugging and tube failure?

12 MR. THOMAS: Pardon? You say isn't there?

13 JUDGE SMITH: Yes.

14 MR. THOMAS: I think that question at least
15 should be put to the witness as a foundation question
16 before he uses the graph in this manner.

17 MR. GALLO: I am through using the graph.

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25

1 BY MR. GALLO:

2 Q Have any tubes been plugged in domestic
3 reactors operating with Westinghouse steam generators
4 because of flow induced vibration?

5 A Yes.

6 Q In this country?

7 A Yes.

8 Q What reactor do you have in mind?

9 A We have heard quite a bit of testimony in the
10 past week or two about the investigative program that has
11 been conducted at the Model D steam generators. My
12 understanding of that investigative program is
13 accelerometers have been added, for example, at the McGuire
14 plant and it was testified to yesterday that in order to
15 add an accelerometer you have to plug tubes to do that.

16 Q Have any tubes been plugged at McGuire because
17 of wear due to flow induced vibration?

18 A Because of the tube plugging criteria I suspect
19 is the trust of your question. I don't believe so.

20 Q So the trend is yet to develop from this
21 problem; is that correct?

22 A The data is not yet in hand on how those tubes
23 are going to respond and how many will have to be plugged,
24 but I think it is a fair projection that there are tubes
25 that are going to be plugged as a result of those Model D

1 problems.

2 Q When you use tube failures in your testimony,
3 did you mean tube burst, or did you mean something else? I
4 am referring to line 8 for your benefit.

5 A I was referring primarily to tube ruptures that
6 would cause the off-site release of radioactivity as a
7 result of that.

8 Q How many tube ruptures, to your knowledge, have
9 occurred with respect to operating nuclear reactors?

10 A There have been four domestic plants that have
11 been identified and discussed in quite some detail.

12 Q Is it your testimony that these four failures
13 established the trend that you testified to here on page 5?

14 A Those four failures or those four failure
15 events plus the tube vibration problems that we were just
16 discussing, yes. I guess I should correct your
17 characterization of my statement. I did not really say that
18 there was a trend. My statement is that there is an
19 increased probability.

20 Q I stand corrected. Have you quantified that
21 increased probability?

22 A No, I have not.

23 Q Page 7 of your testimony. Can you briefly
24 describe for me what your understanding of what the Steam
25 Generator Owners Group work involves that you refer to on

1 page 7?

2 A I think my testimony briefly describes that,
3 Mr. Gallo. It is starting at line 22 "Steam Generator
4 Owners Group efforts have ranged from investigation of tube
5 materials, operating procedures, improved inspection
6 techniques and development of repair procedures.

7 Q Is that the extent of your knowledge about
8 their activities?

9 A No. That is a summary statement.

10 Q Are you familiar with the water chemistry
11 guidelines developed by the Steam Generator Owners Group in
12 cooperation with EPRI?

13 A Yes.

14 Q Are you familiar with the workings of what you
15 have referred to in your testimony as SGOG Roman numeral
16 II?

17 A I am familiar with the stated goals as I
18 understand it of that change to the Steam Generator Owners
19 Group. It has only recently been formed or rearranged I
20 guess is a way of describing it. I have not had access to
21 any output that has resulted from that Phase II effort.

22 Q Looking at page 8 of your testimony, I think
23 you indicated that the 12 actions listed on that page come
24 from the SAI report; is that correct?

25 A That is correct, yes.

1 Q Is it your understanding that those are 12
2 potential requirements that the NRC staff may have imposed?

3 A That is a simply way of putting it, yes. My
4 understanding is that there are others that are being
5 considered, and I think that was testified to quite
6 extensively the week before last.

7 Q Do you disagree with any of these proposed
8 requirements or potential requirements rather?

9 MR. THOMAS: Objection. Disagree in the sense
10 that they shouldn't be imposed or they should be stricter
11 or what? I just think that the question is vague.

12 MR. GALLO: I will try it again.

13 BY MR. GALLO:

14 Q With respect to any one of these items, have
15 you read the SAI report?

16 A Yes.

17 Q Do you understand what these 12 items are as
18 you have listed them here only by title? Do you understand
19 what the requirement is as spelled out in the SAI report?

20 A I understand the thrust of the requirement, and
21 of course as I am sure you are aware, some of those get to
22 be rather complicated and have subparts to them and so on.

23 I understand the goals that the requirements
24 are attempting to achieve, yes.

25 Q Do you think that any of these potential

1 requirements should be imposed by the NRC staff on PWR
2 licensees?

3 A Yes. I think some of them should be imposed
4 basically across the board. I think of course there are
5 some that do not apply to a number of plants. So I think
6 you have look at each one in the plant and determine where
7 you come out on that.

8 Q Do you think any of these should be imposed on
9 Byron?

10 A Yes, I do.

11 Q Which ones?

12 A I would like to rephrase my answer and say that
13 as far as I am concerned, I think the ones that are most
14 significant to the Byron plant would be the first three and
15 skip the next two. I don't mean skip that at Byron. I mean
16 importance -- and the next three.

17 Perhaps I should state I think the most
18 important ones are prevention and detection of loose parts
19 and foreign objects, stabilization of monitoring of
20 degraded tubes, tube in-service inspection program, the
21 secondary water chemistry program, the condenser in-service
22 inspection program and upper inspection ports. In terms of
23 the particular Byron steam generators, those I think are of
24 the most importance.

25 The next one in line there, the reactor coolant

1 system pressure control during a steam generator tube
2 rupture, it is my understanding from the recent Board
3 notification that that one is already being imposed as a
4 requirement on Byron, and I think that the improved eddy
5 current techniques issue is certainly a very important one,
6 but I think it is more of an industry-wide kind of a
7 subject rather than something that you would "impose" on
8 Byron.

9 I think that Byron should be required to use
10 the latest techniques that are available. So to that extent
11 it certainly should be applicable to Byron.

12 Q Let me ask you, Mr. Bridenbaugh, given the work
13 of the Steam Generator Owners Group and the involvement of
14 EPRI and the staff action in developing these 12 actions
15 and the staff's testimony, a recognition of that testimony,
16 that the final recommendations on this unresolved safety
17 question are due out in July 1983, do you still believe as
18 you state on page 4 that the area of steam generator tube
19 degradation and failures have not been adequately assessed
20 or regulated?

21 A Yes, I still believe that because while I will
22 certainly agree with your assertion, Mr. Gallo, that a lot
23 of effort has been put on this issue, I think you have to
24 look at all of the testimony, all of the witnesses that
25 have been brought up here to talk about that effort,

1 including Mr. Timmons, who spoke of a 200 person task force
2 at Westinghouse on tube vibration alone. I would certainly
3 have to agree that there has been a lot of attention on
4 this issue.

5 But the concern that I have is that this thing
6 has been going on now since 1972, I guess and is when the
7 big blip on that graph you showed me was. It has been
8 identified as a safety issue by the NRC since 1978 at
9 least. It has been spoken of as being almost resolved by
10 the NRC for the past couple of years and to continue to let
11 this thing go without imposing it in some firm way on
12 plants that are being licensed, I do not think is a proper
13 way to go and I do not think that adequate attention in the
14 licensing arena has been given to it. It has been described
15 as a non-safety issue, a reliability issue, and I have
16 heard that story too many times in my experience in this
17 industry.

18 Q Are you just simply frustrated with the fact
19 that the staff just has not issued its final report; is that
20 it?

21 A I am definitely frustrated that they have not
22 issued their final report, but I am not simply frustrated.
23 I am frustrated at these kinds of serious problems that
24 continue to be shoved off to the side and plants are placed
25 in service without doing the work that I think needs to be

1 done.

2 Q You indicated that it was important that a tube
3 in-service inspection program be established as described
4 in the SAI report.

5 A I did not say that, Mr. Gallo. I said that I
6 thought improvements in the tube in-service inspection
7 program is needed. I do not adopt the proposed
8 recommendations as they are written in the SAI report. I
9 think that those are very important areas where
10 improvements are needed, and I am not taking the SAI report
11 as the stone tablets.

12 Q What improvements in in-service inspection
13 would you recommend?

14 A Let me just state a couple of them. I think
15 that it is very important that a commitment be made and
16 that the requirement be spelled out that inspection be
17 required on plugged tubes, for example, as the plant
18 continues to operate. That is not currently a requirement,
19 as I understand it, and I think that is something that is
20 definitely needed.

21 I am not satisfied with the "loopholes", if you
22 will, that the steam generator can go for a number of years
23 without receiving any inspection, and that you only look at
24 the percentage of the total number of tubes in the plant.

25 I think there should be some required

1 inspection of each steam generator perhaps every two years.
2 I think there is a need to do full-length inspection on the
3 tubes and not just the hot leg side as has been done in the
4 past. Those are a few of the improvements that I think are
5 needed.

6 Q You would pull the plug on a plugged tube and
7 then inspect it in some fashion?

8 A No, I am not recommending that at all, but I
9 think you have to develop some method of assuring that that
10 plugged tube is not breaking up and about to cause damage
11 or rupture to adjacent tubes.

12 I have been involved with heat exchanger
13 performance and I have seen a number of cases where
14 adjacent tubes are damaged by failed tubes not in the steam
15 generator, but in the heat exchanger.

16 Q Are you advocating visual inspection of the
17 secondary side?

18 A I said before that I have not developed a
19 specific program that I recommend, but I think that some
20 way has to be incorporated into the inspection program to
21 assure that those tubes are staying in place, either
22 staying in place or removed I guess and that is probably
23 not practical.

24 Q Would a visual inspection on the secondary side
25 satisfy your concern?

1 A I might. I would have to see the details of how
2 that inspection is going to be performed, how reliable and
3 accurate it is, what it can detect, et cetera.

4 Q what if you used a television camera and swept
5 all around the secondary side of the steam generator?

6 A I don't think that in and of itself would be
7 adequate to satisfy my concern because I think you would
8 have a problem with inspecting the tubes in the inner
9 regions of the bundle. I think the television camera
10 certainly has its place, but I don't think that I would
11 agree to rely solely on the television camera.

12 Q How about fiber optics then?

13 A I think that has a place, too. Fiber optics can
14 get places that a television camera cannot. So that
15 certainly could contribute to that level of knowledge.

16 Q Aren't those mechanisms being used for present
17 day inspections of the secondary side of Westinghouse steam
18 generators?

19 A They are to my understanding at some plant, but
20 it is not a requirements as I understand it that that be
21 done.

22 Q So your only concern is that you want to have
23 industry practice embodied in a set of requirements and
24 regulated by the NRC, is that it?

25 A My concern is that these plants be made as safe

1 as they reasonably can. I think one way to assisting that
2 is to properly regulate them and to do that involves some
3 requirements.

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1 Q Is it your position that regulations ensure
2 safety?

3 A Absolutely not.

4 MR. THOMAS: I think I am going to object. we
5 are getting a little argumentative here.

6 MR. GALLO: I will withdraw the question.

7 MR. THOMAS: And the form of the questions.

8 BY MR. GALLO

9 Q Mr. Bridenbaugh, on page 11 of your testimony
10 you say at the bottom that there is no assurance that AVT
11 will eliminate the earlier generic problems. What problems
12 are you referring to?

13 A I am referring primarily to the tube
14 degradation problems that were generally first discussed in
15 USI A-3.

16 Q what are those?

17 A They are described on page 6 and 7 of my
18 testimony, have been described, and NUREG-0886, have been
19 described by almost everybody who has presented testimony
20 on this issue in this case. But we are talking primarily
21 about corrosion and cracking problems that affect the --
22 potentially affect the integrity of the steam generator
23 tubes.

24 we are talking about stress corrosion cracking,
25 intergranular attack. We are talking about denting and so

1 on. And I would say that of those that I have mentioned,
2 and keeping in mind the changes and improvements that are
3 being included throughout the industry and that have been
4 proposed for Byron, that probably denting on Unit 1 is the
5 one that is perhaps the most concerned.

6 JUDGE SMITH: Mr. Thomas, did Mr. Bridenbaugh
7 attempt to delete reference to Attachment B on page 11? I
8 did not get a substitute page for that.

9 MR. GALLO: There is one, Your Honor.

10 JUDGE SMITH: There is a substitute page?

11 MR. THOMAS: You did not get it?

12 (Discussion off the record.)

13 JUDGE SMITH: I overlooked it. I have it. Thank
14 you.

15 BY MR. GALLO:

16 Q Is it your understanding that AVI water
17 chemistry measures are intended to eliminate corrosion of
18 steam generator tubes?

19 A No, it is my understanding that AVI is intended
20 to minimize corrosion. I think that whenever you have got
21 metal and water coming together with a few other things,
22 that corrosion cannot be 100 percent eliminated.

23 Q In fact, wasn't that Dr. Wootten's testimony?

24 A I am sure it was. I do not recall his exact
25 statement. But I would agree with it, yes.

1 Q Then I guess there is no quarrel between you
2 and Dr. wootten because you both agree that AVT is not
3 intended to eliminate tube corrosion. Is that correct?

4 A I am not sure whether there is any quarrel with
5 me and Dr. wootten, but I guess we have both agreed that
6 AVT is not going to eliminate corrosion.

7 Q what caused you to make the statement at the
8 bottom of page 11? The implication of the statement is that
9 somebody suggests that AVT will eliminate steam generator
10 tube corrosion phenomenon. Am I reading your testimony
11 wrong?

12 A I think it is a statement of fact, Mr. Gallo.

13 Q Support that. On what basis do you make that
14 conclusion?

15 A I have the support of Dr. wootten that you just
16 mentioned, that AVT is not going to eliminate all of the
17 generic problems.

18 Q But you are not suggesting that some qualified
19 expert in this proceeding is suggesting that it will do
20 that?

21 A I have not made that claim in my testimony, and
22 I don't make it here.

23 Q Did you read the testimony of Dr. wootten and
24 Mr. Malinowski with respect to denting?

25 A Yes, I did.

1 Q wasn't it your testimony that AVI was intended
2 to combat phosphate wastage rather than denting?

3 A I am not sure whether -- I would have to go
4 back and look at their testimony and see if that is the
5 only thing they said. I think it has been generally the
6 testimony that the improved water chemistry program,
7 including the use of AVI, is supposed to resolve the
8 denting problem from future concern. I don't think it is
9 necessarily going to do that.

10 Q Do you recall the testimony about how denting
11 can be minimized if the materials used in the secondary
12 side of the system is copper-free? Do you recall that
13 testimony?

14 A I recall that that is part of it, yes, that the
15 elimination of copper from the system is helpful to reduce
16 denting. And, of course, I am sure that another aspect that
17 has been discussed is the reduction of oxygen, and you do
18 that by reducing condenser in-leakage. There are a lot of
19 different -- I think Mr. Wootten and Mr. Fletcher and other
20 people said we are talking about very complex chemical
21 interactions here.

