

SHAW, PITTMAN, POTTS & TROWBRIDGE

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JAMES B. HAMLIN
ROBERT E. ZAHLER
RICHARD E. GALEN
ROBERT B. ROBERTS
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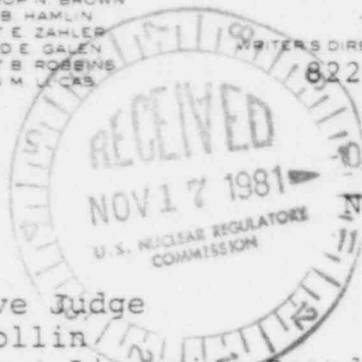
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SANDRA E. FOLSOM
NARCIA R. NIRENSTEIN
JUDITH A. SANDLER
EDWARD D. YOUNG, III



November 6, 1981

Administrative Judge
Gary L. Milhollin
Atomic Safety & Licensing Board
1815 Jefferson Street
Madison, Wisconsin 53711



In the Matter of
Metropolitan Edison Company
(Three Mile Island Nuclear Station, Unit No. 1)
Docket No. 50-289 SP (Restart)

Dear Judge Milhollin:

I enclose several documents which are being provided for the following reasons:

1. A chart which describes by participants and dates the various NRC and Licensee examinations administered to TMI-1 operators, which have been the subject of discovery and which will be discussed during the reopened hearing. You requested that Licensee develop this chart as an aid to the participants during the hearing when reference to particular exams is necessary.

2. Affidavits in support of Licensee's responses to discovery requests. With the press of providing timely responses to discovery requests, Licensee did not complete and coincidentally provide affidavits in support of its interrogatory responses. Affidavits which we indicated with our discovery responses would subsequently be provided, are enclosed.

DS03
5/11

Administrative Judge
Gary L. Milhollan
November 6, 1981
Page Two

3. Kelly-administered examination of Mr. V. In our earlier discovery responses, we indicated that one examination from the Kelly-administered exams in April, 1980, had not been located. The missing examination has been found and is enclosed.

This also will confirm that in response to a request from the Aamodts, Licensee is distributing today under separate cover (directly from the TMI site) some twenty completed RWP examinations randomly selected from the period April 15 to May 15 (but excluding April 28), 1979.

Sincerely,

Ernest L. Blake, Jr.

Ernest L. Blake, Jr.
Counsel for Licensee

cc: (w/encl.) Reopened Hearing Discovery
Service List (attached)
(w/out TMI-1 Restart Service List
encl.) (attached)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Special Master

In the Matter of)	
)	
METROPOLITAN EDISON COMPANY)	Docket No. 50-289 SP
)	
(Three Mile Island Nuclear)	(Restart)
Station, Unit No. 1))	

SERVICE LIST

Administrative Judge
Ivan W. Smith (2)
Chairman, Atomic Safety and
Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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881 West Outer Drive
Oak Ridge, Tennessee 37830

Administrative Judge
Linda W. Little
Atomic Safety & Licensing Board
5000 Hermitage Drive
Raleigh, North Carolina 27612

Administrative Judge
Gary L. Milhollin
Atomic Safety & Licensing Board
1815 Jefferson Street
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1324 N. Capitol Street
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Special Master

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METROPOLITAN EDISON COMPANY)	Docket No. 50-289 SP
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SUMMARY OF PRIMARY TMI-1 OPERATOR EXAMINATIONS
GIVEN SINCE MARCH 28, 1979

EXAM	DATE	LOCATION	EXAMINATION ADMINISTRATOR	PURPOSE	SUBJECT MATTER	METHOD OF ADMINISTRATION	PARTICI- PANTS
KELLY	RO-4/2-4/4/80	South-Audi- torium of TMI-I Service Building	PQS Corp.	OARP Comprehensive Exams; served as 1979-80 Requalifica- tion Exams (originally intended as NRC mock exam)	RO Categories A,A',B,C,D,E,F, G, T (as noted on cover sheet of exam)	Classroom Closed book	RO-A through HH inclusive
	SRO-4/3 and 4/4/80	South Audi- torium of TMI-Service Building			SRO Categories H,I,J,K,L (as noted on cover sheet of exam)		SRO-A,B,E, I,J,O,P, W,X,BB,CC, EE,FF,GG
Round 1, Non- Cat T Make-Up (Cycle 7-3)	7-8/80	TMI Classroom 2 of Training Complex	Licensee	Parts of these re- qual. cycle exams were used as non- cat T make-up exams for those who had received less than 80% on non Cat T areas in the Kelly exams	Unit I Requal. Training	Classroom Closed book	Wk.#1-C,D,B Wk.#2-E,F,G,UU Wk.#3-I,J,EE, M,HH,WW Wk.#4-O,P,Q,R Wk.#5-W,X,Y,AA, BB,CC Wk.#6-S,T,U,V, GG
Round 2, Non- Cat T Make-up (Cycle 7-4)	8-9/80	TMI Classroom 2 of Training Complex	Licensee	Parts of these re- qual. cycle exams were used as non- cat T make-up exams for those who had received less than 80% on non Cat T areas in the Kelly exams	Unit I Requal. Training	Classroom Closed book	Wk.#2-E,F,H Wk.#3-I,J,L,M,HH Wk.#4-O,P,Q,R,OO XX Wk.#5-S,T,U Wk.#6-V,W,X,Y,Z, AA,SS

EXAM	DATE	LOCATION	EXAMINATION ADMINISTRATOR	PURPOSE	SUBJECT MATTER	METHOD OF ADMINISTRATION	PARTICI- PANTS
Round 3, Non- Cat T Make-up (Cycle 7-5)	9-10/80	TMI Classroom 2 of Training Complex	Licensee	Parts of these re- qual. cycle exams were used as non- Cat T make-up exams for those who had received less than 80% on non Cat T areas in the Kelly exams	Unit I Requal. Training	Classroom Closed book	Wk. #1-A,B,C,D,Z, PP,TT*,EEE* Wk. #2-E,F,G,H, FFF*,GGG*,UU*,QQ* Wk. #3-I,J,L,HH, MM,WW Wk. #4-O,Q,R,JJ, KK,RR,YY,XX,HHH* Wk. #5-S,T,U,GG Wk. #6-V,W,X,Y,III *answered only 1 question
Round 1, Cat. T Make-Up (Cycle 7-6)	11/21/80 11/26/80 12/5/80 12/12/80 12/19/80	TMI Classroom 2 of Training Complex	Licensee	Appropriate parts of this requal. cycle exam were used as a Cat. T make-up exam for those who either had not taken the Kelly Exam or had received less than 90% on Cat. T	Category T	Classroom Closed book	11/21-LL,D,C,B, Z,A,PP,TT 11/26-G,F,H,E, KK,QQ 12/5-J,L,HH,II, NN,I 12/12-OO,R,JJ, RR,P,Q,O 12/19-GG,W,MM,X, S,Y
Round 4, Non- Cat T Make-Up (Cycle 7-6)	2-3/81	TMI Classroom 2 of Training Complex	Licensee	During Review Pro- gram, Non-Cat T make up exams given for those who had received less than 80% in Non-Cat T areas on the Kelly exams or on previous Non-Cat T Kelly make ups	Unit 1 Requal. Training	Classroom Closed book	B,C,F,G,H,I,P, S,U,W,Y,Z,BB, CC,GG,R

EXAM	DATE	LOCATION	EXAMINATION ADMINISTRATOR	PURPOSE	SUBJECT MATTER	METHOD OF ADMINISTRATION	PARTICI- PANTS
Round 2, Cat. T Make-up (Cycle 7-6)	3-4/81	Unknown	Licensee	Cat. T. Make Up Exam for those who either had not taken the Cat. T exam or had taken it and received less than 90%	Category T	Take Home Closed book	EE,SS,UU,OO, H,FF,G
ATTS	RO-4/1 and 4/2/81 SRO-4/2 & 4/3/81	TMI Classrooms 1 & 7 of Train- ing Complex	ATTS, Inc.	NRC Mock Exams	RO Categories A,B,C,D,E,F,G,H (as noted on sheet of exam)	Classroom Closed book	RO-4/1-X,EE, B,FF,E,F,GG, BB,U,Z,C,D, UU,L,HH,NN, Q,QQ,RR,I 4/2-A,OO,R,W, O,P,SS,AA,G, H,Y,V,S,CC, DD,T
					SRO Categories I,J,K,L,M,N, (as noted on cover sheet of exam)		SRO-4/2-GG,F, E,Z,BB,FF,B, RR 4/3-U,O,P,W, EE,X,A,CC,S, DD,QQ,I
NRC	RO-4/21 and 4/23/81 SRO-4/22 and 4/24/81	TMI Classrooms 1 and 7 of Training Com- plex	NRC	Operator License Exams	Comprehensive	Classroom Closed book	RO-4/21-V,T,CC, GG,BB,U,UU,SS, H,G,D,F,EE,FF, X,E,RR,QQ,B 4-23-L,Y,P,DD, NN,AA,C,HH,Q, O,I,A,W,S,Z, R,OO
							SRO-4/22-CC,GG, BB,U,F,EE,FF,X, E,RR,QQ,B 4/24-P,DD,O,I, A,W,S,Z

EXAM	DATE	LOCATION	EXAMINATION ADMINISTRATOR	PURPOSE	SUBJECT MATTER	METHOD OF ADMINISTRATION	PARTICI- PANTS
Round 3, Cat. T Make-Up	6/25/81	TMI Classroom 5 of Training Complex	Licensee	Cat. T Make-Up exam for those who had received less than 90% on previous Cat. T exams	Category T	Classroom Closed book	G,H,FF,OO
NRC	RO-10/21 and 10/22/81 SRO-10/28 and 10/29	TMI Classrooms 118 and 119 Training Bldg.	NRC	Operator License Exams	Comprehensive	Classroom Closed book	RO-10/21-B, CC,E,S,BB, EE,GG,FF,T, D,KK,A,WW, AA,H,G,C 10/22-U,P, R,RR,F,OO,V, UU,DD,Q,QC, L,I,Y,Z SRO-10/28-E, CC,E,S,RR,BB, FF,WW,I,Z,F 10/29-B,P,U, GG,DD,QQ,A, KK

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

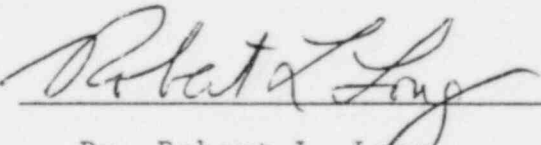
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. I))

Docket No. 50-289
(Restart)

AFFIDAVIT OF DR. ROBERT L. LONG

DR. ROBERT L. LONG, being duly sworn according to law, deposes and says that he is Director of GPU Nuclear's Training and Education Department; that the information contained in Licensee's Response to Aamondt's Second Set of Discovery Requests of Licensee in Reopened Hearing of Cheating Incident (as Modified by Agreement) to Request 12 is true and correct to the best of his knowledge, information and belief.