22 Q Is it your understanding that those measures of
23 eliminating copper and improving the condenser tube
24 materials are in fact going to be installed and have been
25 installed at Byron?

1 A Yes. My understanding is that that is the case.

2 MR. THOMAS: Judge, I don't wish to interrupt
3 the examination, but I am going to have somewhat of a
4 corrosion problem if we don't have a break somewhere in the
5 near future.

6 JUDGE SMITH: All right. Ten minutes.

7 (Brief recess.)

8 JUDGE SMITH: Back on the record.

9 BY MR. GALLO:

10 Q Mr. Bridenbaugh, you talk about -- are you at
11 that page?

12 A Yes, I am.

13 Q You mention a number of tube rupture events,
14 four to be specific, in your testimony. Correct?

15 A Yes, sir.

16 Q You know the year that Point Beach occurred?

17 A I don't recall. I have got the report here
18 on the evaluation of the steam generator tube rupture
19 events, NUREG-0651.

20 Q Why don't you confirm whether it is 1975 or
21 not?

22 A Point Beach is February 26, 1975.

23 Q Was the tube rupture at Point Beach caused by
24 tube degradation of a corrosion-type phenomenon?

25 A Yes, it was.

1 Q Can you turn to the description in that NUREC
2 document on Surry?

3 A Okay.

4 Q What was the year of that event?

5 A That was September 15, 1976, and the failure
6 was of the U-bend due to stress corrosion cracking.

7 Q Was it attributable to a corrosion-type
8 mechanism?

9 A Yes, it was.

10 Q Has there been a tube rupture since that time
11 at a domestic PWR steam generator attributable to corrosion
12 mechanisms?

13 A No, there hasn't. The other two that are
14 mentioned in my testimony that I am aware of are Prairie
15 Island and Ginna. Both of those have been identified as
16 having been caused by foreign material.

17 Q There has been no tube rupture due to corrosion
18 mechanisms for about 7 years, is that correct?

19 A Yes, that is correct.

20 Q What significance do you attach to that, if
21 any?

22 A I think one bit of significance, I guess, that
23 I would attach to that is that there has been more careful
24 attention placed on inspection and identification of the
25 corrosion phenomenon problems and the implementation of the

1 use of the tube plugging criteria to try and avoid having
2 steam generator tube ruptures as a result of that.

3 Q Does it indicate that the overall program is
4 having success in this area?

5 A I am not sure that I would determine it a
6 complete success, but it is certainly improved, yes.

7 Q Somewhere in your testimony you characterized
8 the Ginna plugged tubes, the plugged tubes at Ginna, as
9 deteriorating. Do you recall that testimony?

10 A Yes. I don't know whether I used that word, Mr.
11 Gallo. But, yes.

12 Q Do you think that those tubes failed due to
13 corrosion mechanism at Ginna? Those plugged tubes is what I
14 am referring to.

15 MR. THOMAS: we are referring to page 20, line
16 1b?

17 MR. GALLO: Yes. Thank you.

18 BY MR. GALLO:

19 Q Do you have that reference?

20 A Yes, I do.

21 Q When you said "significantly deteriorated,"
22 were you thinking of deterioration due to corrosion of the
23 plugged tubes?

24 A That is not my understanding. I think there was
25 some damage. There was one tube that had ruptured,

1 fractured, and it had rubbed on adjacent tubes.

2 Q So those tubes failed because of wear?

3 A I am not sure whether all of them were in that
4 category or not. I have not gone back and looked at that
5 report recently.

6 Q What is your basis for your understanding of
7 the Ginna rupture event?

8 A What is the basis for my understanding?

9 Q Yes.

10 A The information that I have on the Ginna plant
11 are the NUREG documents that describe that event.

12 Q Did the NUREG documents indicate, as you state
13 on page 19 of your testimony, that the Ginna tube rupture
14 event came close to being a multiple-tube failure due to
15 jet impingement and vibratory mechanical damage?

16 A I am not sure that I would describe it just the
17 way that you said without putting it in context. I think if
18 you look at the sequence of failure at Ginna, which was a
19 failure of a plugged tube due to another piece of foreign
20 material, as I understand it, from the baffle plate
21 removal, and then the fact that that failed tube caused
22 failure, caused wear and damage to other tubes, I think it
23 is indicative of the fact that multiple tube failures due
24 to interaction between the associated tubes is an entirely
25 feasible event and one that should be considered.

1 Q Do you draw that conclusion from the fact that
2 the severed plugged tube could have ruptured more than one
3 tube through the wear process?

4 A Yes. It is perhaps not accurate to ascribe jet
5 impingement to that, because obviously there was no jet
6 impingement from a plugged tube.

7 Q For multiple tube failure to occur, as we are
8 discussing here, wouldn't the wear rates at two or more
9 tubes have to be almost at the same rate so that the
10 failure would occur simultaneously?

11 A If you assumed that these are not related
12 events, that's correct, yes. If they are totally random
13 events, that is correct.

14 However, if you throw into the equation the
15 possibility of foreign material, degradation of plugged
16 tubes, and corrosion phenomenon, tube vibration and so on,
17 I think it is in my opinion you can postulate a feasible
18 accident scenario where you have failures caused to weaken
19 tubes as a result of the failure of a single tube.

20 Q Are you adding considerations and causes other
21 than those that were actually at Ginna reactor when that
22 tube burst? You mentioned corrosion and other aspects.

23 A I was talking in general. I was not talking
24 specifically of Ginna there.

25 Q Let's talk about this sentence. I asked you a

1 question about multiple tube failure, whether or not the
2 only way such a matter could occur in the Ginna
3 circumstances was a simultaneous failure. Let me ask you
4 this question: Wasn't the cause of the failure the fact
5 that the active tube ultimately was worn through by loose
6 plug tube?

7 A Yes, that is what caused the leak.

8 Q How could two or more tubes fail under that
9 circumstance?

10 A If you have a plugged tube that is damaged in
11 some way or comes loose -- and that is what happened at
12 Ginna -- it is entirely possible for that tube to wear on
13 more than one tube at the same time. It could certainly
14 wear on all of the surrounding tubes and cause a reduction
15 of wall thickness in a relatively rapid fashion.

16 And then if you had some transient event or if
17 the tube failed and the succeeding transient event, jet
18 impingement and so on, you could have the subsequent
19 failure of those other degraded tubes that are in the
20 vicinity.

21 Q Did they have that transient event at Ginn?

22 A No.

23 Q Page 20, you address yourself to eddy current
24 testing.

25 A Yes.

1 Q You indicate in the middle of the page that
2 there is reduced sensitivity of eddy current testing where
3 the tube passes through the support plate or other nearby
4 structural members. Do you see that?

5 A Yes, I do.

6 Q Do you recall Mr. Malinowski's testimony that
7 interference from these support plates or other structural
8 members is dealt with through the use of multifrequency
9 eddy current testing.

10 A I am not sure he said it was dealt with. I
11 recall Mr. Malinowski's testimony that improvements have
12 been made in eddy current testing, that multifrequency
13 testing is now being utilized and that that helps to
14 improve the sensitivity at the tube support area.

15 But I think there is also substantial testimony
16 on the record talking about the limitations of eddy current
17 testing, the fact that we are really at about 20 percent
18 detectability. And if you look at the most likely effect of
19 the tube vibration that the D model units have had, you are
20 talking about degradation that may not be easy to detect,
21 because that occurs, of course, right at the tube support
22 and/or baffle plates.

23 Q Didn't Mr. Timmons describe the eddy current
24 testing program for the tube vibration issue?

25 A Yes, he did.

1 Q Did you recall the testimony of Mr. Timmons
2 that when they pulled the tube at one of the foreign
3 reactors and compared it with the eddy current test results
4 of that same tube, that the eddy current test results
5 overstated the amount of wear?

6 A I don't remember the details of what he said.
7 But I believe that is the case, yes.

8 Q You still stand by the sentence, in view of
9 that, that this reduced sensitivity is a problem?

10 A Yes. I stand by that. I said -- if you read my
11 sentence, I said for some time eddy current testing
12 utilized for tube wall thickness measurement has reduced
13 sensitivity. And that is addressed in the NRC's A-3
14 program. It is discussed in the SAI report. And I think
15 anybody that you would ask would agree that there is a need
16 for improved capabilities in the eddy current testing
17 program. I assume that is why hundreds of thousands of
18 dollars are being spent in that area.

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25

1 Q Do you mean reduced sensitivity at the location of
2 the support plate to the point where eddy current testing is
3 not adequate for the purpose intended?

4 A No. What I mean by reduced sensitivity is that if
5 you look at the capabilities of eddy current testing, if you
6 were testing the tube in a vacuum, if you will, with no
7 supporting structure, you could get much better sensitivity
8 than having to deal with the configuration that steam generator
9 tubes are in actuality, that they have to be supported, they
10 do have supporting structures, they do go through baffle plates
11 and tube support plates, so that reduces the sensitivity of
12 the instruments that are being used.

13 Q But you do not mean to the point where the eddy
14 current testing at that location is not adequate.

15 A The primary thrust of my testimony is, looking at the
16 overall experience of eddy current testing, looking backwards,
17 I would certainly agree that the multi-frequency testing that
18 is now being used is a significant improvement and it may very
19 well prove to be adequate. I don't think that we have enough
20 experience with it yet.

21 Q Do you know how long they have been using multi-
22 frequency eddy current testing?

23 A I think in some limited cases at some plants it has
24 been used for about four years. It has not been utilized on
25 an industry-wide basis, and I don't think it is a requirement.

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1 I think it should be.

2 Q Turning to your recommendations on pages 22 and 23,
3 why do you recommend that the Byron operating chemistry
4 procedures should be reviewed by an independent body?

5 A I recommend that because, as I read Commonwealth
6 Edison's testimony and as I read -- and listen to the cross-
7 examination of the various witnesses, NRC, Westinghouse and
8 Edison, and the issue of steam generator tube degradation, it
9 is my reaction or response to what is being stated that
10 tremendous amount of reliance is being placed on the use of
11 proper procedures and the proper chemistry program at Byron,
12 and at all other pressurized water reactors, for that matter,
13 on the use of a very thorough and complete program to resolve
14 and to continue to resolve for a relatively long time in the
15 future the corrosion degradation phenomenon that has occurred
16 in pressurized water reactors.

17 There have been some material improvements made in
18 the Byron Unit 2 steam generator. There has not been a whole
19 lot of change made in the material selection on the Unit 1
20 steam generator.

21 Q We are talking about procedures now.

22 A Yes, we are talking about procedures.

23 Q All right.

24 A So in my viewpoint, I think the prevention of tube
25 degradation, particularly Unit 1, is almost totally dependent

6joy3 1 upon the use of -- the use and control of water chemistry
2 in that plant. Therefore, I think it is particularly
3 important that those procedures be thoroughly developed,
4 reviewed, implemented at the plant, the appropriate training
5 of the people who are going to be following those procedures
6 be performed, and therefore I think that because that is such
7 an important issue, I think they should receive independent
8 scrutiny.

9 I would like to think that the NRC perhaps could do
10 that, but I think that that really is not the NRC's job. The
11 NRC's job is to regulate the safety and make sure the
12 regulations are being followed. And furthermore, in my
13 experience with the NRC's review of operating procedures at
14 specific plants in the past, they don't normally do that.
15 They are more active in the review of generic procedures, and
16 so I think this should get some particular scrutiny by
17 someone other than Commonwealth Edison.

18 Q Doesn't the resident inspector and Inspection and
19 Enforcement periodically review these procedures for
20 compliance?

21 A The resident inspector is one man who covers a
22 whole raft of different disciplines, and while he is there
23 and will assure that the procedures are in place, in most
24 cases I think that the resident inspectors review of procedures
25 is limited to either assurance that the procedure as

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1 identified in the table of contents is there and an updated
2 version is being followed, or if a particular problem arises,
3 he might get into the review in more detail. But the
4 resident inspector is incapable of reviewing all of the
5 procedures for technical content that are involved with the
6 nuclear plant.

7 Q We are talking about procedures for chemistry
8 procedures and operating procedures relating to water chemis-
9 try. Doesn't he in fact review those for compliance from time
10 to time?

11 A For compliance what?

12 Q For compliance by the utility from time to time.

13 A I have answered that question, Mr. Gallo. He
14 reviews the plant operation to make sure that the procedures
15 are there. He may perform some cursory review to make sure
16 that the guy who is actually operating has access to the
17 procedures. I don't think -- let me -- I don't know who the
18 resident inspector is for the Byron plant. I would be very
19 surprised if he has the unique capability and experience
20 necessary to do the kind of review that I am talking about.

21 Q But you don't know, do you?

22 A I don't know. I don't think there is one person
23 who has all of those capabilities. I am talking about an
24 independent review by one or more individuals who have
25 in-depth experience in this issue.

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1 Q How about Region 3 Inspection and Enforcement?

2 Don't they come into the plant from time to time and review,
3 among other things, these procedures for compliance?

4 A They do that through their program. But again, as
5 I say, the type of review that I am talking about, that type
6 of review is really, again, a regulatory compliance review. It
7 is not a review of the procedure before the plant goes into
8 operation to assure that t e latest and most complete technical
9 knowledge has been incorporated in the procedures.

10 Q Mr. Bridenbaugh, do you have any reason to believe
11 that you can state on this record that the Edison procedures
12 will not be completed as necessary and contain the high level
13 of water chemistry procedures implementation that you have
14 described here in your testimony?

15 A I don't have any unique information available to me
16 that says they are not going to be. I am just saying that
17 because this is such an important aspect of the operation of
18 the steam generators, that I think an additional action
19 should be taken by Commonwealth Edison, and that is to get
20 some assistance to assure that they have got the right things
21 in place.

22 Q In fact, wasn't that done when EPRI with the
23 Steam Generator Owners Group developed EPRI water chemistry
24 procedures?

25 A No. I think what I am talking about is something

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1 different than that, Mr. Gallo. Certainly the EPRI
2 guidelines are an important improvement to the body of
3 knowledge that is available to Commonwealth Edison, and of
4 course we talked about how they are incorporating that
5 into their procedures, ad nauseum two weeks ago, I guess,
6 and what I am talking about is the piece of paper getting
7 it down to pumps and valves and pipes and demineralizers
8 and sampling techniques and making sure that the
9 principles that are generally included in the EPRI guide-
10 lines are in fact being implemented to the greatest degree
11 that they can be at Byron.

12 Q And you think that this independent review
13 independent of the NRC should be done prior to startup.

14 A Yes.

15 Q And you would not issue an operating license for
16 Byron if this was not done; is that your testimony?

17 A I would not issue an operating license for Byron
18 unless I were assured that Commonwealth Edison has adequate
19 water chemistry procedures in place. This is one way to
20 help obtain that assurance. I have no way of obtaining
21 that assurance personally.

22 Q You are suggesting that these procedures be
23 independently reviewed by an independent body other than
24 the NRC. I am trying to find out if you are suggesting
25 that unless this is done, an operating license for Byron

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1 should not be issued.

2 A That is what I have recommended, yes. I did
3 in my last response say that is one way of doing it. That
4 may not be the only way of doing it. That is an obvious
5 way that I see. It is a way that other important issues
6 have been addressed in nuclear plant safety matters. That
7 is the use of independent design verification. This is what
8 we are talking about here.

9 Q Have you had occasion to look at the procedures
10 at the Zion nuclear plant?

11 A No, I have not.

12 Q You do not know whether or not those are
13 adequate or inadequate or superlative.

14 A You did mention Zion. I assume you did that
15 by intent.

16 Q Yes, Zion.

17 A No, I don't know because I have not seen them.

18 Q You don't know what the record of Commonwealth
19 Edison is with respect to these operating procedures.

20 A No, I don't.

21 Q Why is this particular item so important that
22 you would hold up the operating license for Byron given the
23 fact that we have not had a tube rupture failure for the
24 last seven years attributable to tube corrosion mechanisms?

25 A I think it is important because at some point in

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1 time when you are licensing and placing nuclear plants
2 into operation, you have to say, okay, this is the point
3 where I am going to implement all of these great and
4 glorious improvements that I have been talking about for
5 the past 15 years, and do it at the right point before the
6 plant starts out.

7 I guess I get back into my frustration mode here,
8 you know, when I respond to this question, but I have
9 conducted studies on proposed plants where people have
10 said, don't worry about steam generators, we are going to
11 have the quatrefoil tube support plate sothat denting is
12 not a problem, et cetera, et cetera, et cetera. But that
13 ever elusive point in time when all of that comes together
14 keeps being pushed out five and ten years off into the
15 future.

16 I think in the case of Byron-1 where you have
17 some design improvements that have not been incorporated
18 in the steam generator, i.e., the carbon steel tube
19 support plates, you have got an uncertainty which I consider
20 will remain in the adequacy of the fix on the preheater
21 tube vibration problem.

22 I think it is important to do the best job you
23 can to assure that you are starting off on the best basis,
24 and that is what I am recommending here.

25 Q These frustrations lead you to recommend that
Byron not be allowed to operate unless this independent

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1 review is conducted of these procedures; is that it?

2 MR. THOMAS: Objection. The question has been
3 asked and answered now several times.

4 JUDGE SMITH: I think it has been established
5 now that Mr. Bridenbaugh does not make his recommendation
6 for technical reasons but more for incentive reasons. I
7 think we understand his position. I think that is probably
8 in the purview of the Board, in any event.

9 MR. GALLO: I will just move on at this point.

10 BY MR. GALLO: (Resuming)

11 Q Item 5. You indicate that you recommend that
12 accident analysis to cover the potential of certain
13 multiple accidents be performed; is that correct?

14 A Yes, sir.

15 Q Hasn't that analysis been performed for Byron
16 Station?

17 A It has not been reported in the FSAR.

18 Q All right; but hasn't it been performed?

19 A I have been told that some such analyses have
20 been performed. We did not have too much luck in getting
21 much information on those when we were cross-examining
22 the Commonwealth Edison witnesses.

23 Q Are you talking about the Byron risk assessment?

24 A That is my understanding of where some of those
25 studies have been reported, yes.

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1 Q Was a copy made to you by your counsel for your
2 review? Let me restate that question.

3 Was a copy of that Byron risk assessment made
4 available to you by your counsel?

5 A I could have had access to it. I did not choose
6 to study it.

7 Q You did not study it.

8 A No.

9 MR. GALLO: That's all I have.

10 JUDGE SMITH: That concludes your cross-examina-
11 tion?

12 MR. GALLO: Yes.

13 JUDGE SMITH: Mr. Goldberg.

14 MR. GOLDBERG: Yes, Judge. I have some cross.
15 Don't be too daunted by the length. It will be compressed.

16 JUDGE SMITH: Incidentally, Mr. Gallo, your
17 cross-examination plan, I thought, was a very good example
18 of an ideal cross-examination plan. It was very helpful.

19 BY MR. GOLDBERG:

20 Q Mr. Bridenbaugh, on Attachment A, consisting of
21 your professional qualifications, in the period of 1973 to
22 1976 you indicate you held the title of Manager, Perform-
23 ance and Evaluation and Improvement, General Electric
24 Company; is that correct?

25 A That's correct, yes.

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1 Q And you describe in the first sentence your
2 responsibility for establishment and management of systems
3 to monitor and measure boiling water reactor equipment and
4 system operational performance; is that correct?

5 A Would you restate that, Mr. Goldberg?

6 Q Yes. I was directing your attention to the
7 first sentence under the description of your job in the
8 period 1973 to 1976, page 1 of Attachment A to your
9 written testimony.

10 A Yes. My only question, that I thought you were
11 reading and it did not line up with what I was looking at
12 here. Perhaps you were paraphrasing. Perhaps if you would
13 restate the question, I would be able to respond.

14 Q All right. Why don't you read the first
15 sentence?

16 A "To manage 17 technical and 7 clerical
17 personnel with responsibility for establishment and
18 management of systems to monitor major boiling reactor
19 equipment and system operational performance."

20 Q Did that equipment and system operational
21 performance include steam generators?

22 A Yes, it did, to some degree.

23 Q To what degree?

24 A Well, you have to go back. I have given this
25 answer a number of times. But some of the early boiling

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1 water reactors did include steam generators, and so on those
2 earlier boiling water reactors, the performance of the
3 steam generators was very closely monitored by General
4 Electric and by my organization while I was there. I did
5 not include in this statement of primary responsibilities
6 the discussion that I had with Mr. Gallo earlier in talking
7 about the monitoring of competitors' equipment, but that
8 also was a part of my job.

9 Q When did boiling water reactors cease to have
10 steam generators?

11 A Some of them still do, Mr. Goldberg. General
12 Electric has not built one or has not designed one that
13 has a steam generator since about 1966.

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1 The last one with steam generator was Tarapur
2 in India, which went into service in 1967, as I recall.
3 T-a-r-a-p-u-r.

4 Q Mr. Bridenbaugh, have you been present for all
5 of the direct Applicant and Staff testimony on the steam
6 generator tube integrity contentions?

7 A Almost all, Mr. Goldberg. I was not present on
8 April 15th, which perhaps is significant, a significant
9 date. I believe that is when you did your redirect. I
10 have read that transcript, and there were some of the --
11 several hours that I was not here on the first date that
12 this issue was discussed, and I guess I missed an hour
13 earlier this week, although that was procedural discussion
14 rather than testimony.

15 Q Apart from the revisions in the testimony provided
16 by your counsel at the outset of this session, did any
17 of the testimony you have read or heard alter any of the
18 positions that were presented in your written testimony?

19 A I did mention changes to my testimony as a result
20 of some of the testimony in the positions, but all of
21 those have been identified and are included in the revi-
22 sions.

23 Q So the revisions that have been prompted by your
24 reading or observance of the testimony are contained in
25 the revision pages to your written testimony provided this
morning.

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1 A Yes, sir.

2 Q In preparation for your written testimony, did
3 you do any independent research or analysis on any of the
4 steam generator tube degradation phenomena upon which you
5 testified?

6 A I certainly did not do any independent testing,
7 and I would not describe my work as research unless you are
8 talking about literature research. I certainly made a
9 very definite attempt to obtain all of the latest documen-
10 tation that I could of reports that were relevant to the
11 issue.

12 In the past several years I have, of course, as I
13 indicated earlier, been following this issue and I have
14 attempted to develop a library of documents and reports
15 that are related to the steam generator problems, and I have
16 had on occasion discussed some of these issues with
17 metallurgical people but I have not personally performed
18 any what I would describe research on the issue, technical
19 research.

20 Q I would like to turn your attention, please, to
21 page 5 of your written testimony. I think this line of
22 questioning may have been asked. If it has, I am sure
23 there will be an objection.

24 You indicate on line 7 that there is an increased
25 probability that an accident will be initiated by tube

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1 failures occurring during normal operation. Do you
2 see that testimony?

3 A Yes, I do.

4 Q Did you perform any analysis or calculations to
5 quantify that probability which you describe?

6 A I think you are right, Mr. Goldberg, it has
7 been asked; but no, I did not.

8 Q You indicate on line 10 of page 5 that there
9 is an increased likelihood that an accident sequence that
10 is not now considered in the safety analyses may occur
11 as a result of the degraded condition of steam generator
12 tubes after some period of operation. Do you see that
13 passage?

14 A Yes, I do.

15 Q Did you do any independent calculations or
16 analyses to quantify that increased likelihood?

17 A No, I did not.

18 Q I would like to refer your attention to page 6
19 of your revised testimony, beginning with what appears to
20 be approximately line 24, because there is a gap between
21 line 24 and 25 on the copy I have.

22 A Yes.

23 Q I would like to draw your attention to the
24 statement, the final statement on the insert paragraph
25 beginning, "This latter issue in turn renewed questions."

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1 Do you see that?

2 A Yes, I do.

3 Q Could you just read that sentence, please, into
4 the record?

5 A "This latter issue in turn renewed questions
6 about the need to consider multiple tube failures in
7 concurrent tube rupture and LOCA events in accident
8 analysis for licensing."

9 Q Have you done any independent calculations or
10 analyses to ascertain the probability or radiological
11 consequences of such combined events?

12 A No, I have not.

13 Q I would like to turn your attention to page 7,
14 line 3, of your revised testimony, the written insert
15 there.

16 MR. THOMAS: The typed.

17 MR. GOLDBERG: Yes.

18 BY MR. GOLDBERG:

19 Q The statement is made there -- correct me if I'm
20 wrong -- on the second line -- the Staff has testified in
21 this proceeding that A-3 referred to unresolved safety
22 issue -- A-3 will be resolved by approximately mid-1983.

23 Is that your testimony?

24 A Yes.

25 Q Were you here during the Staff direct testimony --

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1 I believe you stated that you were either present or read
2 the Staff testimony in this proceeding; is that correct?

3 A That is correct, yes.

4 Q Would it be fair to summarize that testimony as
5 standing for the proposition that while the Staff has not
6 memorialized the resolution of A-3, it nonetheless
7 considers it resolved as a safety issue?

8 A I don't remember, Mr. Goldberg, that those
9 type of statements were made, that specific statement
10 was made. I think I would prefer to describe it in another
11 way: that the Staff members who were here testified that
12 in their opinion, there were no surprises going to happen
13 and that most of the work had been completed, and the
14 mid-1983 date that I am citing in my revised testimony
15 here I think stems from the estimate that I read in the
16 transcript that the resolution of A-3 report is expected
17 to be released approximately in July; so that is where that
18 date comes from.

19 It is my understanding, however, that the review
20 of A-3 resolution as expected by the Staff witnesses has
21 not been completed within the NRC. It is my understanding
22 that the CRGR Committee has not yet completed their
23 review of the issue.

24 I would suspect very strongly that the Commissioners
25 will be briefed and in some way will sign off or at least

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1 tacitly agree with the proposed recommendations; and I do
2 not believe those steps have been completed, and it is
3 almost exactly the same point that the Staff was at back
4 in 1981 when they were estimating they were going to
5 resolve the thing in early 1982.

6 There is many a slip between the cup and the
7 lip, and that is what I am pointing out here.

8 Q Is it your testimony that on the basis of the
9 Staff testimony here, there has been no progress in the
10 appreciation or technical resolution of A-3?

11 A No, I wouldn't say that. I certainly would
12 agree that a lot of manpower has been spent on the issue.
13 Progress has been made. There is a better understanding
14 of the technical issues. So I certainly would not say
15 that there has not been any progress. I would just like to
16 see it get formalized and wrapped up into a requirement
17 that is enforced in the field.

18 Q Is it your understanding that there is much in
19 the way of Staff technical analysis that stands in the
20 way of the formalization and the resolution of the
21 issue?

22 A I do not believe there is a great deal of work
23 that has not been basically at least started.

24 Q Only started?

25 A Started and carried out to the point where a

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1 preliminary or proposed solution is in hand.

2 Q In fact, if I am accurately recalling the
3 testimony, if there is a resolution in June, that does not
4 leave much time, does it, to finalize --

5 MR. THOMAS: I object to the form. That is not
6 even a question.

7 MR. GOLDBERG: I will withdraw the question.

8 BY MR. GOLDBERG:

9 Q Can I direct your attention to page 23 -- I'm
10 sorry, page 11, line 23, please, Mr. Bridenbaugh.

11 A Yes.

12 Q Do you see the last statement on that page?

13 A Yes.

14 Q Would you read that, please?

15 A Continuing on to the next page. "AVT has
16 intended to combat one of the most significant tube
17 degradation problems: denting."

18 Q Isn't it a fact, Mr. Bridenbaugh, that the
19 denting phenomenon did not arise until the conversion to
20 AVT?

21 A I think certainly it did not arise as a prevalent
22 condition. I am not sure whether it had been observed with
23 the phosphate treatment or not.

24 Q If I were to show you a passage in SECY-82-72
25 formerly appended to your testimony, that states that denting

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1 did not occur until the conversion to AVT, would you
2 believe that?

3 MR. THOMAS: I cannot believe that I am hearing
4 this after the Staff position and after two hours of
5 argument yesterday about the use of this document, and now
6 he is trying to use it to cross-examine Mr. Bridenbaugh.
7 I have no objection --

8 JUDGE SMITH: If you don't have any objection --

9 MR. THOMAS: If he will stipulate to the attach-
10 ment of the document to Mr. Bridenbaugh's testimony.

11 JUDGE SMITH: The use of the document will only
12 have value if it is translated into a statement or an
13 opinion which originates with him, Mr. Bridenbaugh. There
14 is a distinction in the use of a document for cross-examina-
15 tion as compared to having it in evidence.

16 MR. GOLDBERG: Let me distinguish. I am only
17 using this for impeachment purposes; I am not seeking to use
18 it affirmatively. He either shares or does not share the
19 statement, and we will let the record stand.

20 JUDGE SMITH: There may be some merit to Mr.
21 Thomas' position; however, there is no objection.

22 MR. THOMAS: There is an objection.

23 JUDGE SMITH: You are going to use it for what
24 purpose?

25 MR. GOLDBERG: Impeachment. He made the statement

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1 in his testimony that AVT is intended to combat denting,
2 and I asked him if he regarded the SECY paper previously
3 attached as a reliable source for that.

4 JUDGE SMITH: Let's proceed until you come -- the
5 moment that I think you are going to come to in which you
6 are trying to use the SECY paper itself as a demonstration
7 for a fact.