Dr. Robert L. Long

Sworn to and subscribed before
me this 5th day of November,
1981


Notary Public

My commission expires March 7, 1985
ALICE J. HOUSE
NOTARY PUBLIC OF NEW JERSEY

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
METROPOLITAN EDISON COMPANY)	Docket No. 50-289
)	(Restart)
(Three Mile Island Nuclear)	
Station, Unit No. 1))	

AFFIDAVIT OF MICHAEL J. ROSS

MICHAEL J. ROSS, being duly sworn according to law, deposes and says that he is Manager of Plant Operations, TMI-1; that the information contained in Licensee's Response to Aamondt's Second Set of Discovery Requests of Licensee in Reopened Hearing of Cheating Incident (as Modified by Agreement) to Request No. 4 is true and correct to the best of his knowledge, information and belief.

Michael J. Ross
Michael J. Ross

Sworn to and subscribed before
me this 5th day of
November, 1981

Darla Jean Berry
Notary Public

My Commission Expires June 17, 1985
DARLA JEAN BERRY, NOTARY PUBLIC
MIDDLETOWN BORO, DAUPHIN COUNTY
MY COMMISSION EXPIRES JUNE 17, 1985
Member, Pennsylvania Association of Notaries

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

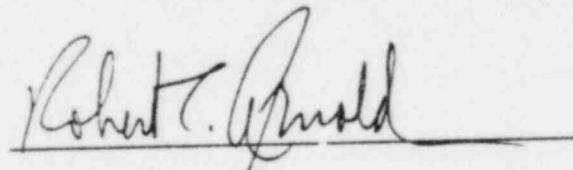
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. 1))

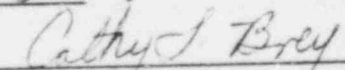
Docket No. 50-289

AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law,
deposes and says that he is a senior Vice President of
Metropolitan Edison Company; that the information con-
tained in Licensee's Response to Aamodt's Follow-On
Interrogatories of Licensee Re Reopened Hearings of
Cheating Incident to Requests 3, 13 and 17 b and c is
true and correct to the best of his knowledge.


Robert C. Arnold

Sworn to and subscribed before me
this 5th day of November, 1981


Notary Public

My Commission Expires Oct. 24, 1983

CATHY L. BREY, Notary Public
Lebanon Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

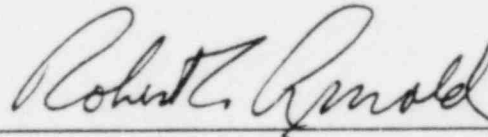
UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY) Docket No. 50-289
(Three Mile Island Nuclear) (Restart)
Station, Unit No. 1))

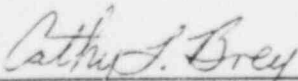
AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law, deposes and says that he is Senior Vice President of Metropolitan Edison Company; that the information contained in Licensee's Response to Aamodt's First Set of Discovery Requests of Licensee in Reopened Hearing of Cheating Incident (As Modified by Agreement and by Rulings of the Special Master) to Issue 1, Request No. 1, and Issue 2, Request Nos. 1 and 2, is true and correct to the best of his knowledge, information and belief.



Robert C. Arnold

Sworn to and subscribed
before me this 5th day
of November 1981.


Notary Public

My Commission Expires

CATHY L. DREY, Notary Public
Econ. Dev. Bldg. 1st Fl., Berks County, Pa.
My Commission Expires Oct. 21, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

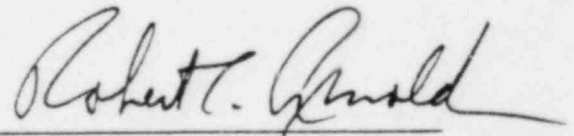
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
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METROPOLITAN EDISON COMPANY)
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(Three Mile Island Nuclear)
Station, Unit No. 1))

Docket No. 50-289
(Restart)

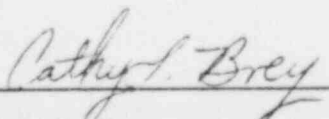
AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law, deposes and says that he is Senior Vice President of Metropolitan Edison Company; that the information contained in Licensee's Response to Aamondt's Second Set of Discovery Requests of Licensee in Reopened Hearing of Cheating Incident (as Modified by Agreement) to Requests Nos. 1, 6 and 7 is true and correct to the best of his knowledge, information and belief.



Robert C. Arnold

Sworn to and subscribed before
me this 5th day of November,
1981


Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Londonberry Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

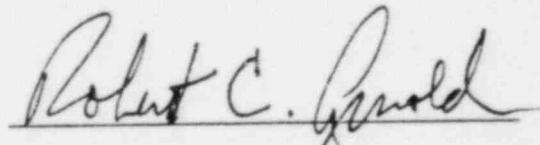
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. 1))

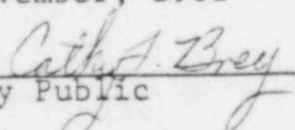
Docket No. 50-289
(Restart)

AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law,
deposes and says that he is a Senior Vice President of
Metropolitan Edison Company; that the information contained
in Licensee's Response to Aamodt's Third Set of Discovery
Requests of Licensee in Reopened Hearing of Cheating Incident
to Request 5 is true and correct to the best of his know-
ledge, information and belief.


Robert C. Arnold

Sworn to and subscribed
before me this 5th day
of November, 1981


Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Lancaster Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

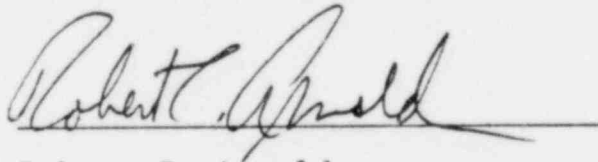
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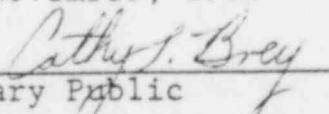
Docket No. 50-289
(Restart)

AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law, deposes and says that he is a Senior Vice President of Metropolitan Edison Company; that the information contained in Licensee's Supplemental Response to Aamodt's First Set of Discovery Requests of Licensee In Reopened Hearing of Cheating Incident (As Modified by Agreement and by by Rulings of the Special Master) to Issue No. 2, Request No. 1, is true and correct to the best of his knowledge, information, and belief.


Robert C. Arnold

Sworn to and subscribed
before me this 5th day
of November, 1981


Notary Public
My Commission Expires _____

CATHY L. GREY, Notary Public
Lebanon Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

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NUCLEAR REGULATORY COMMISSION

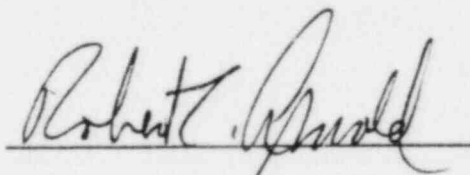
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Docket No. 50-289
(Restart)

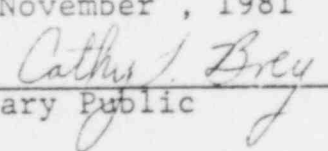
AFFIDAVIT OF ROBERT C. ARNOLD

ROBERT C. ARNOLD, being duly sworn according to law,
deposes and says that he is a Senior Vice President of
Metropolitan Edison Company; that the information contained
in Licensee's Response to TMIA's First Set of Interrogatories
Addressed to Licensee (As Modified by Agreement) to Requests
1, 2, 3, 4, 9, 10, 11, 12, 40, 46, 47, 48, 49, 50, and 51 is
true and correct to the best of his knowledge, information
and belief.



Robert C. Arnold

Sworn to and subscribed
before me this 5th day
of November, 1981


Notary Public

My Commission Expires _____

KATHY L. BREY, Notary Public
Lic. expires Ten. 24, Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Docket No. 50-289

GATHY L. BROY, Notary Public
Lawrence Twp., Dauphin County, Pa.
Commission Expires Oct. 24, 1933

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Docker No. 50-289

J.F. WILSON, being duly sworn according to law, deposes and says that he is an attorney; that the information contained in Licensee's Response to TMIA's First Set of Interrogatories Addressed to Licensee (As Modified by Agreement) to Requests 5, 6, 8, 18, 20, 24, 25, 27f, 42, 43, 44, 52 and 53 is true and correct to the best of his knowledge, information and belief.

Sworn to and subscribed
before me this 4th day
of November, 1981

My Commission Expires on

CATHY L. BRY, Notary Public
Londonderry Twp., Dauphin County, Pa.
My Comm. expires Dec. 31, 1978

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

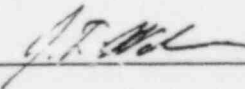
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. 1))

Docket No. 50-289

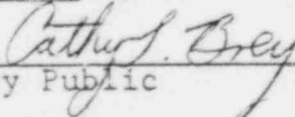
AFFIDAVIT OF J.F. WILSON

J.F. WILSON, being duly sworn according to law,
deposes and says that he is an attorney; that the
information contained in Licensee's Response to Aamodt's
Follow-On Interrogatories of Licensee Re Reopened Hearings
of Cheating Incident to Requests 2, 6, 10, 11 and 12 is
true and correct to the best of his knowledge.



J.F. WILSON

Sworn to and subscribed before me
this 4th day of November, 1981


Notary Public

CATHY L. BREY, Notary Public
Londonderry Twp., Dauphin County, Pa
My Commission Expires Oct. 24, 1992

My Commission Expires _____

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
METROPOLITAN EDISON COMPANY)
)
 (Three Mile Island Nuclear)
 Station, Unit No. 1))

Docket No. 50-289

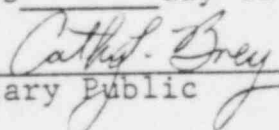
AFFIDAVIT OF R.D. LLOYD

R.D. LLOYD, being duly sworn according to law,
deposes and says that he is an attorney; that the infor-
mation contained in Licensee's Response to Aamodt's
Follow-On Interrogatories of Licensee Re Reopened Hearings
of Cheating Incident to Requests No. 7, 9 re telephone
conversation of 9/22/81, and re grader's credentials and
modified questions, and 15 re ATT's view on proctors is
true and correct to the best of his knowledge.



R.D. Lloyd

Sworn to and subscribed before me
this 4th day of November, 1981



Notary Public

My Commission Expires _____

CATHY L. DREY, Notary Public
Londonderry Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. I))

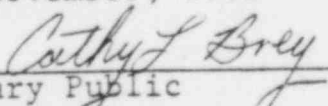
Docket No. 50-289
(Restart)

AFFIDAVIT OF NELSON D. BROWN

NELSON D. BROWN, being duly sworn according to law, deposes and says that he is Supervisor, Licensed Operator Training, TMI Unit I of Metropolitan Edison Company; that the information contained in Licensee's Supplemental Response to Aamodt's First Set of Discovery Requests of Licensee In Reopened Hearing of Cheating Incident (As Modified by Agreement and by Rulings of the Special Master) to Issue No. 5 is true and correct to the best of his knowledge, information and belief.


Nelson D. Brown

Sworn to and subscribed
before me this 4th day
of November, 1981


Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Lancaster Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

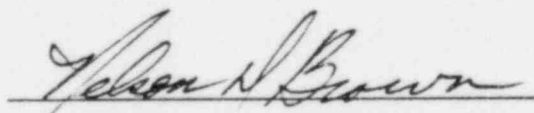
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. 1))

Docket No. 50-289
(Restart)

AFFIDAVIT OF NELSON D. BROWN

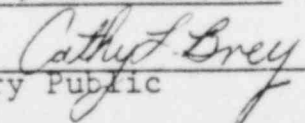
NELSON D. BROWN, being duly sworn according to law, deposes and says that he is Supervisor, Licensed Operator Training, TMI-1; that the information contained in Licensee's Response to Aamodt's Follow-On Interrogatories Of Licensee Re Reopened Hearings of Cheating Incident to Request No. 8, and to Request No. 15 except ATT's view is true and correct to the best of his knowledge, information and belief.


Nelson D. Brown

Sworn to and subscribed before

me this 4th day of

November 1981


Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Lansdownery Twp., Casselman County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION


BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
METROPOLITAN EDISON COMPANY)
)
(Three Mile Island Nuclear)
Station, Unit No. I))

Docket No. 50-289
(Restart)

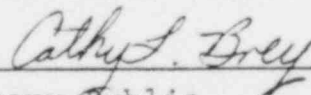
AFFIDAVIT OF NELSON D. BROWN

NELSON D. BROWN, being duly sworn according to law, deposes and says that he is Supervisor, Licensed Operator Training, TMI Unit I of Metropolitan Edison Company; that the information contained in Licensee's Response to Aamodt's First Set of Discovery Requests of Licensee in Reopened Hearing of Cheating Incident (As Modified by Agreement and by Rulings of the Special Master) to Issue 5, Requests Nos. 1, 3 and 5, is true and correct to the best of his knowledge, information and belief.



Nelson D. Brown

Sworn to and subscribed
before me this 4th day
of November 1981.



Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Commission Expires 11/30/82
Notary Public, State of Pennsylvania

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

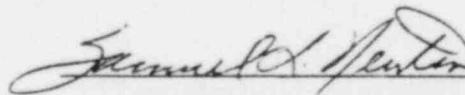
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
METROPOLITAN EDISON COMPANY)
)
(Three Mile Island Nuclear)
Station, Unit No. I))

Docket No. 50-289
(Restart)

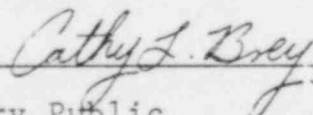
AFFIDAVIT OF SAMUEL L. NEWTON

SAMUEL L. NEWTON, being duly sworn according to law,
deposes and says that he is Operator Training Manager, TMI -
Unit I of Metropolitan Edison Company; that the information
contained in Licensee's Response to Aamondt's Second Set
of Discovery Requests of Licensee in Reopened Hearing of
Cheating Incident (as Modified by Agreement) to Requests
Nos. 5 and 8 are true and correct to the best of his know-
ledge, information and belief.



Samuel L. Newton

Sworn to and subscribed
before me this 4th day
of November, 1981


Notary Public

My Commission Expires _____

CATHY L. BREY, Notary Public
Londonderry Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

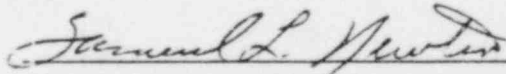
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. I))

Docket No. 50-289
(Restart)

AFFIDAVIT OF SAMUEL L. NEWTON

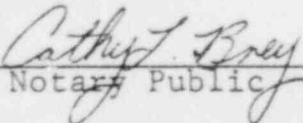
SAMUEL L. NEWTON, being duly sworn according to law,
deposes and says that he is Operator Training Manager -
TMI Unit I of Metropolitan Edison Company; that the infor-
mation contained in Licensee's Response to Aamodt's First
Set of Discovery Requests of Licensee in Reopened Hearing of
Cheating Incident (As Modified by Agreement and by Rulings
of the Special Master) to Issue 12, Requests Nos. 1 and 2,
are true and correct to the best of his knowledge, information
and belief.



Samuel L. Newton

Sworn to and subscribed

before me this 4th day
of November, 1981



Notary Public

CATHY L. BREY, Notary Public
Londonderry Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

My Commission Expires _____

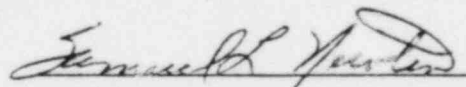
UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of)	
METROPOLITAN EDISON COMPANY	}	Docket No. 50-289
(Three Mile Island Nuclear)	
Station, Unit No. 1)	}	

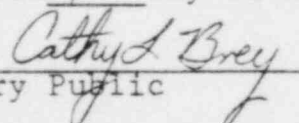
AFFIDAVIT OF SAMUEL L. NEWTON

SAMUEL L. NEWTON, being duly sworn according to law, deposes and says that he is Operator Training Manager, TMI-Unit I; that the information contained in Licensee's Response to Aamodt's Follow-On Interrogatories of Licensee Re Reopened Hearings of Cheating Incident to Request 9 re Licensee Proctors is true and correct to the best of his knowledge, information and belief.



Samuel L. Newton

Sworn to and subscribed before
me this 4th day of November, 1981


Notary Public

My Commission Expires

CATHY L. BREY, Notary Public
Londonderry Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

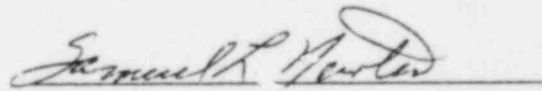
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
METROPOLITAN EDISON COMPANY)
(Three Mile Island Nuclear)
Station, Unit No. I))

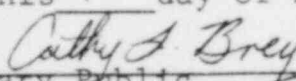
Docket No. 50-289

AFFIDAVIT OF SAMUEL L. NEWTON

SAMUEL L. NEWTON, being duly sworn according to law,
deposes and says that he is Operator Training Manager,
TMI - Unit I; that the information contained in Licensee's
Response to Aamodt's Follow-On Interrogatories of Licensee
Re Reopened Hearings of Cheating Incident to Request No.
16 is true and correct to the best of his knowledge, infor-
mation and belief.


Samuel L. Newton

Sworn to and subscribed before
me this 4th day of November, 1981


Notary Public

My Commission Expires

CATHY L. BREY, Notary Public
Lewistown Twp., Dauphin County, Pa.
My Commission Expires Oct. 24, 1983

PQS CORPORATION
REACTOR OPERATOR LICENSE EXAMINATION

Facility Three Mile Island #1
Reactor Type PWR - Babcock & Wilcox
Date Administered April 14, 1980
Examiner F.L. Kelly
Applicant V

Category Value	% of Total	Applicant's Score	% of Cat. Value	
<u>9.5</u>	<u>13.8</u>	<u>9.5</u>	<u>95.3</u>	A. PRINCIPLES OF REACTOR OPERATION
<u>8.0</u>	<u>11.7</u>	<u>7.7</u>	<u>97.5</u>	A'. PRINCIPLES OF HEAT TRANSFER AND FLUID FLOW
<u>8.5</u>	<u>12.4</u>	<u>7.91</u>	<u>97.2</u>	B. FEATURES OF FACILITY DESIGN
<u>8.0</u>	<u>11.7</u>	<u>6.4</u>	<u>70.0</u>	C. GENERAL OPERATING CHARACTERISTICS
<u>7.5</u>	<u>11.0</u>	<u>7.2</u>	<u>96.0</u>	D. INSTRUMENTS AND CONTROLS
<u>8.0</u>	<u>11.7</u>	<u>7.25</u>	<u>90.6</u>	E. SAFETY AND EMERGENCY SYSTEMS
<u>10.0</u>	<u>14.6</u>	<u>8.62</u>	<u>86.2</u>	F. STANDARD AND EMERGENCY OPERATING PROCEDURES
<u>9.0</u>	<u>13.1</u>	<u>8.0</u>	<u>88.9</u>	G. RADIATION CONTROL AND SAFETY
<u>68.5</u>	<u>100.0</u>			
<u>9.0</u>	<u>N/A</u>	<u>7.77</u>	<u>N/A</u>	T. TMI INCIDENT AND SMALL BREAK CONCEPT

FINAL GRADE 90.2

DO'S AND DON'TS FOR EXAMS

DO'S

1. Read the questions carefully.
2. Note the number of points allotted to each question.
3. Question the examiner if in doubt.
4. Pace yourself - don't spend hours drawing fancy sketches.
5. Show all calculations.
6. Look for any two-part questions which may not be labeled as such.
7. Recognize whether definition or explanation (discussion) is required.
8. List more than two reasons if some or few are requested.

DON'TS

1. LEAVE ANY BLANKS
 2. Read hidden meanings into the questions.
 3. Show the examiner your answers for his concurrence.
 4. Write your name on every sheet.
-

A. PRINCIPLES OF REACTOR OPERATION (9.5)

1. The effects of Xe on are important in reactor operation.
 - a. Explain the term equilibrium Xenon. (1.0)
 - b. Discuss the effects on reactivity that would occur should the reactor be taken to power shortly after Xenon has peaked. (1.0)
2. Two identical reactors are taken to the "just critical" level. Reactor "A" has a rod speed of 50 steps per minute, while Reactor "B" has a rod speed of 25 steps per minute. (Assume continuous rod withdrawal). (1.5)
 - a. Which reactor will achieve criticality first.
 - b. Which reactor will have the highest level of source range counts at criticality.
 - c. Which will have the highest critical rod height.

Explain your answers.
3. Would the insertion of $0.1\% \Delta K/K$ to the reactor at 10^{-8} amps on the intermediate range result in the same change in power level as the same insertion at 80% of full power. Explain your answer. (1.0)
4. a. Sketch and explain the startup recorder trace for one minute following a rod withdrawal amounting to an increase in K_{eff} (each time) of .005 from the following initial conditions: (1.5)
 - I. $K_{eff} = 0.9$, counts = 100
 - II. $K_{eff} = 0.99$, counts = 1,000
 - III. $K_{eff} = 1.00$, counts = 5,000

 - b. Calculate the SUR for case III. (0.5)
5. Would control rod worth be greater: (1.5)
 - a. When the moderator is at 150°F or 500°F .
 - b. When it is next to a withdrawn control rod or surrounded by inserted control rods.
 - c. When C_g is 500 ppm or 1500 ppm.