8 MR. GOLDBERG: I am not going to use it affir-
9 matively, and by affirmatively, I am not going to use it
10 to establish the truth or falsity of it. In the prior
11 version of Mr. Bridenbaugh's testimony, he references this
12 document in support of the proposition upon which I am
13 questioning him now.

14 JUDGE SMITH: Let's see what happens.

15 MR. GOLDBERG: I only have this one question.

16 JUDGE SMITH: All right.

17 BY MR. GOLDBERG: Perhaps you still have the
18 document appended to your testimony, Mr. Bridenbaugh.

19 THE WITNESS: You are correct. I have not been
20 as efficient as the court reporter in purging --

21 MR. GALLO: May I be heard? I just object to
22 Mr. Goldberg using this document, and not because I object
23 to the question being asked, but we have excluded the
24 document for use in cross-examination by counsel for the
25 Intervenors, we have excluded it from being used as

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1 evidence by Mr. Bridenbaugh, and I don't want those two
2 rulings to be infected by allowing counsel for the NRC to
3 use the document.

4 JUDGE SMITH: My memory about using it on
5 cross-examination of the Staff witness is hazy. I don't
6 really understand why you have to use the document, Mr.
7 Goldberg, to ask him the question. It will do you no
8 good unless you can generate the information solely and
9 exclusively from Mr. Bridenbaugh and not from the document.

10 MR. GOLDBERG: Let me do it this way.

11 BY MR. GOLDBERG:

12 Q Will you look at page 12 of your revised
13 testimony, Mr. Bridenbaugh?

14 A Yes.

15 Q I withdraw the question.

16 Can you tell me what your determination was on
17 this issue?

18 MR. THOMAS: What issue?

19 JUDGE SMITH: The difficulty is Mr. Gallo is
20 correct, we apparently did rule that the document could not
21 be used to cross-examine the Staff witness. I do not recall
22 the context of that ruling. The document can be used,
23 a totally unreliable, knowingly false document can be used
24 in cross-examination if it serves one of the recognized
25 purposes: for example, refreshes the memory of the witness.

1 And in those instances it generates information from the
2 witness and not -- it is not information from the unreliable
3 document which is getting into evidence. The ruling was
4 that the objection was premature but virtually inevitable.

5 MR. GOLDBERG: Let me ask this.

6 BY MR. GOLDBERG:

7 Q What is the basis for your opinion on page 11
8 that AVT was designed to control denting?

9 A The basis for that statement is my recollection
10 of the time, of the time that AVT changes were first
11 introduced, is that it was held out as sort of the panacea,
12 if you will, that was going to resolve all steam generator
13 tube degradation problems.

14 Now, if you go on and read down on line 6, lines
15 5 and 6 of my testimony on page 12, you will see that I
16 don't really restrict my conclusion and my statement there
17 to AVT. I say "AVT and other procedural controls are
18 expected to control or eliminate the denting phenomenon."

19 That is really the essence of my testimony,
20 that there have been a number of changes made in the water
21 chemistry program in the procedures; that it has been
22 alleged by a number of people that denting is not going to
23 be a problem. I don't mean by that that it has not been
24 completely eliminated, but it should not be a problem. And
25 all I am saying is that even after these improved procedures

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1 have been introduced, there still has been denting
2 experienced.

3 Q Is it your testimony that AVT was intended to
4 or will have the effect of controlling denting?

5 A You asked two questions there, Mr. Goldberg. I
6 think that gives me a problem. You said was intended to.

7 Q That is my first question.

8 A Okay. It is not my testimony that AVT was
9 introduced to control denting, because it is my under-
10 standing that denting had not really been identified as a
11 problem at the time that AVT was first introduced; so I
12 cannot make that statement.

13 I do believe that AVT was introduced to control
14 a range of corrosion problems in steam generators, as well
15 as other procedures, and that it was expected that denting
16 would no longer be a problem.

17 Q If I understood the first portion of your answer,
18 you no longer adhere to the testimony give on page 11, line
19 23, that AVT is intended to combat one of the most
20 significant tube degradation problems: denting. Is that
21 correct?

22 A I guess if I look at that sentence in a vacuum
23 without the context, I would have to agree with your
24 characterization of that statement.

25 Q Do you know of any plant that experienced denting
before the conversion to AVT?

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1 JUDGE SMITH: Before? Is that your question?

2 MR. GOLDBERG: Yes.

3 THE WITNESS: NUREG-0886 indicates denting was
4 first identified in 1975, and that was the first time that
5 AVT was introduced. In answer to your question, no, I do
6 not know of any specific plant where it was identified. It
7 does not necessarily mean that it was not going on, I guess.

8 BY MR. GOLDBERG:

9 Q But you cannot identify any plant that experienced
10 denting prior to the conversion of AVT.

11 A No, I can't.

12 Q Page 12 of your revised testimony, line 9 states,
13 and correct me if I am wrong, that from a practical stand-
14 point, steam generator tube degradation is a problem that
15 will probably never be totally solved.

16 MR. THOMAS: Resolved.

17 MR. GOLDBERG: Resolved. I am sorry.

18 BY MR. GOLDBERG:

19 Q I believe you testified -- correct me if I am
20 wrong -- as long as you have metal coming into contact
21 with water, you are going to have some corrosion.

22 A That's right, yes.

23 Q What more do you feel can be done to minimize
24 steam generator tube corrosion than has already been done?

25 A Well, I guess -- you know, you have given me a
pretty wide open range of things to talk about. One thing

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1 you could do is you could replace the steam generators on
2 Unit 1 at Byron and put in new steam generators with
3 stainless steel tube supports and thermally treated tubes.
4 That is one thing you can do.

5 Q And if you did that, there would still be some
6 corrosion; is that correct?

7 A There would certainly still be some corrosion,
8 but I would expect that you would have reduced the problem
9 a little bit more.

10 Q Can you quantify the reduction that would be
11 occasioned by such a switch?

12 A No, I can't.

13 Q I would like to direct your attention, Mr.
14 Bridenbaugh, to page 19 of your testimony, please. Are
15 you familiar with the radiological consequences of the
16 four previous steam generator tube rupture events described
17 in your testimony on page 19 and discussed further by you
18 today?

19 A I cannot quantify them, if that is what you mean.
20 I am generally familiar with them.

21

22

23

24

25

1 Q You state there on line 14, all four of these
2 events demonstrated tube leakage rates far in excess of the
3 nominal one gallon per minute assumed in the Byron FSAR
4 accident analysis. Is that correct?

5 A Yes.

6 Q Are you talking there about the single steam
7 generator tube rupture event analyzed in the FSAR?

8 A There is a reference to 19, which is the Byron
9 FSAR, Table 15.6-2. My recollection of that particular table
10 indicates that in the accident analysis it is assumed that
11 there is a failure of one tube and a leakage rate is 1 gpm.
12 That is my recollection; I don't have that table in front
13 of me.

14 Q Isn't it true that that analysis postulates the
15 complete severance of a single tube?

16 MR. THOMAS: The FSAR analysis?

17 MR. GOLDBERG: The FSAR steam rupture tube analysis.

18 THE WITNESS: I believe that's correct, yes.

19 BY MR. GOLDBERG:

20 Q And you believe that the leakage rate from
21 the complete severance of a single steam generator tube is
22 only 1 gpm?

23 A No, I don't believe that at all. What I'm reporting
24 is what is reported in the FSAR. I believe the complete
25 severance of a single steam generator tube could certainly be

1 as high as 760 gpm because that is what was seen at Ginna.

2 Q Were you present during the Staff testimony of
3 Mr. Marsh?

4 A The Staff testimony of Mr. Marsh? Yes. Some of it.

5 MR. GOLDBERG: Judge, I'm sorry, I don't have
6 the FSAR table involved. My recollection -- correct me if
7 I'm wrong -- is that Mr. Marsh testified that the postulated
8 design basis steam generator tube rupture accident postulated
9 the complete severance of the tube and the instantaneous
10 leakage of its contents. Is that correct?

11 MR. THOMAS: I object. He's asking about his
12 recollection of Mr. Marsh's testimony, which is not in front
13 of us, regarding a table in the FSAR which is not in front
14 of us. This is not a memory contest. If there's an issue,
15 that's one thing, but -- that's my objection.

16 MR. GOLDBERG: If he has no recollection, he has
17 no recollection and we'll just have to let the record speak
18 for itself. And then I will profer a document that I do have
19 that might --

20 JUDGE SMITH: What's your recollection, Mr.
21 Bridenbaugh?

22 THE WITNESS: My recollection is that Mr. Marsh
23 spoke of the expected leakage rates that would be expected
24 for a complete tube severance event. I don't recall that he,
25 however, addressed the issue of what had been analyzed

1 specifically for Byron and what had been reported in the FSAR.
2 That's really my point.

3 I think that Mr. Marsh's testimony supports the
4 point that I was trying to make here; that as I read the
5 FSAR, they appear to have only looked at low leakage rates,
6 and I think they should look at higher leakage rates.

7 MR. GOLDBERG: Let me show the witness and counsel
8 page 15-17 of the Staff SER, Table 15.4, which itemizes the
9 assumptions used in that postulated steam generator tube
10 rupture accident, and ask him if that is consistent with his
11 understanding of the assumptions of the leakage quantity
12 and rate contained in the FSAR table which regrettably, I
13 don't have in front of me.

14 MR. THOMAS: Just so the record is clear, this is
15 the SER that's being shown, not the FSAR.

16 (Counsel handing document to witness.)

17 THE WITNESS: I don't recall what your question is.

18 BY MR. GOLDBERG:

19 Q I wanted to direct your attention, Mr. Birdenbaugh,
20 to the first assumption, which the Staff Safety Evaluation
21 Report indicates was utilized in the single steam generator
22 tube rupture analyzed in the Applicant's FSAR, and ask you
23 to read the first assumption.

24 A Let me first read the first assumption. This is
25 Table 15.4 from the Staff's Safety Evaluation Report, page

1 15-17, and it says, "The rupture is a double-ended guillotine
2 break resulting in an average leakage of 66 pounds per second
3 from the reactor coolant system to the steam generator
4 secondary side." That's the end of the quote.

5 Just to make sure that it's clear, this reference
6 is in pounds per second and not gallons per minute, so they
7 can be compared but they are not the same units.

8 Q If you were to compare them, how would this compare
9 with the nominal 1 gpm leakage rate which you utilized in
10 your testimony as the basis for statements we have discussed?

11 A First of all, Mr. Goldberg, I don't utilize the
12 number in my testimony. I only report what the FSAR says.
13 However, if I compared the two, this is a much higher rate.

14 JUDGE COLE: Higher than what, sir?

15 THE WITNESS: Higher than the 1 gpm which is
16 identified in the FSAR.

17 JUDGE COLE: Not higher than the 760 that you
18 referred to?

19 MR. WITNESS: No, although I've not done that
20 calculation. I'm not sure what that is.

21 BY MR. GOLDBERG:

22 Q Now I want to get back to my original line of
23 questions about radiological consequences. Have you compared
24 the off-site radiological consequences resulting from the
25 postulated single steam generator tube rupture accident

1 performed in the FSAR with the off-site radiological conse-
2 quences experienced in the four steam generator tube rupture
3 events that have occurred?

4 A No.

5 Q Isn't it true that there was Staff testimony from
6 Mr. Marsh that the consequences of the four steam generator
7 tube rupture events that have occurred are less than those
8 postulated to result from the single steam generator tube
9 rupture event analyzed in the FSAR for design basis purposes?

10 MR. THOMAS: I object to the relevance of the
11 question. Let's assume that there is testimony by Mr. Marsh
12 to that effect. What is the point of asking this witness
13 whether there is such testimony? If there is, there is. And
14 if there is not, there is not.

15 MR. GOLDBERG: I think in the context of appre-
16 ciating the safety significance of the known steam generator
17 tube rupture events, to which Mr. Bridenbaugh assigns some
18 importance, I would like him to know whether or not any steam
19 generator tube rupture event that has occurred in the domestic
20 history of operating plants in this country has exceeded the
21 design basis accident analysis performed as a routine matter.

22 I think that's important.

23 JUDGE SMITH: It is relevant. Don't you agree?

24 MR. THOMAS: I'd agree that is a relevant question,
25 but as to whether Mr. Marsh testified to this or that, that's

1 a different question. Now he's posing, you know, another
2 question.

3 JUDGE SMITH: Why don't you answer the second
4 question?

5 THE WITNESS: I have not performed any analysis
6 or comparison of those events, so I don't really know the
7 answer to your question.

8 BY MR. GOLDBERG:

9 Q Do you accept my representation that there was
10 testimony to that effect, or would you like to be provided
11 with a reference to that testimony?

12 MR. THOMAS: I have a relevancy objection to that
13 question, too. It's the same question about whether he
14 testified to that. Maybe there's something I don't understand.
15 I just don't understand now the importance of it.

16 MR. GOLDBERG: I have indicated the importance.
17 He has not done any analysis. I'm asking whether he is
18 prepared to accept the analysis that was done, or if he wants
19 to see it in print.

20 JUDGE SMITH: That's fair. The question is, is
21 he willing to accept the analysis done by the staff.

22 MR. THOMAS: Assuming that Mr. Marsh testified to
23 that, does Mr. Bridenbaugh accept that? Does he agree with it.
24 Okay. And then I have no objection to that question, either.

25 BY MR. GOLDBERG:

1 Q Do you have the question in mind, Mr. Bridenbaugh?

2 A Not specifically, no.

3 Q There has been testimony that Staff analysis has
4 shown that the off-site radiological consequences from each
5 of the four known steam generator tube rupture events are less
6 than those postulated to occur from the design basis, single
7 steam generator tube rupture event. Are you aware of such
8 testimony?

9 JUDGE SMITH: He has to lay the groundwork for
10 the question in some way. I think you're causing him more
11 trouble than you should be. He's allowed to go to the point
12 where he's going.

13 MR. THOMAS: I agree. Assuming -- well, --

14 MR. GOLDBERG: He doesn't have to assume; I'll
15 show him the testimony, which is where we left off. Just let
16 me show him the testimony right now.

17 JUDGE SMITH: All right.

18 (Counsel handing document to witness.)

19 (Pause.)

20 BY MR. GOLDBERG:

21 Q Page 4801 of the April 15th transcript -- .

22 A Just so your question doesn't call into question
23 my memory, Mr. Goldberg, that's the date that I was not here.
24 I'm at page 4801.

25 Q Is it true -- the question appearing on line 17 --

1 that I asked Mr. Marsh whether the Staff had analyzed the
2 system performance and radiological consequences of each of
3 the four steam generator tube rupture events that have
4 occurred to date? Is that correct?