A. PRINCIPLES OF REACTOR OPERATION (CONTINUED)

6. As the reactor is operated, plutonium 239 is gradually formed from uranium 238. Describe: (1.5)

a. The formation process

b. How this formation affects reactor control

A/. PRINCIPLES OF HEAT TRANSFER AND FLUID FLOW (8.0)

1. Briefly explain the following heat transfer and fluid flow terms: (2.5)
 - a. Natural circulation
 - b. Reactor coolant saturation condition
 - c. Nucleate boiling
 - d. Sub-cooling
 2. The following units are used with what important nuclear and/or thermal parameters: (1.0)
 - a. KW/ft
 - b. MWD/T
 - c. KW/liter
 - d. Btu/hr-ft²
 3. Sketch a DNB curve. Label the abscissa and ordinate and identify the various regions shown on the curve. (1.5)
 4.
 - a. Describe the phenomena known as "pump cavitation". (0.5)
 - b. What symptoms would alert the TMI operators to such a condition for the RCPs. (1.0)
 5.
 - a. With TMI-1 operating at full power what are the hottest and average fuel rod temperatures which exist in the core. (1.0)
 - b. In the event of a LOCA, what temperature should the Zircaloy clad be limited to and for what reason. (0.5)
-

B. FEATURES OF FACILITY DESIGN (8.5)

1. List the purpose(s) of the Makeup and Purification System. (1.5)
2. Sketch a simplified system schematic diagram of the proposed HPI Cross-connect. Label components and indicate flow directions. (2.0)
3. Why are there two (2) vibration transducers on the DHR heat exchangers and only one (1) on the DHR pumps. (1.0)
4. With regard to the Core Flood System:
 - a. Briefly describe the purpose of the system. (1.0)
 - b. List normal operating pressure, temperature and volume conditions. (0.5)
 - c. What system valves are controlled from the main control board. (0.5)
5. Sketch a one-line diagram of the BOP 480 volt distribution system. Indicate the systems and/or components fed by the system. (2.0)

C. GENERAL OPERATING CHARACTERISTICS (8.0)

1. Describe how and why the following RCS chemistry parameters are controlled during startup and full-power operation. (1.5)

- a. Oxygen
- b. Chlorides
- c. pH

2. With regard to the EFW pumps, approximately how long will each pump require to reach full flow. (0.5)

3. Explain how and why the Moderator Temperature Coefficient is affected by changes in RCS boron concentration. (1.0)

4. The Reactor is operating at 10% power when the turbine bypass valves for "A" SG fail open. Two (2) minutes later the operator isolates the turbine bypass valve(s). Sketch the following parameters from the initial valve failure to four (4) minutes later for: (2.5)

- a. Reactor power
- b. SG level
- c. PRZ level
- d. FW flow

5. Describe the means of solid condition operation verification which operators can determine from the control room. (1.0)

6. a. Describe (a formula is acceptable) how the following isotopes are formed and where they would be most commonly be found in the reactor systems: (1.0)

- 1) N-16
- 2) SM-149
- 3) Krypton-85

b. List the half-lives of each of these isotopes. (0.5)

D. INSTRUMENTS AND CONTROLS (7.5)

1. Concerning the nuclear instrumentation:
 - a. Describe the reaction by which the detectors produce a signal corresponding to neutron radiation. (1.0)
 - b. Does gamma radiation affect the signals from detector. Explain why or why not. Assume detectors are properly calibrated and operated. (1.0)
 2. Describe the principle of operation of the RCS Saturation Margin Monitor, including the inputs to the monitor. (1.0)
 3. Upon loss of both feedwater pumps, the ICS positions the control valves EF-V30A/B to maintain SG H₂O level. What level is maintained and where is this indicated:
 - a. With reactor coolant pumps available. (0.5)
 - b. With reactor coolant pumps not available. (0.5)
 4. With regard to cold, safe shutdown, list ten (10) pertinent instruments which have been selected for placement on a separate panel outside the control room. (2.0)
 5. At 90 minutes and again at 113 minutes into the TMI-2 event, operators observed anomalous increases on the intermediate range NIs.
 - a. Approximately what was the order of magnitude of the increases. (0.5)
 - b. Explain the cause of these increases. (1.0)
-
-

E. SAFETY AND EMERGENCY SYSTEMS (8.0)

1. a. Outline all of the Unit #1 Emergency Feedwater System modifications. (2.0)
b. List the signals which will automatically start the "A" motor driven EFW pump and the turbine driven EFW pump. (1.0)
2. Explain the purpose of the PRZ Heater Emergency Power Supply System. (1.0)
3. What RPS trips are bypassed when in the Shutdown Bypass Mode. (1.0)
4. Recently, Crystal River Unit #3 suffered the loss of the +24 volt power supply to the non-nuclear instrumentation, with the reactor at 100% power. List the cause of the loss of voltage and briefly describe the significant events that occurred due to the condition. (2.0)
5. List the following full power RPS trip setpoints, with four (4) RCS pumps in operation: (1.0)
 - a. Nuclear power (% of rated power)
 - b. High Reactor coolant pressure
 - c. Lo Reactor coolant pressure
 - d. RCS maximum temperature
 - e. High Reactor building pressure

F. STANDARD AND EMERGENCY OPERATING PROCEDURES (10.0)

1. With regard to a normal Reactor startup and approach to criticality, list: (2.5)
 - a. Maximum SUR
 - b. Minimum overlap between source and intermediate range indication.
 - c. Action required if criticality is achieved prior to rods reaching .50 %ΔK/K below ECP. (Fill in the blank, also.)
 - d. Exceptions to the rule that CRA Safety groups be at upper limits whenever positive reactivity is being inserted.
 - e. Number of licensed operators in the control room.
2. Prior to TMI-1 modifications, during a transient which results in overcooling of the RCS, PRZ level decreases and the operators open MU-V16B and start a second make-up pump to restore PRZ level. With the installation of the HPI cross-connects, would such operator action be appropriate. Explain your answer. (1.0)
3. During a TMI-1 startup, in-core quadrant tilt indicates +6%. What operator action, if any, is necessary for this condition. (1.0)
4. With the plant operating at full power, certain precautions and limitations apply. Provide the following information and operator action pertaining to these: (1.5)
 - a. The control room computer becomes inoperable
 - b. Maximum PRZ level
 - c. Minimum boron concentration
 - ~~d. Maximum core thermal power~~
 - e. A limiting condition for operation can not be met

F. STANDARD AND EMERGENCY OPERATING PROCEDURES (CONTINUED)

5. During full power operation, an explosion and fire occurs local to the control room of Unit #1, resulting in thick, acrid smoke filling the control room. Supervision determines that evacuation is necessary. Prior to evacuation, operators must perform certain duties. List those duties. (1.5)
6.
 - a. List the symptoms which would alert the operators to the occurrence of an OTSG tube rupture. (1.5)
 - b. If HPI actuates on lo RCS pressure during the event, what immediate operator action is necessary. (0.5)
 - c. In an attempt to determine which OTSG has the rupture, the Chemistry Department is directed to sample both and analyze for what types of radioactive isotopes. (0.5)

G. RADIATION CONTROL AND SAFETY (9.0)

1. It is necessary to you to work in an area where you may receive an amount of radiation which will cause you to slightly exceed your 10CFR Part 20 routine quarterly limits. Is this permitted, and if so, what conditions must be met for you to do this. (1.5)
2. List four (4) different types of radiation and give typical situations in which each may be encountered at the TMI Station. (1.5)
3. What respiratory devices would provide adequate protection against: (1.0)
 - a. Radioactive gas
 - b. Radioactive particles
 - c. Tritium
4. A TMI plant chemtech accidentally spills a freshly taken primary coolant sample on the floor.
 - a. Discuss what actions he should take. (1.5)
 - b. If a portable monitor reads 50 mrem/hour γ two feet from the spill, what is the contact level of radiation. (1.0)
5. With regard to "leaky" fuel elements, how could operators detect a leak which occurs in a TMI fuel element: (1.5)
 - a. In the core at full power
 - b. In spent fuel storage
 - c. Which is new fuel being received
- ~~6.~~ Assume that an emergency unscheduled entrance into the reactor building is necessary. Describe what considerations (clothing, instruments, people, exposure limits) must be factored into the entry. (1.0)

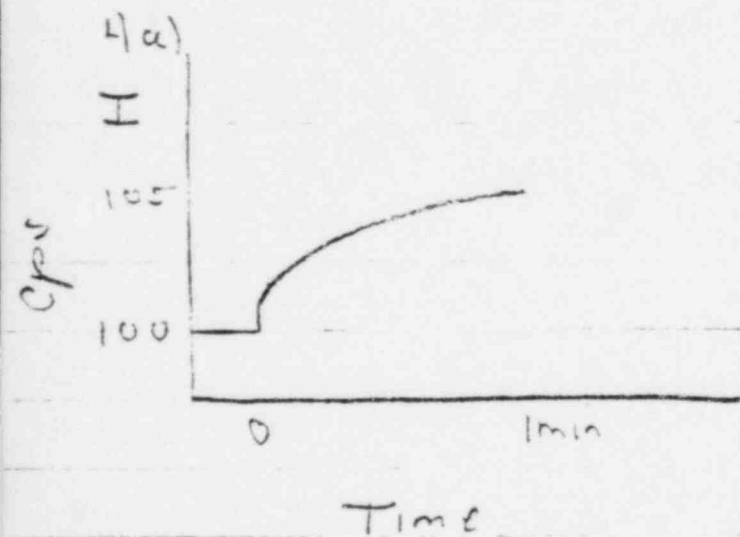
T. TMI-2 INCIDENT AND SMALL BREAK CONCEPT (9.0)

1. List three objectives of the training program on the above subject which was administered to TMI and other operating B&W plant operators. (1.0)
 2. Explain why the availability of steam generator feedwater and RCS pump operation have little effect in the event of a large LOCA but may have a significant effect in a small break. (1.0)
 3. During the TMI-2 event, the operators had no direct indication of saturation conditions. What indirect means of determining that the condition existed were available to them. (1.0)
 4. With all RCPs secured after a reactor trip, how do the TMI operators verify that natural circulation is occurring. (1.0)
 5. Within the first eight minutes of the TMI-2 event the PRZ level indications went off-scale high. What was the cause of the increasing PRZ level. (0.5)
 6. List four (4) objectives of the emergency core cooling system after actuation and of operator action on a loss of coolant accident. (1.5)
 7. What plant indications or conditions would alert you as an operator to whether a transient is an overcooling situation of the RCS or a small break. (1.0)
 8. A number of operating ~~procedures~~ contain the statement "verify emergency feedwater flow". What indications do you as an operator have with which you can verify this flow. (1.0)
-
9. List the major mechanical failures and errors that created or aggravated the TMI-2 incident. List minimum of four (4). (1.0)

- 1a Equilibrium Xenon is the term used to describe when Xenon production (from fission $\lambda = 135$ decay) equals Xenon removal (from burnout & Xe decay) for a given power level. For 100% FF equilibrium Xenon is worth ~ 2.976 dk/k.
- b If power is increased following Xenon peak, the resultant flux increase will increase Xenon burnout term. This in conjunction with the fact Xenon decay is a first order reaction, $\lambda = 135$ decay results in a large reaction in the total Xenon inventory with a corresponding rapid positive reactivity response.
- 2a Reactor B will achieve criticality first. Since Reactor A will be closer to twice the rate of Reactor B critical position will be achieved in $\sim 1/2$ the time from shutdown of 100% motion.
- b Reactor B will have the highest level of counts. This is a result of the increased time to reach criticality which will result in an increased number of generations of subcritical multiplication in Reactor A.
- c Critical rod height will be identical. Since both reactors are identical critical rod position at 100% power will be identical.

Section 4 pg 2

- c. If a 0.1% ^{235}U addition @ 10^6 amps in Zr would result in a positive SUR of ~ 0.5 decades per minute which would increase Reactor power to the point of severe heat production ($\sim 10^6$ amps in Zr) at which point Doppler & moderator temperature coefficients would be negative reactive & stabilize power levels, resulting in a SUR of ~ 0.5 decades per minute. The same point in reactivity would immediately result in a change in SUR & moderator temp with the resultant negative reactivity addition. The Doppler & moderator temp. even that power would not increase significantly relative to the increase experienced @ 10^6 amps.



$$CR_2 = CR_1 \left(\frac{1 - \beta}{1 - \beta_2} \right)$$

$$CR_2 = 100 \left(\frac{1 - .0}{1 - .095} \right)$$

$$CR_2 = 100 \left(\frac{1}{.905} \right)$$

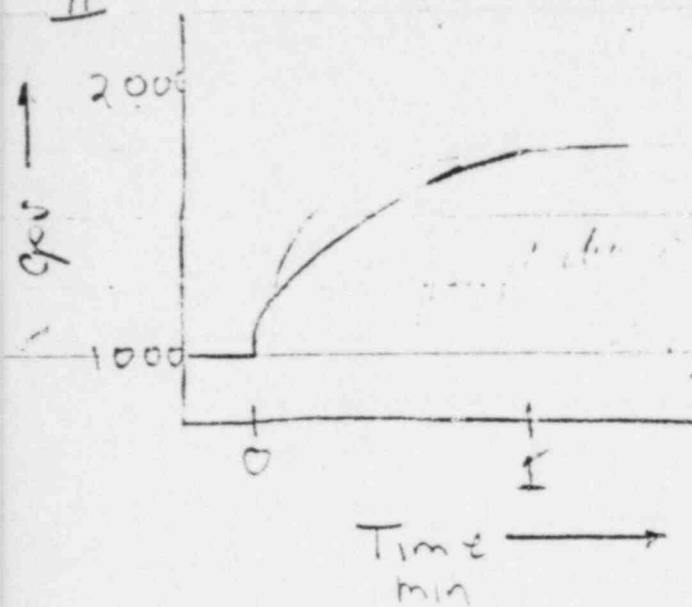
$$CR_2 = 105 \text{ cps}$$

cps increase to equilibrium
& stabilize as result of subcritical
multiplication

Assuming equilibrium
is reached distant
from equilibrium

Section II

II



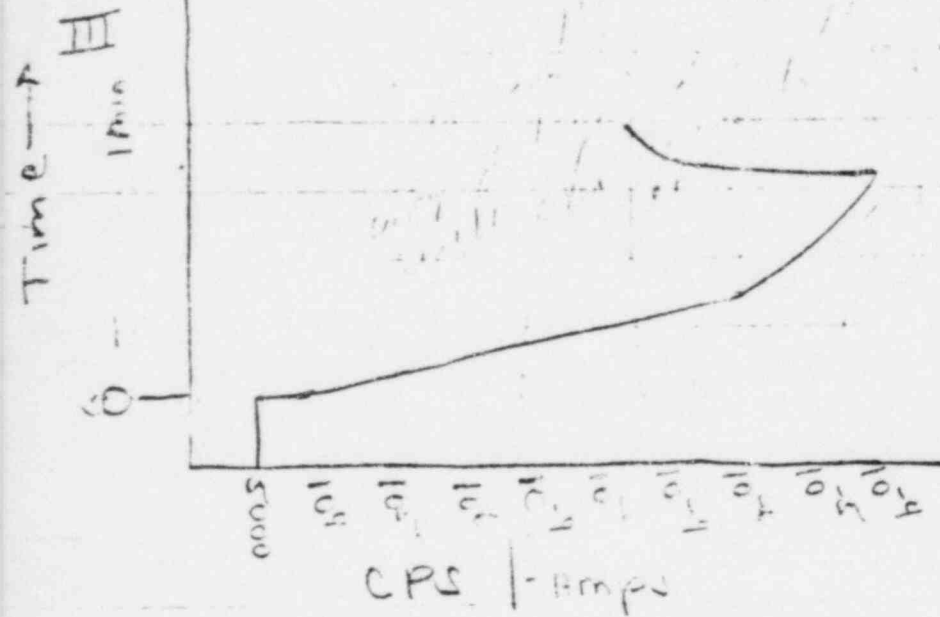
$$CR_2 = CR_1 \left(\frac{1-k_1}{1-k_2} \right)$$

$$= 1000 \left(\frac{1-.99}{1-.995} \right)$$

$$= 1000 \frac{.01}{.005}$$

$$CR_2 = 2000 \text{ cps}$$

Assuming equilibrium is reached before time specified



Assuming of .005 sec to

Response time of .005 sec

cur when starts to turn @

10^6 in IR due to doppler

(motion Temp. Reson.)

Ry traps @ 105.5% FR (10^5)

with resultant prompt drop in

amp (10%) to 10^4 & continues

to decrease @ approx. 100%

$$4b \quad T = \left(\frac{L^x}{AF} \right) + \left(\frac{B-P}{2P} \right)$$

$$T = \left(\frac{36 \times 10^{-6}}{.08 \times .00495} \right) +$$

$$\left(\frac{.0055 - .00495}{.08 \times .00495} \right)$$

$$T = \left(\frac{36 \times 10^{-6}}{.000395} \right) + \left(\frac{.00052}{.000395} \right)$$

Assume

$$Z = .08$$

$$P = \frac{1-k}{k} = .00495$$

$$B = .0055$$

$$\frac{B-P}{2P}$$

$$\bar{T} = .000556 / .000090$$

$$\bar{T} = 1.399$$

$$SUN = 26.06 / \bar{T}$$

$$= 26.06 / 1.399$$

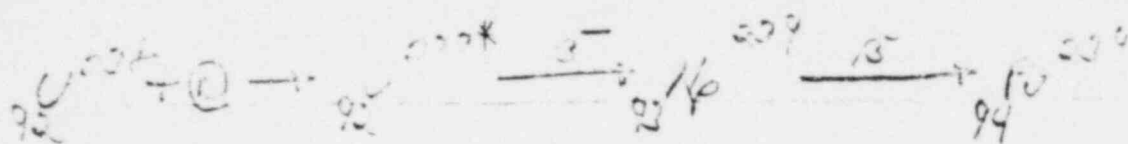
$$= 18.65 \text{ decads/min}$$

5a Control rod worth greater at 500°F due to decreased competition for ϕ from poison no result of decreased moderator density

5b Control rod worth greater for rod with $\rho_{1/2}$ with drawn rod due to decreased competition for ϕ from with drawn rod

5c Rod worth is greater if $C_2 \approx 500$ ppm why?

Sept 11, 1964



6 b. Ra^{227} is built into the core the β effective decreases resulting in faster response for a reactivity change. The β effective change is a result of the fact the $^{92}\text{Th}^{231}$ has a β fraction of $1 / (1 + \lambda) = .0064$ & ($\lambda = .0117$) and the contribution to total power increases from 15% to 40% respectively ($^{92}\text{Th}^{231}$ is 98% & $^{92}\text{U}^{235}$ is 2% over core). The result is β effective decreases from $\sim .0064$ to $\sim .0052$ @ $\bar{\omega}$.

1a - Natural Circulation is the process by which flow is induced in a system without the aid of pumps as a result of a density difference in the coolant. At a higher elevation, ie a water heating up its density decreases causing it to rise. If it is then cooled the density increases will cause it to fall.

1b Reactor coolant subcooled circulation is when the water in the reactor is at temperature below saturation & pressure with steam being formed in the reactor, resulting in a 2 phase flow mixture of steam & water. As the fuel elements warm up the temperature of the coolant increases.

1c Nucleate boiling is the formation of small bubbles at surface site imperfections on the fuel which are then carried away by the turbulent flow into the flow channel where the bubbles collapse.

1d ✓ Subcooling is the amount by which the major portion of the coolant is below saturation conditions in the reactor. At 100% LWR this is 200°F

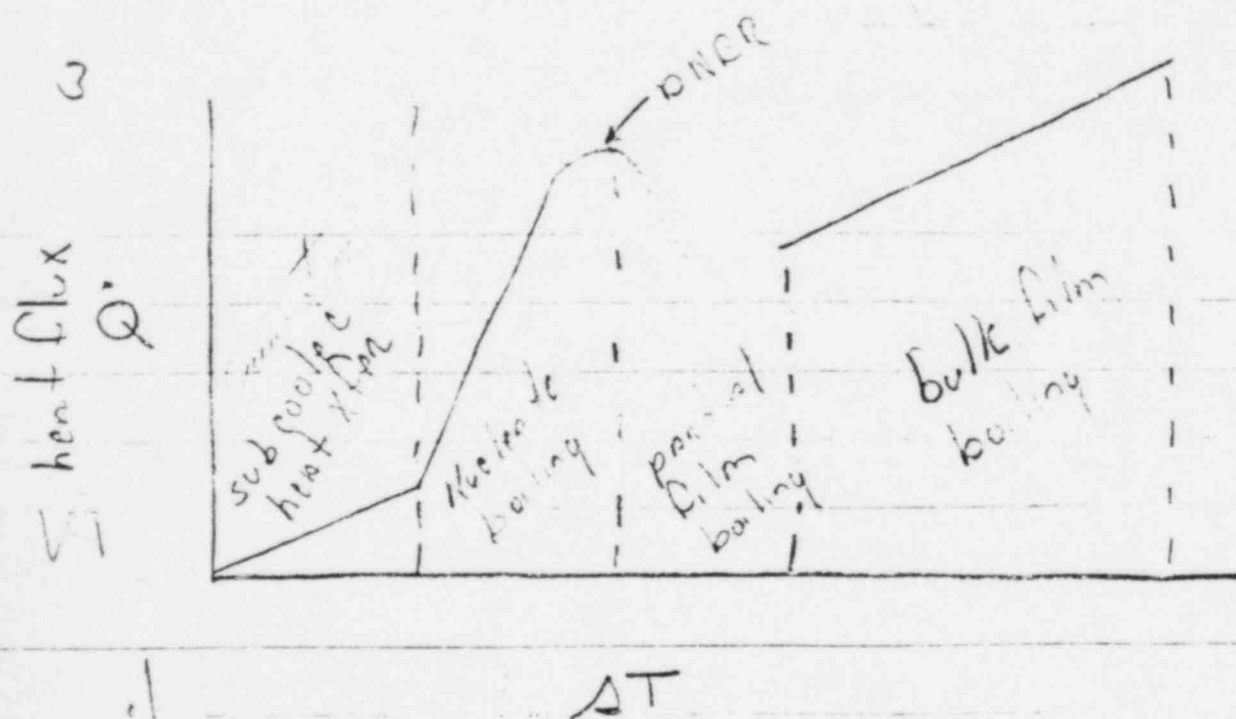
Sect. H pg 2

2a) kw/ft^2 - limited by Tech Spec to 14.2 kw/ft^2 to prevent fuel center line melt

b) mw/T - megawatts per metric ton limited by Tech Spec to 55,000. This is a measure of fuel burnup or depletion

c) kw/ft^2 - Power density limited by design to prevent fuel element failure, fuel element, Rod worth (control of APRC) Fuel depletion

d) $\text{ktu}/\text{hr-ft}^2$ - Measure of heat transfer coefficient for heat exchangers (ie CTRC reactor) Used to determine heat removal capability



Section A' pg 3

4a) Due to the pressure drop in the impeller or a clogged pump steam bubbles will form collapse if the Net positive Suction Head is insufficient to prevent the phenomenon from occur. This will result in vibration, flow oscillations, steam erosion of the impeller, steam blanketing of bearing surface & release of entrained gases which could grab the pump &/or the shaft.