5 A Yes, that's correct.

6 Q I asked at line 20 for a summary of the results;
7 is that correct?

8 A That's correct.

9 Q Now, can you just read the answer continuing onto
10 page 4802, please, and I will tell you where to stop.

11 A Okay.

12 Yes. Quote, "The NUREG-0651 evaluated the system
13 performance, operator actions and radiological consequences
14 of the three domestic steam generator tube rupture accidents
15 which had occurred previous to that time. Those were the
16 first three, the Point Beach, Surry and Prairie Island steam
17 generator rupture accidents, and the results in the NUREG-
18 0651 document state that the systems' performance and operator action
19 were as expected. The operators performed in an expeditious
20 and beneficial manner in those accidents."

21 "Also, we found that the radiological consequences
22 were very, very low, far less than the design basis steam
23 generator tube rupture accident."

24 Q That's enough, unless you'd like to just read to
25 yourself beyond that point.

1 A I'd like to at least read to myself the rest of
2 the answer.

3 Q Sure.

4 (Pause.)

5 "The systems performance and the operator actions
6 and radiological consequences for the Ginna event..." -- I
7 think perhaps the "in" should be an "and" -- "...for the
8 Ginna event have been evaluated in two documents; NUREG-0909
9 and 0916. They likewise found that the overall system
10 performance, operator actions and radiological consequences
11 were as expected. However, there were some systems perform-
12 ance aspects that were described in those documents which
13 the staff looked at and incorporated into the ongoing generic
14 assessment."

15 Q On the subject of the comparison of the radio-
16 logical consequences from the four steam generator tube events,
17 would the single tube rupture design basis event -- have you
18 performance any independent evaluations to compare the conse-
19 quences of those two categories?

20 A No, I have not.

21 Q Do you have any basis to disagree with the Staff's
22 analysis as testified to by Mr. Marsh in the passage you just
23 read about their comparison?

24 A I have no basis to not believe what he says. I'd
25 only point out that it's not totally clear from this answer

1 what the results, in fact, were, at least for Ginna. It says
2 that the radiological consequences were as expected, and it
3 is not absolutely clear to me what that means.

4 I'd also point out that the radiological consequences
5 depend to -- depend on a lot more factors than the leakage
6 flow. Depends on the activity that existed in the coolant,
7 depends on a number of factors. And the operator action and
8 so on. I have no reason to believe that the radiological
9 consequences at Ginna exceeded the tube rupture accident
10 analysis, but that does not tell me that they were less than.

11 Q You have not performed any analysis taking into
12 account those factors or others to make that comparison,
13 have you?

14 A No, sir.

15 Q While we're on the subject of Ginna, on page 19
16 of your testimony you were questioned by Mr. Gallo about
17 the statement appearing on line 19, that the Ginna tube
18 rupture event came close to being a multiple tube failure.
19 Is that correct?

20 A Yes, sir.

21 Q Is there any indication from your knowledge of
22 the facts of the Ginna incident that the fractured plugged
23 tube involved in the Ginna incident rubbed up against anymore
24 than one adjacent tube in service?

25 A No.

1 Q Wouldn't it have to rub adjacent to more than one
2 tube in service to even approach the possibility of a multiple
3 tube rupture?

4 A Yes, it would. But the basis for my statement
5 there is that the tubes are very close together, and if a
6 tube is loose to the point where it can rub on one tube, it
7 is almost certain that it could have rubbed on another tube,
8 or several other tubes.

9 Q You indicated before your familiarity with the
10 Staff report describing the Ginna event. Is that correct?

11 A Yes, I have referenced it in -- at the end of
12 the testimony. I don't have it with me.

13 Q Is there any information there to suggest that,
14 in fact, the fragment of the plugged tube did rub adjacent
15 to more than one tube in service?

16 A I'm not aware of any specific statement to that
17 effect.

18 MR. GOLDBERG: If I could just have a moment, Judge,
19 I think I am concluded.

20 (Counsel conferring.)
21
22
23
24
25

1 MR. GOLDBERG: I am completed. I'm told that
2 maybe the infamous FSAR Table may be available. Maybe we
3 could have a moment to refer to it and see what it says.

4 Judge, I'm going to try, with your indulgence --
5 when did you want to conclude today?

6 JUDGE SMITH: We had a site visit planned. It
7 looks like that is imperiled.

8 MR. GOLDBERG: There is some confusion, I suppose,
9 in the table in the text, which I could probably develop
10 after a few minutes. I just don't want to take up the
11 Board's and parties' time to do it, since it's not a Staff
12 document.

13 JUDGE SMITH: Would you object if Dr. Cole began
14 his questioning and you can be working on the problem?

15 MR. GOLDBERG: No, not at all. In fact, I just
16 may not pursue it.

17 JUDGE SMITH: All right.

18 BOARD EXAMINATION

19 BY JUDGE COLE:

20 Q I'll try to be brief, Mr. Bridenbaugh. You're
21 the 16th witness on the steam generator tube integrity. Is
22 it fair to say, sir, that the major problems associated with
23 steam generator tube integrity have been identified in this
24 record?

25 A I think all that are known at this time have been,

1 yes, sir.

2 Q I knew I was going to get an answer like that.

3 (Laughter.)

4 Those problems that are identified -- and you've
5 indicated that you've read the record -- are these problems
6 in your view, adequately summarized?

7 A Yes, I think so.

8 Q On page 8 of your testimony, in response to some
9 questions, I believe it was by Mr. Gallo, you identified 6
10 of the 12 actions on page 8 of your testimony. You identified
11 6 of those as being of prime importance at Byron. Do you
12 recall that, sir?

13 A Yes, I do.

14 Q I believe you identified -- they're not numbered
15 on the page, but if we were to number them from 1 to 12, you
16 identified 1, 2, 3, 5, 6 and 7, is that correct, sir?

17 A No, sir. That's not correct. It would be 1, 2, 3,
18 6, 7 and 8.

19 Q Are you familiar with the proposed actions or
20 programs that the Applicant plans to use in addressing those
21 six items?

22 A I am familiar only to the extent that they are
23 discussed in the Applicant's testimony, or have been
24 discussed here during the cross examination, or to the extent
25 that they're discussed in the FSAR and SER.

1 Q In certain parts of your testimony on your recom-
2 mendations you identify certain things that you consider to
3 be deficiencies. For example, you state that the inspection
4 program should be different in that it should be more frequent.

5 A Yes.

6 Q Are you familiar with the details of their in-
7 service inspection program for tubes?

8 A I have not seen their detailed in-service inspection
9 program. I've heard it generally described. In my
10 experience -- and I may be wrong in this case -- but it is
11 usually not true that the in-service inspection program is
12 actually formalized until sometime after the plant goes into
13 service, or at least that is relatively a common thing,
14 although the requirements are, of course, identified ahead
15 of time.

16 Q Whose requirements?

17 A The NRC requirements. Or the ASME, whichever
18 the case may be.

19 Q Are you familiar with those requirements, sir?

20 A Yes, sir, I am.

21 Q Do you agree that at a minimum, the Applicant would
22 meet those requirements?

23 A Yes.

24 Q So you would have them meet a different standard?

25 A I don't -- I recognize that there is a difference

1 between the legal requirements and what is desirable and what
2 a licensee may choose to do. In the context that these
3 requirements are discussed on page 8 of my testimony, and
4 specifically, we are talking about in-service inspection, I
5 would not propose that Commonwealth Edison be required to
6 meet a different standard than another licensee, other than
7 if an interim program, for example, were to be imposed upon
8 them because of a particular problem or a unique situation,
9 which is done at other plants.

10 For example, if I may just give an example, it's
11 my understanding that with the identification of the pre-
12 heater tube vibration problem, that additional inspection
13 requirements have been imposed, for example, upon McGuire.
14 I think that that is an appropriate thing to do, and I
15 would not say that because of that, all other steam generators
16 should have the same requirements imposed upon them. I
17 think that's appropriate, that unique situations like that
18 be developed.

19 The recommendation that I make here on page 8
20 primarily is that it's my opinion that the tube in-service
21 inspection program, as identified in the current standards,
22 is not quite complete and it needs to be augmented. I think
23 that should be done through the proposed NRC requirements
24 program.

25 Q All right, sir, I understand your position on that.

1 Did you look at their proposed program on detection
2 of loose parts in steam generators?

3 A Yes, I have looked at -- I've looked at the FSAR
4 and I've looked at the SER. That's really the extent of my
5 investigation. I guess my position there is that I think
6 there is a need for a stronger requirement on the loose
7 parts monitoring system on the secondary side of the steam
8 generator. Since steam generator tube degradation is an
9 issue and one that I believe is a safety issue, I think that
10 the LPMS should be a tech spec requirement.

11 Q All right, sir. Are you aware of any of the
12 Applicant's plans for loose parts detection on the secondary
13 side?

14 A Yes, I am. My understanding is that they have
15 detectors. I don't recall exactly how many. I think there
16 are two on each steam generator.

17 It's also my understanding that that is not an
18 active system; it is there for periodic monitoring, and I also
19 understand that it's not required in the technical specifica-
20 tion, that it is not a limiting condition for operation.

21 Q And you're saying it should be a limiting condition
22 for operation?

23 A Yes.

24 Q With respect to the other three or four items there,
25 is there anything about -- that you are aware of that the

1 Applicant has proposed to do or is not doing that you think
2 they should be doing with respect to any one of those -- of
3 the total six items that you mentioned as most important?

4 A We've already covered items 1 and 3, I guess, in
5 our discussion. Item 2 is, of course, not anything that they
6 can do right now. It could be included in the inservice
7 inspection program as a requirement that in the event that
8 there are plugged tubes, that there would be a commitment to
9 periodically assure that the integrity of those tubes is
10 adequate and is not jeopardizing any adjacent tubes. I'm
11 not sure exactly how you would do that. I assumed that that
12 could be incorporated in the ISI program.

13 The condenser inservice inspection program is one
14 that I believe is not required anyplace or in any regulation
15 or any technical specification that I'm aware of. I think
16 that is an entirely new potential requirement, if you will,
17 although I'm sure that Commonwealth Edison is going to do
18 inspection of the condenser.

19 Q There's testimony in the record to indicate that
20 they do plan a program of condenser inservice inspection
21 and detection. Are you familiar with their proposal on that?

22 A Yes. I was here for that crossexamination.

23 Q In your view, is that an adequate program?

24 A I have not really decided on that one yet, Judge
25 Cole. I would like to see -- because it is such an important

1 issue, I would like to see some kind of a regulatory require-
2 ment on it. I'm very familiar with Commonwealth Edison, have
3 worked with them on other projects for more than 20 years
4 probably. There's no doubt in my mind that they are going
5 to inspect the condenser, and they will do so.

6 I think that because it has an important effect
7 on the future performance of steam generators, I think there
8 should be some kind of a regulatory requirement on that.

9 Q It should be formalized, in your view?

10 A Yes.

11 Q Is it generally your same view on primary to
12 secondary leakage limit detection in the secondary water
13 chemistry program?

14 A Yes. As far as the primary to secondary leakage
15 limit, it's my recollection that the limits that were
16 discussed in the SAI report are basically going to be followed
17 at Byron.

18 Q Did you want to add anything further on those six
19 items, sir? I would like to move to something else.

20 A No. I would only say it's my understanding that
21 there's some uncertainty on the upper inspection port
22 as to whether or not that is going to be there or not.

23 Q All right, sir. There is considerable testimony
24 in the record on that. Are you familiar with that testimony?

25 A Yes, I am.

1 Q Do you recall the initiating reason for upper ports
2 in steam generators? Was it not associated with the denting
3 problem in the upper plate at the small U-bends?

4 A Yes, sir, that's correct.

5 Q Do you recall the testimony in the record that
6 indicates that that might not be the problem that it was
7 previously?

8 A Yes. I recall that there has been a change made
9 in the support plate that's supposed to preclude that particu-
10 lar problem from happening. I guess I'd only add that I
11 think that in my experience on plants and maintenance, that
12 you can never really have enough or too many inspection ports
13 unless you get one that leaks, and then you say you have one
14 too many. But you can never predict what's going to happen
15 in the future. So I think it was desirable to have it.

16 Q All right, sir. Do you recall some of the testimony
17 that -- on the wisdom of an after-the-fact penetration of the
18 steam generator for the purpose of installing ports.

19 MR. GALLO: Excuse me, Judge Cole, I'm sorry to
20 interrupt but one of my witnesses is going to take the stand
21 after Mr. Bridenbaugh finishes. Perhaps I should have done
22 this already, and I apologize, but he's going to point out
23 that indeed, that upper inspection port on Unit 1 steam
24 generators has been, in fact, installed.

25 JUDGE COLE: They have been installed?

1 MR. GALLO: Yes.

2 JUDGE COLE: Okay.

3 THE WITNESS: I guess it wasn't so hard after all.

4 JUDGE COLE: We'll forget that.

5 MR. GALLO: We'll explain how easy that was.

6 THE WITNESS: Since the issue -- my only comment
7 was that I was in some disagreement with the difficulty that
8 Mr. Conway described it would take to install such a port.

9 BY JUDGE COLE:

10 Q I was going to ask what your recommendation as a
11 professional engineer with your experience in the field, what
12 your recommendation would be about the upper inspection port.

13 A My recommendation would be if it was, in fact, as
14 difficult as Dr. Conway described it, I would probably agree
15 with him. I don't really believe it's quite that difficult.

16 Q All right, sir, thank you. You mentioned the
17 difference between the D4 and the D5 steam generator with
18 the carbon steel plates versus the stainless steel and the D5.
19 Is the problem with the carbon steel in the D4 associated
20 with the denting problem? Is that the principal concern?

21 A Yes.

22 Q Do you recall reading in the record testimony to
23 the effect that venting is not as serious a problem as it
24 was in the past? In fact, there are some statements in the
25 record that I recall that just denting is not a serious

1 problem. Do you agree with that, sir?

2 A I agree that denting is not likely to be an
3 accident initiator type problem. I think it could be a
4 reliability problem, and in terms of requiring plugging of
5 tubes or additional inspection, if, in fact, it does develop,
6 it's going to be present at Byron 1. I don't see it as an
7 accident problem.

8 Q All right, sir, thank you. You listened to and/or
9 read the testimony on the technical fix that Westinghouse has
10 proposed and CeCo has apparently agreed to for resolving the
11 flow-induced tube vibration problem.

12 A Yes, sir.

13 Q What's your professional judgment of the adequacy
14 of the technical fix, sir?

15 A I think if the data that we heard in the In Camera
16 Session in terms of the reduction or the benefit that the
17 tube expansion is expected to produce turns out to be the
18 case at Byron, it sounds to me like it should succeed.

19 Q All right, sir, thank you. Just one or two quick
20 questions, sir. With respect to the tube rupture incident
21 at Ginna in which they experienced a flow from the primary
22 to the secondary of 700 plus gallons per minute, you read
23 the reports on that incident, did you not, sir?