4b) RC flow reduction &/or reduction
RC pump vibration on bearing surface increasing
RC motor vibration increasing/decreasing
Decreased motor amps
Increasing pump bearing temp

5a) Highest fuel temp. in core is $\sim 2000^{\circ}\text{F}$ peak center line
in the worst case fuel assembly
Average fuel temperature is $\sim 1100 - 1200^{\circ}\text{F}$

5b) Cladding temperature should be limited to $< 2200^{\circ}\text{F}$
to ensure $< 1\%$ H_2 formation from zircaloy oxide reaction
and $< 1\%$ cladding oxidation

Section B p91

1. RCS inventory control ✓

low for emergency

RCS Boron control ✓

RCS H_2 inventory control ✓

Provides seal injection to RC pumps ✓

Injection of hi concentration Boron from BWST or REBAT or BART for emergency boration ✓

→ provides seal injection to RC pumps for emergency boration

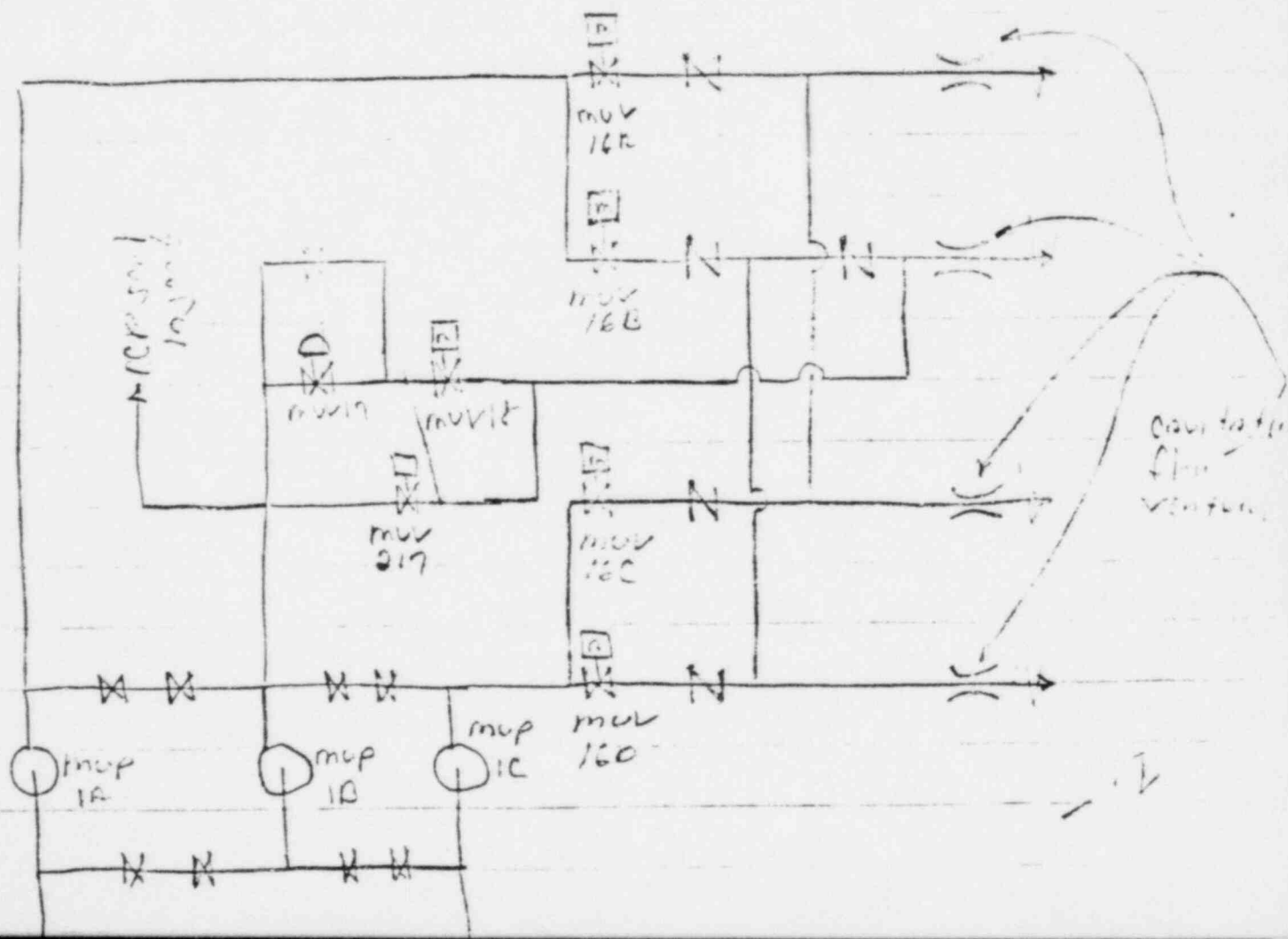
to provide seal injection to RC pumps for emergency boration

Provides for collection of pumps in H_2 seal and seal out of RC pump

→ provides for collection of pumps in H_2 seal and seal out of RC pump

RCS H_2O quality control ✓

2)



Sect B pg 2

3) Due to the possibility of debris impinging on the face of the cooler, causing a leak in DFR coolant & loss of structural support provided by flow of coolant, the cooler requires 2 transducers to insure that this is not a problem prior to leak occurring.

4) a Provides a means of covering & cooling the core in the event of a SCOA independent of operator action, initiating signals to power supplies.

b press - $600 \pm 25 \pm$

Temp - $> 110^\circ F$

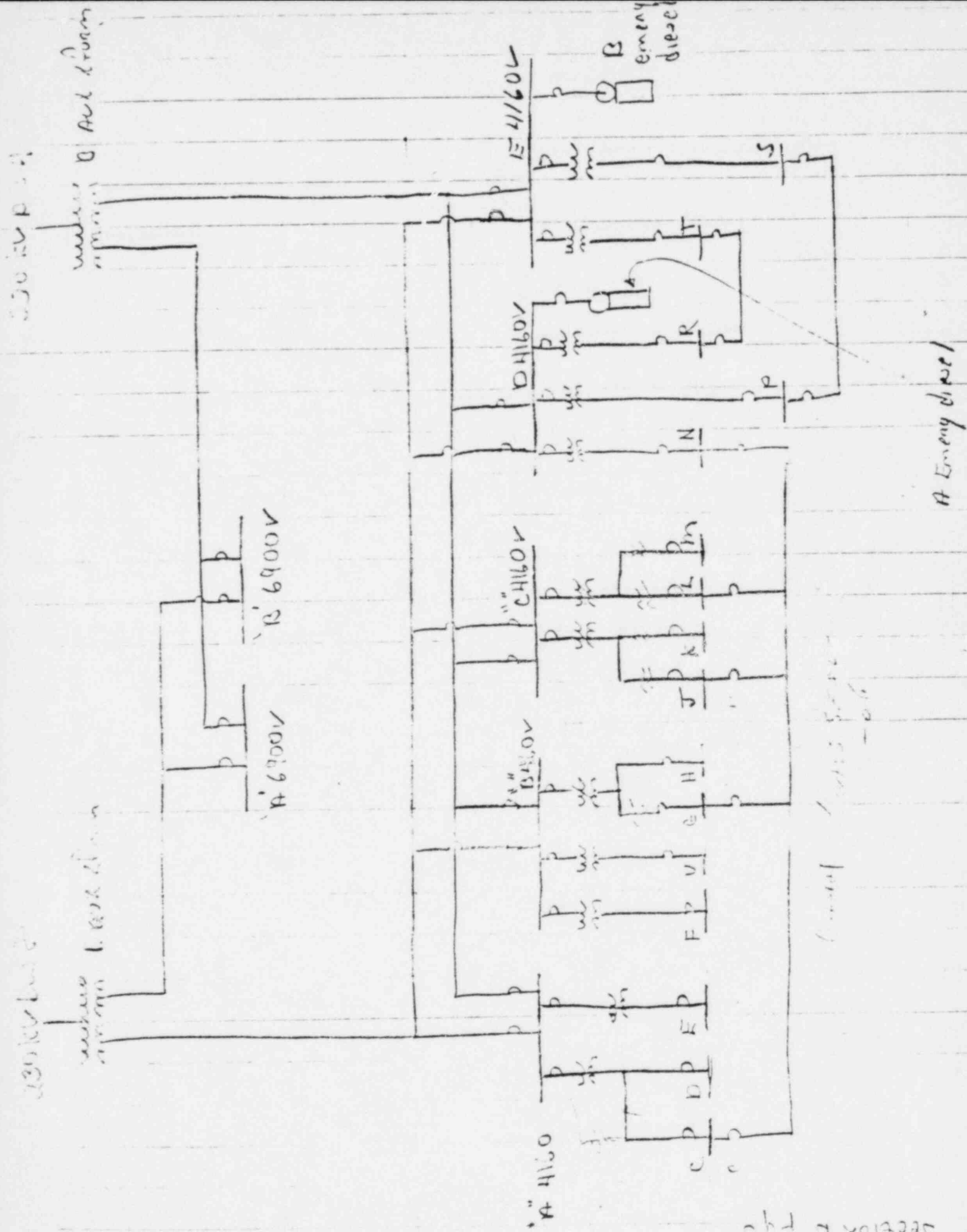
Volume - $13.5 \text{ ft}^3 \pm 0.45 \text{ ft}^3$ corresponding to $1040 \pm 30 \text{ lb of H}_2\text{O}$
@ 2270 ppm boron

c CF-V-1A/1 Core flow decrease

CF-V-2A/1

CF-V-1A/2

CF-V-3A/1



1a O_2 is controlled in the RCS by several means. Minimizing O_2 content of makeup water used, by addition of hydrogen which could scavenge O_2 , N_2 blanket of O_2 in the steam generator to displace O_2 & by maintaining a positive O_2 monitoring system to scavenge O_2 limited to $< 0.1 \text{ ppm}$ by TSC.

This is required to minimize potential corrosion & protect a pressure chloride stress cracking of steel is recovered, since Cl^- is only seen in presence of O_2 .

1b Chloride is controlled by control of makeup to RCS & L, use of mu-k-life (makeup & production chems) to remove any present limited to $< .15 \text{ ppm}$ by TSC.

Chloride in the presence of O_2 @ high temp will cause cracking of stainless steel which is under stress. Since

Primary system is primarily SPS under stress from manufacture, pressure, temp, etc and the primary is

@ $\sim 574^\circ F$, This is limited to ensure system integrity.

1c Li Ph control is used in the RCS. This is accomplished by means of mu-k-life IP/O which remove Li from RCS coolant. It is produced from $(R^{10}H)$ in reaction

✓ 1) Ph control is required to caustic stress corrosion.

Section C, pg 3

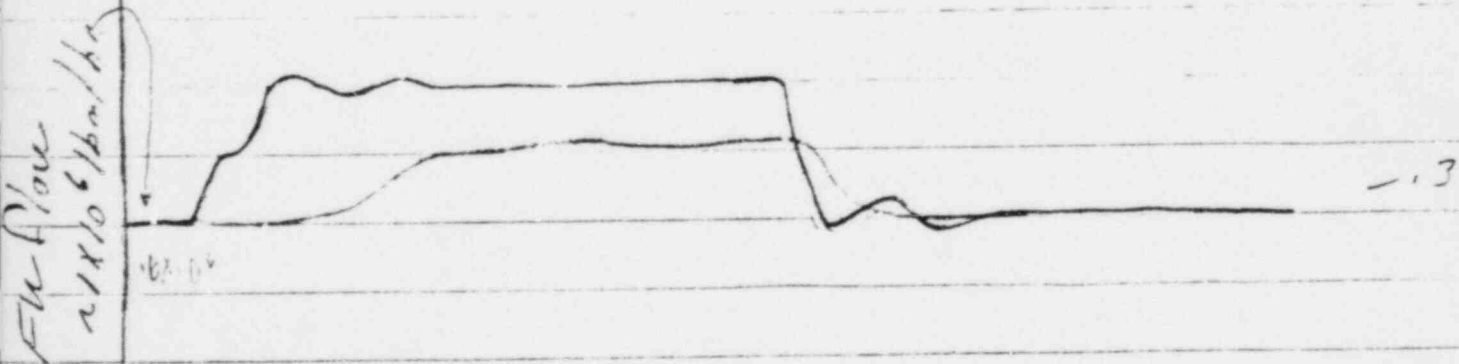
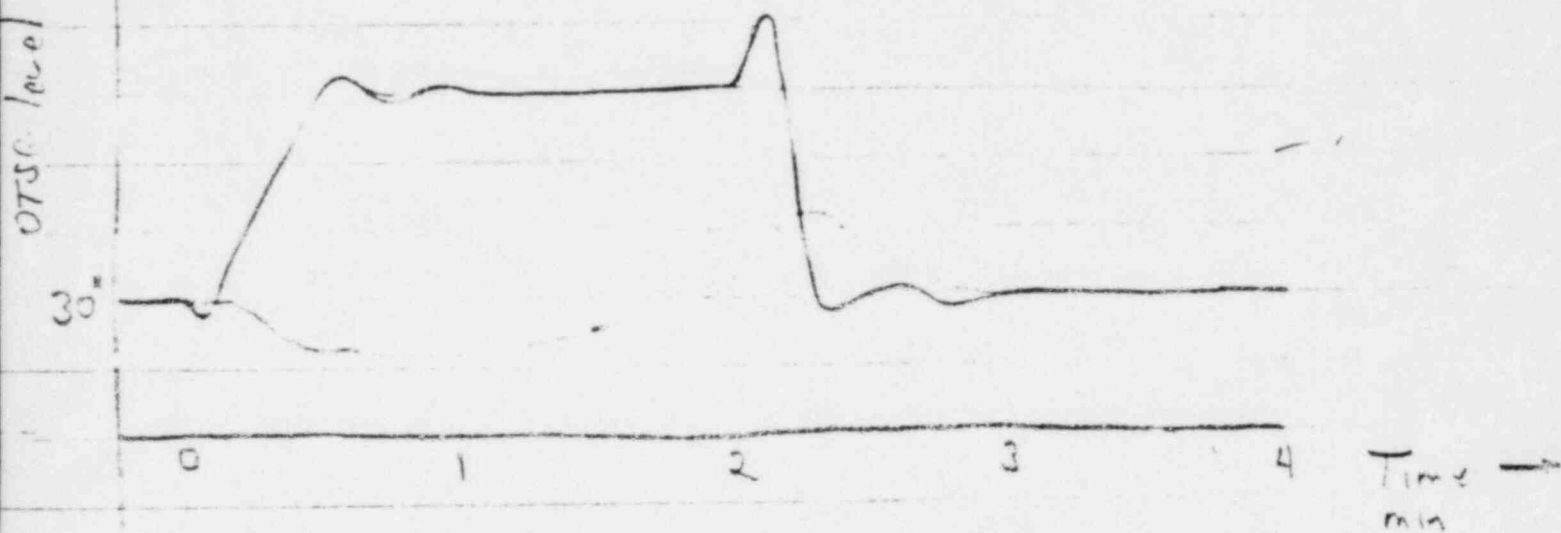
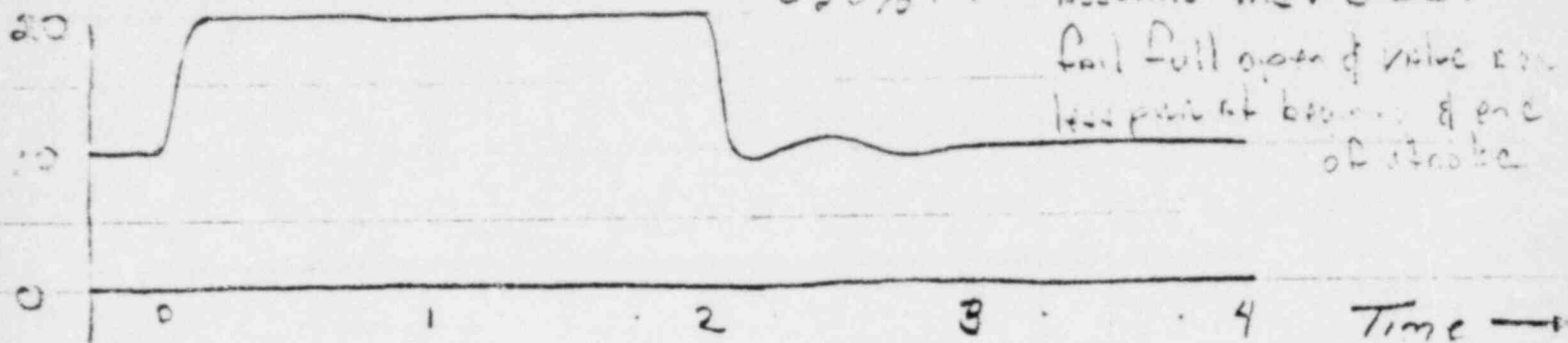
10

13

~20% F.P.

assume msV 3 DEF

fail full open of valve and
less part at beginning & end
of stroke



5) Power $10^4 > 400^4$ ✓
 $> 500^\circ\text{F}$ Sub cooled \rightarrow Test meter T_n vs T_a for RN power
 Power temp \rightarrow RCS hot leg
 Power increasing to 2.5×10^4
 Reaction $P \propto T^4$ \rightarrow $10^4 \rightarrow 2.5 \times 10^4$

6) a) $^{16}_8\text{O} + ^1_0\text{n} \rightarrow ^{17}_8\text{O} \xrightarrow{\beta^-} ^{17}_7\text{N} \xrightarrow{\beta^-} ^{16}_8\text{O}$ found primarily in coolant

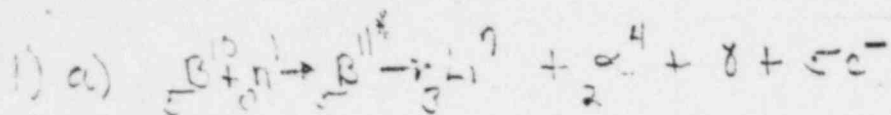
2) $^{140}_{50}\text{Nd} \xrightarrow{\beta^-} ^{140}_{51}\text{Pm} \xrightarrow{\beta^-} ^{140}_{52}\text{Sm}$ - found primarily in fuel & reactor process poison in T

3) comes primarily directly from reactor found in core
 fuel pins as fission gas in H₂O

6 b) 7.6 sec

2 10^{14} years

3 $4\frac{1}{2}$ hrs & 10.7 yrs



A neutron is absorbed by Boron which then decays by emitting an alpha particle & 5 electrons. The resultant event is slow (Purkin Range or Intermediate Range) or ~~fast~~ (source range) is fast & measure of the number of events occurring in the detector.

b) gamma radiation will result in the production of current or pulse (if it is sensed by the detector). However in the Source Range this results in a pulse $< 1/6$ the size of a pulse resulting from a α interaction. This smaller pulse can then be discriminated against (ie signal is clipped to remove the smaller pulse).

In the IIC, a gamma only signal is automatically added to the signal produced by neutron and gamma such that the resultant signal is neutron only (ie the gamma is compensated for).

In the Pur Range the gamma signal is not corrected for for 2 reasons 1) It is proportional to pure α 2) it is several orders of magnitude less than the signal resultant from neutrons.

2 RCS subcooling margin monitor receives inputs from T_h , T_c , & Press for both RCS loops. From pressure it computes a T_{sat} and then subtracts the selected Temperature to give a subcooling margin. Two

inputs to bistable latching. The output is a signal to the alarm system if subcooling margin is $< 50^\circ F$. Compare further to 1.2

Section D page 3

- 3) a) 30" on the steam level indication on Condenser
 b) 50% on the operating range level indication on Condenser

- 1) 1 Control indication (position of damper) installed ✓
 2 Control indication (position of damper) $\approx \approx \approx 30$ ✓
 3 EES hot leg Temp T_{HL} ✓
 4 EES hot leg Temp T_{HL} ✓
 5 Pressurizer level ✓
 6 Pressurizer Temp ✓
 7 HPI Flow ✓
 8 BWT level ✓
 9 letdown flow ✓
 10 letdown temp ✓

5) a) Approximately one decade, i.e. from 10^{-11} to $\sim 10^{-10}$

b) This increase was due to the increased volume in the core which resulted in an increase in the neutron leakage from the core seen by the detectors.