24 A Yes, I did.

25 Q Do you know how long it took the operators at the

1 plant to detect that tube rupture?

2 A I don't recall the length of time, Judge Cole.

3 Q Based upon your experience with the operation of
4 reactors, could you make some estimate as to a likely time
5 that that kind of a leak would have been detected from the
6 primary to the secondary?

7 A I would think it would be detected at the -- by
8 radiation monitoring the air ejector very rapidly, within
9 a matter of probably seconds.

10 Q Do you know what the response of the operator
11 would be upon detection of that rupture?

12 A There is, of course, emergency operating procedures.
13 They are called different things at different plants, but
14 when he identifies a rupture of that magnitude, he is
15 supposed to isolate that steam generator and equalize the
16 pressure.

17 Q All right, sir. With respect to the relative
18 frequency of single tube versus multiple tube ruptures, does
19 not this kind of a response to a single tube rupture, doesn't
20 that work against the possibility of having multiple tube
21 ruptures?

22 A It certainly makes them less probable, yes, sir.

23 Q Did you read the testimony of -- and listen to
24 the testimony of Mr. Hitchler the other day?

25 A Yes, I did.

1 Q Do you recall in his testimony where he made
2 estimates of the steam generator tube rupture frequencies?

3 A Yes.

4 Q In his testimony, he -- based upon the statistical
5 evaluation of tube ruptures, he -- do you recall him
6 estimating that the frequency of a tube rupture in one of
7 the Byron units, either Byron Unit 1 or Byron Unit 2, is
8 about one tube in 33 years? Do you recall that, sir?

9 A Yes, sir, I wrote that number down in the margin
10 of his testimony before he made that statement.

11 Q Do you have any information that would dispute
12 that number, sir?

13 A No, I don't.

14 JUDGE COLE: That's all I have, thank you very
15 much.

16 BY JUDGE CALLIHAN:

17 Q One clarification, please. On page 5 of your
18 testimony you referred to probability, I think, is your word
19 of increasing numbers of events in steam generators.

20 A Yes, sir.

21 Q Is that normalized for the number of steam genera-
22 tors in service? In other words, it's a relative number or
23 is it an absolute number that you're addressing -- absolute
24 value that you're addressing?

25 A Perhaps the probability was not the right word.

1 That should have been used there, and perhaps I should have
2 used "likelihood." What I'm really addressing there is
3 that because of the tube degradation problems that have
4 developed over the past years, and coupling that with the
5 tube vibration problem of the preheater at Byron, that in
6 my view there is an increased likelihood that the Byron
7 plant would experience tube failure increased above and
8 beyond what might have been predicted had you looked at it,
9 say, in 1970.

10 So, it is a statement that I make for the
11 class of steam generator that's being looked at at Byron,
12 and it would be a relative probability, I guess, in answer
13 to your direct question, sir.

14 Q Perhaps my question is really more simpleminded
15 than that. Assume that more nuclear power steam generating
16 plants come online; more events of one type or another may
17 be anticipated just because there are more places for
18 those events to occur. My question was simply, is that
19 factor brought in as a normalizing factor in your statement?

20 A No. I was not looking at the number of events
21 in a year. I was really talking about the likelihood of
22 a given event at a given plant.

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1 Q I have a series of questions on what you observed
2 at this hearing, what you thought the future might be, but
3 I certainly want you not to be repetitious, and I think
4 that subject has been pretty well covered in the last two
5 series, at least the last two series of questions. So I
6 will withhold and withdraw, and thank you as though you
7 were speaking to my inquiries.

8 JUDGE SMITH: Are there any questions based upon
9 Board questions?

10 (No response)

11 MR. GALLO: No questions.

12 MR. GOLDBERG: No questions.

13 JUDGE SMITH: Do you want to go to that previous
14 issue?

15 MR. GOLDBERG: No, Judge.

16 JUDGE SMITH: Do we have any redirect?

17 MR. THOMAS: No, Judge.

18 JUDGE SMITH: Thank you, Mr. Bridenbaugh.

19 (The witness was excused.)

20 JUDGE SMITH: How long do we think Mr. Blomgren
21 will take?

22 MR. GALLO: My direct will be very short, about
23 ten minutes.

24 Whereupon,

25

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JOHN BLOMGREN

1 was recalled as a witness and, having previously been
2 sworn, resumed the stand and was examined and testified
3 further as follows:
4

DIRECT EXAMINATION

BY MR. GALLO:

5
6
7 Q Mr. Blomgren, you are still under oath. Were you
8 present in the courtroom when Mr. McCracken testified?

9 A Yes, I was.

10 Q Do you recall page 3 of Mr. McCracken's testimony
11 where in that testimony he indicates that the secondary
12 water chemistry program includes, among other things, power
13 reduction to 50 percent if steam generator impurity limits
14 are exceeded, to minimize concentration of corrosive
15 species? And he was speaking with respect to the Byron
16 secondary water chemistry program.

17 A Yes, I recall that.

18 Q Is that 50 percent figure the figure that is, in
19 fact, in the proposed technical specifications for the Byron
20 secondary water chemistry program?

21 A I think you are referring to the proposed -- not
22 the proposed technical specifications but the approved
23 Byron Station secondary water chemistry control program.

24 Q I stand corrected. Is that figure of 50 percent
25 in that program?

A No, it is not.

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1 Q What is the number?

2 A The Byron secondary water chemistry control
3 program contains the figure 30 percent, which is consistent
4 with the EPRI Steam Generator Owners Group secondary
5 water chemistry guidelines.

6 Q Mr. Blomgren, have you had occasion to read Mr.
7 Bridenbaugh's testimony?

8 A Yes.

9 Q Specifically Attachment, I believe it is, F, and
10 the reference in his testimony to the water chemistry
11 procedures for Byron.

12 A Yes.

13 Q What is Attachment F to that testimony?

14 A Attachment F is titled "Commonwealth Edison's
15 November 17, 1982 Response to Rockford League of Women
16 Voters' Interrogatory No. 4." It is specifically the
17 response to Interrogatory No. 4, paragraph C.

18 Q Is that response a calculation of the status as
19 of that time of the Byron operating and water chemistry
20 procedures?

21 A Yes.

22 Q What was the date, again?

23 A The date was November 17, 1982.

24 Q Have you had occasion to reivev and update that
25 list?

A Yes, I have.

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1 Q Do you have a list in front of you entitled
2 "Current Status of Procedures Listed in Interrogatory No. 4
3 of C?"

4 A Yes, I have that list.

5 Q Was this prepared under your supervision and
6 direction?

7 A Yes, it was.

8 Q What is the date of that list?

9 A That list was prepared as of April 12th, 1983.

10 Q And does this current status of procedures
11 indicate the status in relation to what was reported in
12 Interrogatory 4C?

13 A Yes, it does.

14 Q Can you just summarize in general terms what the
15 current status is with respect to these procedures in terms
16 of differences with those reported in Interrogatory 4C?

17 A In the answer to Interrogatory 4C that was pro-
18 vided in November of 1982, some 44 procedures were identi-
19 fied in a list and their status was identified as being
20 either approved in some draft form or as being identified
21 only. As of April 12, 1983, 26 of those procedures had
22 changed status; 13 of them had gone from the draft stage to
23 an approved station procedure stage; 8 had gone from an
24 identified status to a draft status; and 5 had gone from
25 an identified status to approved.

10joy5 1 Q Locking at this current status, when would you
2 expect that the operating procedures would be completed by
3 in terms of their status?

4 A The remaining procedures will complete before
5 fuel load.

6 Q How about the chemistry program description?

7 A The secondary chemistry program descriptions
8 specifically for the steam generator water chemistry
9 program is complete and approved at this time. One
10 procedure, NRC/Regulatory Program, which is identified on
11 this list as BPD 300-2, would be completed upon receipt
12 of the final technical specifications for the plant.

13 Q When would that be?

14 A That would be sometime before fuel load.

15 Q And when would the chemistry system description
16 be complete?

17 A Those would also be completed before fuel load.

18 Q And finally, the chemistry procedures shown on
19 the second page.

20 A Those will also be completed before fuel load.

21 Q I believe you indicated to me that there were one
22 or two minor typographical errors on the status report.

23 A Yes, there are. There is one procedure in the
24 operating procedures section. The number is BOPAF-3.

25 JUDGE SMITH: Are you going to bind this in?

MR. CALLO: I am going to move so, yes.

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1 BY MR. GALLO:

2 Q What is the correction?

3 A F-3. The approved date was typed in as 9/3/72.
4 It is 9/3/82. In Section No. 2, procedure No. BPD-200-2
5 should read 200-7.

6 Q Is the status report otherwise current and
7 complete?

8 A Yes, it is.

9 Q Let me ask a different question. Strike the last
10 question and answer.

11 Is it otherwise accurate and complete?

12 A Yes, it is.

13 MR. GALLO: Judge, at this time I would like to
14 move into evidence and have bound into the transcript
15 the current status of procedures listed in Interrogatory
16 number 4C. It is a two-page document that Mr. Blomgren
17 has been testifying from.

18 JUDGE SMITH: Are there any objections?

19 MR. THOMAS: When was this document prepared?

20 THE WITNESS: This was prepared April 12, 1983.

21 MR. THOMAS: Has this been served on anybody
22 prior to this time or is this the first public -- is this
23 the first distribution of this document to the parties,
24 to your knowledge?

25 MR. GALLO: It is the first distribution. I can

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1 tell you that.

2 MR. THOMAS: That is all I have. No objection.

3 JUDGE SMITH: All right. The document is
4 received.

5 (The document referred to, Current Status of
6 Procedures Listed in Interrogatory No. 4C, follows:)

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CURRENT STATUS OF PROCEDURES LISTED IN INTERROGATORY NO. 4C

The following is a listing of the Byron Operating and Chemistry Procedures or documents which concern the steam generators, their water quality, and chemistry control. Each procedure is identified as to whether it has been written, drafted or identified. The procedures are as follows:

1. Operating Procedures

<u>Procedure Number</u>	<u>Procedure Name</u>	<u>Current Status</u>			<u>Int. 4C Status</u>
		<u>Approved</u>	<u>Draft</u>	<u>Identified</u>	
BOA SEC-8	Generator Condition Monitor Trouble S/G Hi Conductivity/Operating Limitations	2-26-83			Identified
BOG CD-3	Placing S/G in Wet Lay-up	Deleted 1-10-83			Identified
BOP PS-3	S/G Blowdown Sample		X		Identified
BOP PS-5	S/G Monitoring		X		Identified
BOP SD-1	Start-up of S/G Blowdown		X		Identified
BOP SD-2	Shutdown of S/G Blowdown	2-21-83			Identified
BOP AF-3	Placing the S/G in Wet Lay-up	9-3-72			Identified
BOP CF-8	Main Feed System Chemical Feed	82	X		Identified
BOS 7.2.1-1	S/G Press/Temp Limitations with Primary or Secondary Coolant less than 70°F			X	Identified
BOS 4.5.0-1a	S/G Inoperable			X	Identified
BOS 4.7-1A	RCS Chemistry Surveillance			X	Identified
BOS 7.2.1-1A	S/G Press/Temp Limit Exceeded			X	Identified
BVS 4.5.0-1	ASME Surv. Requirements for S/G's			X	Identified
BVS 4.5.1-1	S/G Inspection Shutdown			X	Identified
BVS 4.5.2-1	S/G Tube Inspection			X	Identified
BVS 4.5.3-1	S/G Inspection Frequencies			X	Identified
BVS 4.10-11	S/G Eddy Current Examination			X	Identified

2. Chemistry Program Descriptions

BPD 100-3	Flushing	X			In Draft
BPD 100-4	Secondary Chemistry Program	X			In Draft
BPD 100-5	Hot Functional Program	X			In Draft
BPD 100-7	Circulating Water Program		X		Identified
BPD 100-8	Post Accident Program			X	Identified
BPD 200-1	Quality Control Program	X			In Draft
BPD 200-2 7	Data Management Program		X		In Draft
BPD 300-2	NRC/Regulatory Program			X	Identified

3. Chemistry System Descriptions

BCD 200-1	Condensate	X			In Draft
BCD 200-2	Feedwater	X			In Draft
BCD 200-3	Heater Drain	X			In Draft
BCD 200-4	Main Steam	X			In Draft
BCD 200-5	Steam Generator Blowdown	X			In Draft
BCD 200-6	Condensate Polishing	X			Identified
BCD 300-2	Auxiliary Feedwater	X			In Draft
BCD 300-3	Auxiliary Steam	X			In Draft
BCD 300-5	Chemical Feed	X			In Draft
BCD 300-7	Circulating Water		X		In Draft
BCD 300-10	Make-up Demineralizers	X			In Draft
BCD 300-14	Process Sampling - Secondary	X			Identified

4. Chemistry Procedures

Procedure Number	Procedure Name	Current Status			Int. 4C Status
		Approved	In Draft	Identified	
BCP 300-9	S/G Tube Leak Detection		X		In Draft
BCP 300-10	Secondary System Air Inleakage		X		Identified
BCP 300-11	Condenser Tube Leak Detection			X	Identified
BCP 400-T22 #	Operational/layup Data Form		X		In Draft
BCP 400-T32*+	Chemical Addition Request Form	X			+
BCP 400-T33*+	Chemical Addition Log	X			+
BCP 400-T37	S/G Blowdown Data Form		X		Identified
BCP 400-T42+	S/G Layup Data Form	X			+
BCP 400-T51+	Condensate Data Form		X		+
BCP 400-T52+	Main Steam Data Form		X		+
BCP 400-T53+	Heater Drains Data Form		X		+
BCP 400-T54+	Feedwater Data Form		X		+
BCP 400-T55+	Secondary Chemistry Surveillance Data Form		X		+
BCP 700-1	Limitations and Actions		X		Identified
BCP 700-2+	Chemical Addition to Plant Systems		X		+
BCP 400-T35	Chemical Addition to the Secondary Side		Deleted		Identified

* - BCP 400-T35 has been deleted, T32, T33 now cover this.

+ - Not listed previously in answers to Interrogatories.

- Listed as approved in Int. 4C, that was a typo, should have been listed in Int. 4C as In Draft

The following are the personnel which assisted in compiling this list:

- Tom Joyce - Operating Department
- Don Goldsmith - Rad/Chem Department
- Steve Barrett - Byron Station Chemist
- Jim VanLaere - Rad/Chem Supervisor

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BY MR. GALLO:

Q Finally, Mr. Blomgren, we have had a lot of testimony about the upper inspection port as described in the SAI report and whether or not such a port has been installed in the D4 steam generators in Unit 1 at Byron. Can you tell me whether or not such a port has been installed in the steam generators, Unit 1, at Byron?

A Byron Unit 1 does have the inspection ports referred to in the SAI report at the top tube support plate to inspect the top tube support plate and U-bend region.

Q And do you know when that was done?

A That modification was done over a period of time in late 1978, was completed in early 1979.

Q Do you know how the upper inspection port was installed in those steam generators?

A Yes, I do.

Q What is the basis for your knowledge?

A I have reviewed the procedures that were used to install that upper inspection port.

Q Did you have the advice of any individual from Westinghouse on that question?

A Yes. I also talked to the individual from Westinghouse that actually did do the installation on the Byron site.

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1 Q And who is that?

2 A Mr. Lloyd Hall.

3 Q Based on that discussion and your review of
4 procedures, are you able to describe how the installation
5 was affected of the Byron steam generator Unit 1?

6 A Yes.

7 Q Would you do so?

8 A The upper inspection ports that were installed
9 on each steam generator at Byron were installed -- they
10 are 2-1/2 inch holes that were drilled in the steam
11 generator shell, and prior to drilling the hole through
12 the steam generator shell, a portion of the shell was
13 machined in such a manner that it will receive a gasket and
14 a blind flange. So there was no cutting or welding or
15 anything that needed to be done to install those upper
16 inspection ports.
17

18 Q You say the hole was essentially drilled; is that
19 correct?

20 A Yes, sir, it was drilled.

21 Q Was a torch or any heat device used at all?

22 A No, sir.

23 Q Do you know whether or not this process you
24 described disrupted the stress relief properties of the
25 steam generator?

A No, The temperatures that one would see in

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1 drilling would not come anywhere close to approaching the
2 temperatures it would require to disrupt the stress relief.

3 MR. GALLO: That's all I have, Your Honor.

4 JUDGE SMITH: Do you have cross-examination, Mr.
5 Thomas?

6 CROSS-EXAMINATION

7 BY MR. THOMAS:

8 Q Have you informed Dr. Conroy of this?

9 A No, I have not, but I'm sure Mr. Hall will.

10 Q How is it that you could have it since 1978 and
11 not know about it until today, or whenever you learned of
12 it?

13 A When I was on the earlier panel I was uncertain
14 as to whether or not that specific port was installed on
15 the steam generators on Unit 1. I was aware that it had
16 been done on Unit 2 because I inspected those.

17 Q You had not inspected Unit 1?

18 A I had looked at both of the steam generators, but
19 I at that point was not very certain in my mind as to which
20 one I was looking at, whether it was Unit 1 or Unit 2, when
21 I recalled those specific ports.

22 MR. THOMAS: I have nothing further.

23 JUDGE SMITH: Mr. Goldberg.

24 MR. GOLDBERG: No questions.
25

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BOARD EXAMINATION

1
2 BY JUDGE CALLIHAN:

3 Q How many ports are there?

4 A There is one port in each steam generator.

5 JUDGE SMITH: Thank you. You are excused.

6 (The witness was excused.)

7 JUDGE SMITH: Is there any further business?

8 MR. THOMAS: Yes, Judge. I want to make it clear
9 at this point, if it is not already clear, that Intervenors
10 object to closing the record on this issue on the grounds
11 that this issue as identified here is still an unresolved
12 safety issue, and also because of the evolving or develop-
13 ing status, let's say, of the tube vibration problem, and
14 so I wanted to make that clear, that we object to closing
15 the record on this issue given what we think is its uncer-
16 tain status.

17 JUDGE SMITH: Anything further?

18 MR. GALLO: Do you require a counter-argument
19 on that point?

20 JUDGE SMITH: Go ahead; argue.

21 MR. GALLO: I would just like to observe that I
22 believe the record amply demonstrates that the record
23 should be closed on the issue. While it is true that there
24 are still matters outstanding with respect to yet to be
25 performed on the flow-induced vibration issue, there is

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1 ample evidence in this record to substantiate the
2 proposition that enough is known now to serve as a licens-
3 ing basis for the Byron steam generators and appropriately
4 close the record.

5 JUDGE SMITH: Mr. Goldberg.

6 MR. GOLDBERG: Yes, Judge, I would agree. In
7 fact, I anticipated Applicant to move that the record be
8 closed for the purpose of establishing a finding schedule,
9 which I thought might be one of the procedural matters we
10 would take up now.

11 With regard to the opened status of the unre-
12 solved status of the unresolved safety issue, I think we
13 have had ample testimony on the technical resolution, and
14 I think the testimony reflects what essentially remains
15 is the memorialization of that in an official staff
16 document.

17 Moreover, there is ample case law for the
18 proposition that notwithstanding the pendency of a
19 so-called unresolved safety issue, that if an adequate
20 justification for interim operation exists and has been
21 demonstrated, that it is not a barrier to the grant of an
22 operating license.

23 I think we have had ample testimony regarding
24 the proposed tube vibration modification to enable the
25 Board to reach reasoned findings about the acceptability

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1 of such a modification.

2 JUDGE SMITH: The Board will take the motion
3 under advisement.

4 MR. THOMAS: Judge, I have two other matters.
5 One is very technical and it involves the ALARA issue, and
6 I raise this because I know you said at the beginning that
7 we want to close the record on everything but, you know,
8 what we are going to do the week of May 23rd.

9 The only point regarding the ALARA -- and I do
10 not even know if the Board remembers this, but there is
11 a question of one of Dr. Morgan's graphs. Mr. Rowsome,
12 who is not here and I believe really should be here for
13 resolution of that graph, has proposed a stipulation.

14 I would just like to leave the issue of that one
15 graph open so that we can resolve it when Mr. Rowsome is
16 here, not for the purpose of introduction of any more
17 evidence or testimony or anything like that, just that
18 issue.

19 JUDGE SMITH: The difficulty with both your
20 earlier motion and your present motion is what do we do
21 about proposed findings? We would have to start that now.

22 MR. GALLO: I assume that is the order of the
23 Board based on yesterday's ruling. Am I incorrect on
24 that? That is why I did not move to close the issue. I
25 thought the Board ruled yesterday that at close of the

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1 hearings today, the only outstanding issues were those
2 scheduled for the end of May, and findings would automa-
3 tically begin to be drafted and filed 30 days thereafter.

4 JUDGE SMITH: This certainly was our objective.

5 MR. THOMAS: That was my understanding, too, on
6 those issues that are closed. I guess with regard to the
7 graph, it -- you know --

8 JUDGE SMITH: It is not necessarily inconsistent
9 that the Board would reserve jurisdiction over the subject
10 matter of your original motion and issue an initial
11 decision or a partial initial decision and resolve the
12 issue up to date, so that can be done. I do not understand
13 what we would do about Dr. Morgan's graph at all.

14 MR. THOMAS: If you could continue jurisdiction --
15 perhaps we can resolve this before the next session if I
16 were to submit to the Board the graph -- maybe Mr. Rowsome
17 and I can work it out pursuant to stipulation, too. That is
18 also a possibility. I do not want to cut it off.

19 JUDGE SMITH: I don't recall the graph.

20 MR. GOLDBERG: Let me also say I am familiar
21 with the Staff position on it. The Staff position is we
22 have no objection to its appearance in the record for
23 illustrative purposes, but not for evidentiary purposes,
24 and that has been and remains our position, and the matter
25 really is maybe ripe now.

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1 In any event, I think we ought to close the
2 record on the issue subject to Mr. Thomas --

3 JUDGE SMITH: Why is the matter still pending?

4 MR. THOMAS: It is still pending because Dr.
5 Morgan had to run out at the point -- remember, it is the
6 one on the blackboard.

7 JUDGE SMITH: Oh, that.

8 MR. THOMAS: Yes. And then it was the --

9 JUDGE COLE: The equation, not the graph.

10 MR. THOMAS: The equation. And then it was
11 transferred to a piece of paper.

12 JUDGE SMITH: What is your position on it?

13 MR. GALLO: It seems to me -- mine is one of
14 compromise. Why don't we order that the findings on this
15 issue be commenced with the close of the hearing today,
16 and allow, if they can stipulate by the next hearing,
17 allow them to add that to the record at that time.

18 JUDGE SMITH: You do not object to it being in.
19 For the life of me, I do not know what kind of finding we
20 can make on that piece of paper, but if no one objects to
21 it, fine, put it in. I don't know what finding we can make
22 on it.

23 MR. GOLDBERG: We have no objection to its
24 appearance for illustrative purposes, that is, to illustrate
25 the point that Dr. Morgan was making, but not evidentiary

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1 purposes. It was not to provide the basis for any
2 affirmative findings.

3 JUDGE SMITH: That is, as we have observed before
4 in this hearing, a poor practice. If the parties do not
5 object to it and it solves the problem, let's do it. At
6 least it demonstrates what he was doing up there that day
7 and what we were telling him about it. So then your
8 problem is solved.

9 MR. THOMAS: Solved? My problem is solved as
10 far as Mr. Gallo is concerned. I am not sure it is
11 solved as far as the Staff is concerned.

12 JUDGE SMITH: It is going to be made a part of
13 the record of the proceeding. It will not be available
14 for a finding of fact. Dr. Morgan was not cross-examined
15 on that and I thought we had already moved. I had ruled
16 on it.

17 MR. THOMAS: I don't think so. In fact, you
18 asked to see this piece of graph paper, according to Mrs.
19 Johnson. She informs me that you asked to see this piece
20 of graph paper. I have it here. To tell you the truth --

21 JUDGE SMITH: I just cannot believe -- I don't
22 recall that I indicated an affirmative wish to have that
23 paper put into evidence. All of my comments were that it
24 was not going to get into evidence while he was doing it.

25 MS. JOHNSON: Excuse me, if I may interject. Mr.

10joy17

1 Thomas has the information back at his office and did not
2 bring it. This graph paper is separate from the formula.
3 You specifically in the record asked to have this entered.

4 JUDGE SMITH: That is different. We switched
5 subject matters.

6 MS. JOHNSON: So we can just send you this; is
7 that right?

8 JUDGE SMITH: I don't remember it.

9 MS. JOHNSON: It is here and you did ask for it.
10 I believe you do not have a copy of it. Dr. Morgan sent
11 it to us because he ran out without it.

END T 10

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1 MR. GOLDBERG: The parties don't have a copy and
2 I don't know what it is.

3 JUDGE SMITH: I don't remember what it is.

4 MS. JOHNSON: That's separate.

5 MR. THOMAS: Let me serve it on the parties.

6 That's why I wanted to resolve the issue not today, but to
7 resolve it next time we get together.

8 JUDGE SMITH: What would we do with that graph?

9 MR. JOHNSON: This would be a part of the
10 evidentiary record on which you would make findings. You
11 asked specifically that it be entered. Dr. Morgan had to
12 leave and you said, would you please leave this graph paper
13 with us. He carried it off with him and then he sent it to us.

14 JUDGE SMITH: It was supposed to go into his
15 testimony.

16 MS. JOHNSON: That's right.

17 JUDGE SMITH: To explain what he's doing. That's
18 right, okay.

19 Why don't we -- do the parties recall that that
20 was the case? That he was testifying and we directed that
21 that graph be put in and made a part of his testimony?

22 MR. GALLO: I recall it.

23 MS. JOHNSON: That's right.

24 JUDGE SMITH: And then he walked away, so you
25 are correct. So at this point, then, let's bind it into

1 the transcript unless there is renewed objection, but there
2 were none at the time.

3 MR. GOLDBERG: I will rely on your recollection
4 of the status of the graph.

5 JUDGE SMITH: You still have the chart? It's
6 still open?

7 MR. THOMAS: Yes, the chart is still open.

8 JUDGE SMITH: That would be the only basis upon
9 which it could go in and that's not a very good basis. We
10 ruled at the time that it was not an exhibit; it was not
11 evidence in this case.

12 MR. THOMAS: We will accept the stipulation of
13 entering it for illustrative purposes.

14 JUDGE SMITH: All right. Let's bind it into the
15 transcript at this point.

16 (The Graph and the Chart referred to above follow:)
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d = dose additions above natural background radiation

$$\frac{C_s + C_e}{2d} = \text{dose coefficient (cancer/person rem)}$$

$$= 10^{-3} \frac{1}{\sqrt{10} \sqrt{d} + d}$$

○ - plot of above equation

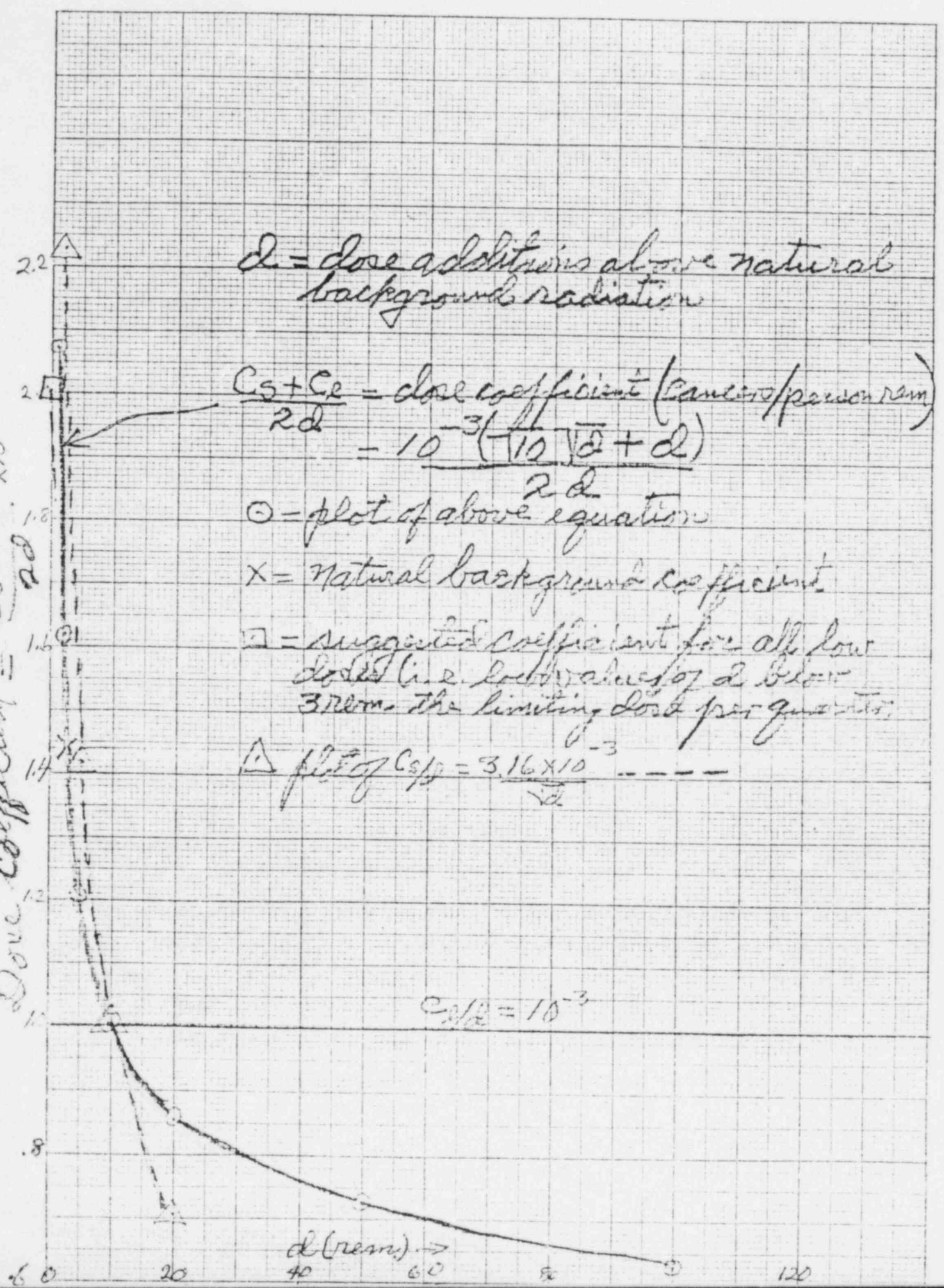
x = natural background coefficient

□ = suggested coefficient for all low doses i.e. low values of d below 3rem. the limiting dose per quarter.

△ plot of $C_{sp} = \frac{3.16 \times 10^{-3}}{\sqrt{d}}$ -----

Dose coefficient = $\frac{C_s + C_e}{2d} \times 10^{-3}$

40 X 20 TO THE INCH 40 1240
1 1/2 X 7 1/4 TO THE INCH
PLUMBER'S CASES CO. CHICAGO, ILL.



2

3 rem/yr | 5 rem/yr

Sr⁹⁰

5 (N-10)

$$D_{50} = \int_0^{50} R_0 e^{-\lambda t} dt = 30 \text{ rem}$$

$$D_{50} = \frac{R_0}{\lambda} (1 - e^{-\lambda t}) = 30$$

$$R_0 = \frac{30 \times 0.693}{17.53 (1 - e^{-0.693 \times 50 / 17.53})}$$
$$= 1.377 \text{ rem/yr}$$

1 JUDGE SMITH: Anything further?

2 MR. THOMAS: The only other thing I have is
3 apparently, there were some mistakes made --

4 MS. JOHNSON: Dr. Morgan, when he sent the graph
5 paper, I had sent him a copy of the transcript, and he sent
6 in changes that were -- they have made a lot of errors in
7 the transcript. He sent an affidavit copy of that, which
8 Mr. Thomas has. Is that something we should turn in to
9 all the parties?

10 JUDGE SMITH: Yes, that is an appropriate thing
11 to do. Traditionally, when the record closes in a case,
12 we allow the parties an opportunity to move to have transcript
13 corrections, and you can do it virtually at any time.

14 I would recommend what you do, however, is wait
15 until the entire hearing is over. However, I think it probably
16 would be a very courteous thing for you to provide that to
17 the other parties, particularly if it involves any substantive--

18 MS. JOHNSON: There were several. They just
19 simply -- the recorders did not understand what he was saying.
20 They got the words wrong.

21 MR. THOMAS: We will provide it, Judge.

22 JUDGE SMITH: That would be a courteous thing to
23 do. The motion is for a corrected transcript to come in
24 sometime during the period following the close of the record
25 and before the final findings of fact.

1 MR. THOMAS: My last matter -- and on this, I am
2 really running errands for Jane Whicher with regard to the
3 QA new witness -- do you have something that you want to take
4 up before this?

5 MR. GALLO: I'd like to clarify the status of
6 the situation on whether or not the record is closed on the
7 steam generators. Judge, are you taking the motion from Mr.
8 Thomas under advisement and, therefore, we should brief the
9 issue in our findings of fact?

10 JUDGE SMITH: I don't think any further briefing
11 is necessary. It's just that the Board has not had an
12 opportunity to consult on it, and I think we can consult
13 and rule quickly.

14 MR. GALLO: You may not have to do it today, but
15 it would be useful to be aware of it.

16 JUDGE SMITH: Yes, it would. What I'm saying is
17 even if we should rule that the record remains open, it does
18 not foreclose the possibility of proposed findings with the
19 record as it exists now, or a decision on the record as it
20 exists now. We have not yet had a chance to consult on whether
21 the record should, in fact, remain open. Maybe we can do
22 that during the lunch break and inform the parties.

23 (Board conferring.)

24 We will issue an order on it very soon. Before
25 next week. We will issue an order next week.

1 MR. GALLO: The only thing I had besides your
2 item is my colleague has a report on the emergency planning
3 issue. You can go first.

4 MR. THOMAS: Okay, thank you.

5 Judge, I was handed this morning a motion on
6 behalf of Jane Whicher with regard to the QA.

7 JUDGE SMITH: I wanted to bring that issue up, too.

8 MR. THOMAS: This is a motion to allow the
9 testimony --

10 JUDGE SMITH: Is it in writing?

11 MR. THOMAS: Yes.

12 (Counsel distributing document.)

13 JUDGE SMITH: Did she file it with the Secretary
14 of the Commission?

15 MR. THOMAS: Her letter does not address that.

16 JUDGE SMITH: She should do that. It's a written
17 motion and it will have to be treated as a written motion.
18 She did, all right.

19 MR. THOMAS: It is on the list, apparently.

20 JUDGE SMITH: She moves to shorten the time for
21 responses. Okay. I wanted to suggest to the parties that
22 the regulatory time for response not be followed here.

23 MR. THOMAS: May I raise one additional point in
24 that regard? In the letter she asks that I bring this to the
25 Board's attention, and she also asks that the Board rule on

1 it immediately. That's why I say -- I pass on the request.

2 JUDGE SMITH: We are not prepared to rule on it.

3 MR. GALLO: I've been looking at this thing.

4 What's the time that is suggested for responses? Is there
5 one in the motion?

6 JUDGE SMITH: Five days.

7 MR. THOMAS: Five days from today, in other words.

8 MR. GOLDBERG: I can oppose that motion right now
9 and save the trouble of having to put it into writing.

10 JUDGE SMITH: You oppose the motion to reopen?

11 MR. GOLDBERG: No, I oppose the request to answer
12 this in writing five days from today.

13 JUDGE SMITH: All right. When would you --

14 MR. GOLDBERG: The Staff customarily has 15 days
15 from receipt. I don't think that this qualifies as official
16 service under the rules.

17 JUDGE SMITH: Are you talking about 20 days?

18 MR. GOLDBERG: No, I would say instead of the 15
19 days, 10 days from its -- maybe we could set a briefing
20 schedule right now. I'm at a disadvantage in that I may not
21 be the one preparing the written response. Someone else
22 from my office is handling the issue and I would hope could
23 handle the written response. The earliest I will get that
24 into that person's hands is tomorrow, unless it has been
25 delivered to the office.

1 MR. GALLO: With the excellence of our lawyers,
2 we should all agree to do it by next Friday.

3 MR. GOLDBERG: I'm not prepared to state that right
4 now. I will shorten the 15 days to 10 days. I just think
5 it's too important an issue to be given cursory treatment.
6 I think the suggestion here for five days is really a
7 little, you know --

8 JUDGE SMITH: A week from Friday is almost 10
9 days. Is eight days, I guess. So how about a week from Monday?

10 MR. GOLDBERG: That would be May 9th?

11 MR. THOMAS: Yes, May 9th.

12 MR. GALLO: The Board has to have enough time to
13 rule on this.

14 JUDGE SMITH: Would you plan to submit the Staff's
15 investigation results?

16 MR. GOLDBERG: This has developed so quickly, and
17 I have really not had an opportunity to confer with the
18 principals.

19 JUDGE SMITH: When responses come in, you should
20 be aware that the Board is already generally familiar with
21 the law on reopening the record. Where we need help is
22 comments on the safety significance -- the factual significance
23 of the allegations.

24 MR. GOLDBERG: Given that, I would say that that
25 is even more an ambitious prospect to be completed. I was

1 inclined to say we will give a written response May 9th, which
2 is really a foreshortened response. You know, if a great
3 deal of importance is going to attach to the ability of the
4 Staff to compile some kind of safety report virtually within
5 a week, I just don't know, Judge. I'm not sure there is an
6 investigative report.

7 JUDGE SMITH: Why don't you try to get it in and
8 commit to a week from Monday. However, if it becomes
9 apparent that you cannot come up with a factual response or
10 address the safety issue in that time, then seek leave for
11 an extension. We have to have some time. The briefing
12 schedule to foreclose all of our options -- you would take
13 up all the time for Staff's brief, present it, and then our
14 options would be gone as far as deciding to receive the
15 evidence and scheduling it. It would mean a separate
16 session. There may even be some discovery necessary, too.

17 MR. GOLDBERG: I will agree -- I agreed at the
18 outset to abbreviate the customary response time. I am
19 just a little reluctant to promise more than we are able to
20 deliver in that timeframe in terms of a safety evaluation of
21 the allegations.

22 JUDGE SMITH: I'm asking you to make your best
23 effort for a week from Monday, and if you need more time,
24 indicate it. The safety information is quite important. It
25 would be pointless for us to answer without it. You have

1 all the latitude you need.

2 MR. GOLDBERG: I'll do my best.

3 JUDGE SMITH: Sure.

4 MR. GALLO: We'll have our response in the Board's
5 hands by the same date.

6 JUDGE SMITH: So necessarily, then, the QA/QC
7 remains open. Let's then have -- the Board wants to remind
8 all the parties that any issues not briefed on proposed
9 findings and conclusions of law will be deemed to be waived
10 perhaps, if we elect to, but the parties are subject to that
11 ruling.

12 MR. THOMAS: Thirty days --

13 JUDGE SMITH: Is the 30-day previous stipulation,
14 is that still agreeable to the parties?

15 MR. GOLDBERG: Forty days best effort --

16 (Laughter.)

17 There is a staggered briefing schedule and it is
18 for a reason. Under the rules, --

19 JUDGE SMITH: The problem is not the 40 days, but
20 the best effort is the problem. I have never participated
21 in an order like that. You always have the option of moving
22 for a greater time if you need it.

23 MR. GOLDBERG: I'm getting beaten here today.

24 JUDGE SMITH: The regulation doesn't say best
25 effort. It's not a traditional approach.

1 MR. GOLDBERG: It was a negotiated stipulation.

2 JUDGE SMITH: There is a point there. The Board
3 was not given --

4 MR. GOLDBERG: Forty days, with the understanding
5 that liberal leave if we -- we are going to endeavor to try
6 to accomplish it.

7 JUDGE SMITH: I am also aware, Mr. Goldberg, that
8 in this hearing, you carried a very, very large burden.
9 It was obvious to us.

10 MR. GOLDBERG: I'm not going to be relieved very
11 much in preparing the findings.

12 MR. GALLO: All of the parties are equal, except
13 one is a little more equal.

14 JUDGE SMITH: As I understand it, we will have
15 to hear your witness on hydrology on Monday.

16 MR. GOLDBERG: Or Friday, at the pleasure of the
17 Board.

18 JUDGE SMITH: Monday would be better because that
19 gives us the greatest flexibility.

20 MR. THOMAS: Can I put in my two cents? Friday
21 would be much better from my perspective. Only at that point,
22 I'll probably be teaching on Monday and Wednesday nights,
23 which I can -- you know, I can drive back and forth.

24 JUDGE SMITH: The difficulty with having a commit-
25 ment at the end of the week invites a very great inefficiency.

1 MR. THOMAS: I know.

2 MR. GALLO: Let's start Tuesday.

3 JUDGE COLE: The witness cannot be there on Tuesday.

4 JUDGE SMITH: Assume we start Tuesday and we
5 conclude by Wednesday night. What do we do? That's why I
6 would like to lead off with the Staff.

7 MR. THOMAS: I don't think there's any danger of
8 concluding Wednesday night. We have hydrology, we may have
9 QA, we have Levine coming back --

10 MR. GALLO: We have Class 9.

11 JUDGE SMITH: If the parties are confident that
12 the hearing will stretch until Friday, then that's fine.
13 We would prefer to start off Monday afternoon. Can you
14 make that, even with inconvenience?

15 MR. THOMAS: We will make some arrangements, one
16 way or another we will be here. Was that 2:30?

17 JUDGE SMITH: 2:00 o'clock.

18 MR. GALLO: My colleague has a report on the
19 emergency planning status.

20 MR. GOLDFEIN: Mr. Bielawski informed me this
21 morning that he and Mr. Savage have agreed to a stipulation
22 for admitting certain affidavits into evidence, based upon
23 the conditions in the stipulation, and he will be sending a
24 copy on Monday to Mr. Goldberg, and if Mr. Goldberg agrees
25 to it we would then propose to send the Board a copy of the

1 stipulation in the attached affidavits. And upon your
2 approval, we would then send the whole packet to the
3 reporting service to be bound into the transcript, if that
4 meets with your approval.

5 JUDGE SMITH: I don't know that's going to work.
6 However, it can be accepted as an exhibit. That suggests
7 another problem. That means, then, that with the acceptance
8 of that stipulation, the record on emergency planning will
9 be closed.

10 MR. GOLDFEIN: That's our understanding.

11 JUDGE SMITH: So then, does our ruling on the
12 proposed findings include emergency planning?

13 MR. GOLDFEIN: Yes, that would be our understanding.

14 JUDGE SMITH: Okay. So why don't you just serve
15 it with a motion that it be accepted as an exhibit, eviden-
16 tiary exhibit, and we will rule on it on that basis.

17 Anything further?

18 Do we still have the option of visiting the site?
19 Has it been worked out with the Intervenors? Do you have a
20 representative who is going to go?

21 MS. JOHNSON: Yes, Paul Holmbeck.

22 JUDGE SMITH: 3:15, is that satisfactory to
23 everybody? At the site, at the operating gate. Is it open
24 to the media, to the press?

25 VOICE: I would prefer a minimum number if possible

1 because of the functions that are taking place. I'm speaking
2 as a person who has tried to arrange this.

3 JUDGE SMITH: If there's nothing further, then
4 we are adjourned.

5 (Whereupon, at 1:15 p.m., the hearing in the
6 above-entitled matter was recessed, sine die.)

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CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the
NRC COMMISSION

In the matter of: Commonwealth Edison, Byron Nuclear
Power Station

Date of Proceeding: Thursday, April 28, 1983

Place of Proceeding: ~~Washington, D.C.~~ Rockford, Illinois

were held as herein appears, and that this is the original
transcript for the file of the Commission.

Barbara Whitlock

Official Reporter - Typed

Barbara Whitlock

Official Reporter - Signature