1a) motor driven EFV will not start
 EFV flow to OTSG added to CC & CL indication
 Motor driven signal changed to ✓

1. loss of all RCP

2. < 50 psid across FWPIA & R

3. > 200 psid between FW pump discharge

& M.S. pressure

EFV 30A/B will be opened & closed by IC ✓

EFV 30C/D will be opened & closed by IC ✓

MSV 12A/B & MSV 6 will have backup from Backup ✓

MSV 12A/B will be opened & closed by IC ✓

1b) loss of all RCPs ✓

< 50 psid across FWPIA & R ✓

> 200 psid between FW pump discharge & M.S. pressure

2) Transfer of a group of lines (likely 10 lines) from normal supply to Emergency Subsystem buses so that they can be energized off the emergency diesel in the event of a station blackout. The work must be performed during the emergency period. Transfer must be accomplished in < 2 hrs follow station blackout ✓

3
 10 press ✓
 press-Temp ✓
 flux-imbalance-Flow (d/dt/flow)
 power to hot pump ✓
 In addition hi pump is administered to be near to 55% & as reaction to pressure trip @ 1720[°] RC press is increased

4 NNI voltage loss was due to a short circuit in the connection for the Test meter. This resulted in the POC & safety valve going full open. It caused Rod withdrawal (Tare low die fail overheat & neutron flux causing with onness) Feedwater was run out due to BTU limits (T_h low & RC flow low due to valve), RC pressure normal intensified causing the reaction to trip on hi pressure. The OTSGs boiled down & feedwater block activated to stop press. THPI activated due to decreasing RC press & the resulting reaction flow caused the RC to go into increasing pressure to 2000[°] RC drain to 1000[°] & rupture of pipe causing release to RC & LK pressure to increase ✓

- a 1055% EP
- b 2200[±]
- c presently 1800[±] will be changed to 1900[±]—
- d 6190[±] ✓
- e 9[±]

Section = pol

- a 1dpm chronograph not to exceed 1.5 dpm
- b \$1 decade in the range 10^4 to 10^6 cps in SR & 10^4 to 10^5 in the
- c .3% $\Delta k/k$
insert rods til 1% s/p
Recirculate RCP
- d during physics testing
low speed testing (1000 - 10000)
- e operation with an inoperable oxygenator
2 out of 3 when will have a SRD license ✓

2) No since this would result in an undue demand
transient on O hpi leg injection nozzle due
to the x-tie. The proper action would be to
open m-x-217 which taps the E injector leg
downstream of the air valve (ie check valve between
x tie & m-x-217) & start a second makeup pump
require.

3) This would require power to be reduced below the power
level cutoff. In position the power must be reduced 2% for each 1% tilt in excess of
the limit (limit is 3.52%) If tilt is not corrected
within 4 hrs in addition RPS setpoint for $\phi/2\phi/4\phi$
must be reduced 2% for each 1% tilt, RCP injection
limits must be reduced 2% for each 1% tilt in excess
of limit & the operational maintenance limit must be

Seet 44 -

3 (cont). decrease by 2% for each 1% fall in excess of fuel
4 a) pressure have to calculate each 2 hrs, have heat to hold even in
if RCS level more each day by hand...

- b) see " if gas-cc shutdown in 10 min
- c) 25 min - if loss shutdown in 10 min
- d) 2535 interthermal - reduce power to ≤ 2535 if gas-cc fails
- e) Control room to be in stand-by at 2535
- f) 1/2 - 1/2 by Red phone
- a) also have to do

5) Trip Reactor & turbo -

to 2535

Start EFR 2 R/O

trip R/P 1 R/O

Open MUV-51

Commenced emergency core action with stroke control in
case MUV-3

leave core & injection in Auto

- 2

6a) 1 R/P-5 increase plant power

100% decreasing

RCS pressure decreasing

Power level decreasing

OTSG level increasing

Secondary power increased

b) trip all R/P & refer to 1202-6R peak causing
auto RPI initiation follow up action

- 13 C I¹³¹, α , long lived particulate (precipitate 15 min approx)

Section 6 p41

1. ~~Yes~~ process is complete, the rate is $< 5(1-10)$ which is equal to $100 - 50 = 50$ ~~the rate is 50~~
~~Supervision is required~~

2. Alpha (α) handling new fuel ~~UNFUELED FUEL~~
 Beta (β) ~~handling new fuel~~
 Gamma (γ) inside only at port ($\gamma = 8$)
 Neutron (δ) inside the core if it's port ($\delta = 10$)

- 3 a. Full face Scott mask with ~~filter~~
 b. Scott mask with Hepa filter (full face mask)
 c. Scott air pack plus

- 4 a. Assume spill is a 1 liter sample from a 1000 liter canister
 So does not constitute a local emergency how he should
 stop it up, warn others to evacuate area, close
 Room, clean it up using proper radiology safety procedures
 & monitor the area clean

- b. Assuming the spill constitutes a point source due to its
 small area then

$$D R_1 \times D_1^2 = D R_2 \times D_2^2$$

$$D R_2 = (D R_1 \times D_1^2) / D_2^2$$

4b. $DR_1 = 50 \left[\frac{(24'')^2}{(12'')^2} \right]$

1) Assume contact reading @ 2"

$DR_2 = 7.2 \text{ Rem/hr}$

5a) by I^{131}/I^{132} ratio, RM L1 for large leaks - 2

b) pr 1 - 4 pr 2 13 pr 3 14 pr 4 15 pr 5 16 pr 6 17 pr 7 18 pr 8 19 pr 9 20 pr 10 21 pr 11 22 pr 12 23 pr 13 24 pr 14 25 pr 15 26 pr 16 27 pr 17 28 pr 18 29 pr 19 30 pr 20 31 pr 21 32 pr 22 33 pr 23 34 pr 24 35 pr 25 36 pr 26 37 pr 27 38 pr 28 39 pr 29 40 pr 30 41 pr 31 42 pr 32 43 pr 33 44 pr 34 45 pr 35 46 pr 36 47 pr 37 48 pr 38 49 pr 39 50 pr 40 51 pr 41 52 pr 42 53 pr 43 54 pr 44 55 pr 45 56 pr 46 57 pr 47 58 pr 48 59 pr 49 60 pr 50 61 pr 51 62 pr 52 63 pr 53 64 pr 54 65 pr 55 66 pr 56 67 pr 57 68 pr 58 69 pr 59 70 pr 60 71 pr 61 72 pr 62 73 pr 63 74 pr 64 75 pr 65 76 pr 66 77 pr 67 78 pr 68 79 pr 69 80 pr 70 81 pr 71 82 pr 72 83 pr 73 84 pr 74 85 pr 75 86 pr 76 87 pr 77 88 pr 78 89 pr 79 90 pr 80 91 pr 81 92 pr 82 93 pr 83 94 pr 84 95 pr 85 96 pr 86 97 pr 87 98 pr 88 99 pr 89 100 pr 90 101 pr 91 102 pr 92 103 pr 93 104 pr 94 105 pr 95 106 pr 96 107 pr 97 108 pr 98 109 pr 99 110 pr 100 111 pr 101 112 pr 102 113 pr 103 114 pr 104 115 pr 105 116 pr 106 117 pr 107 118 pr 108 119 pr 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564 575 pr 565 576 pr 566 577 pr 567 578 pr 568 579 pr 569 580 pr 570 581 pr 571 582 pr 572 583 pr 573 584 pr 574 585 pr 575 586 pr 576 587 pr 577 588 pr 578 589 pr 579 590 pr 580 591 pr 581 592 pr 582 593 pr 583 594 pr 584 595 pr 585 596 pr 586 597 pr 587 598 pr 588 599 pr 589 600 pr 590 601 pr 591 602 pr 592 603 pr 593 604 pr 594 605 pr 595 606 pr 596 607 pr 597 608 pr 598 609 pr 599 610 pr 600 611 pr 601 612 pr 602 613 pr 603 614 pr 604 615 pr 605 616 pr 606 617 pr 607 618 pr 608 619 pr 609 620 pr 610 621 pr 611 622 pr 612 623 pr 613 624 pr 614 625 pr 615 626 pr 616 627 pr 617 628 pr 618 629 pr 619 630 pr 620 631 pr 621 632 pr 622 633 pr 623 634 pr 624 635 pr 625 636 pr 626 637 pr 627 638 pr 628 639 pr 629 640 pr 630 641 pr 631 642 pr 632 643 pr 633 644 pr 634 645 pr 635 646 pr 636 647 pr 637 648 pr 638 649 pr 639 650 pr 640 651 pr 641 652 pr 642 653 pr 643 654 pr 644 655 pr 645 656 pr 646 657 pr 647 658 pr 648 659 pr 649 650 651 pr 650 652 pr 651 653 pr 652 653 654 pr 653 654 655 pr 654 655 656 pr 655 656 657 pr 656 657 658 pr 657 658 659 pr 658 659 660 pr 659 660 661 pr 660 661 662 pr 661 662 663 pr 662 663 664 pr 663 664 665 pr 664 665 666 pr 665 666 667 pr 666 667 668 pr 667 668 669 pr 668 669 670 pr 669 670 671 pr 670 671 672 pr 671 672 673 pr 672 673 674 pr 673 674 675 pr 674 675 676 pr 675 676 677 pr 676 677 678 pr 677 678 679 pr 678 679 680 pr 679 680 681 pr 680 681 682 pr 681 682 683 pr 682 683 684 pr 683 684 685 pr 684 685 686 pr 685 686 687 pr 686 687 688 pr 687 688 689 pr 688 689 690 pr 689 690 691 pr 690 691 692 pr 691 692 693 pr 692 693 694 pr 693 694 695 pr 694 695 696 pr 695 696 697 pr 696 697 698 pr 697 698 699 pr 698 699 700 pr 699 700 701 pr 700 701 702 pr 701 702 703 pr 702 703 704 pr 703 704 705 pr 704 705 706 pr 705 706 707 pr 706 707 708 pr 707 708 709 pr 708 709 710 pr 709 710 711 pr 710 711 712 pr 711 712 713 pr 712 713 714 pr 713 714 715 pr 714 715 716 pr 715 716 717 pr 716 717 718 pr 717 718 719 pr 718 719 720 pr 719 720 721 pr 720 721 722 pr 721 722 723 pr 722 723 724 pr 723 724 725 pr 724 725 726 pr 725 726 727 pr 726 727 728 pr 727 728 729 pr 728 729 730 pr 729 730 731 pr 730 731 732 pr 731 732 733 pr 732 733 734 pr 733 734 735 pr 734 735 736 pr 735 736 737 pr 736 737 738 pr 737 738 739 pr 738 739 740 pr 739 740 741 pr 740 741 742 pr 741 742 743 pr 742 743 744 pr 743 744 745 pr 744 745 746 pr 745 746 747 pr 746 747 748 pr 747 748 749 pr 748 749 750 pr 749 750 751 pr 750 751 752 pr 751 752 753 pr 752 753 754 pr 753 754 755 pr 754 755 756 pr 755 756 757 pr 756 757 758 pr 757 758 759 pr 758 759 760 pr 759 760 761 pr 760 761 762 pr 761 762 763 pr 762 763 764 pr 763 764 765 pr 764 765 766 pr 765 766 767 pr 766 767 768 pr 767 768 769 pr 768 769 770 pr 769 770 771 pr 770 771 772 pr 771 772 773 pr 772 773 774 pr 773 774 775 pr 774 775 776 pr 775 776 777 pr 776 777 778 pr 777 778 779 pr 778 779 780 pr 779 780 781 pr 780 781 782 pr 781 782 783 pr 782 783 784 pr 783 784 785 pr 784 785 786 pr 785 786 787 pr 786 787 788 pr 787 788 789 pr 788 789 790 pr 789 790 791 pr 790 791 792 pr 791 792 793 pr 792 793 794 pr 793 794 795 pr 794 795 796 pr 795 796 797 pr 796 797 798 pr 797 798 799 pr 798 799 800 pr 799 800 801 pr 800 801 802 pr 801 802 803 pr 802 803 804 pr 803 804 805 pr 804 805 806 pr 805 806 807 pr 806 807 808 pr 807 808 809 pr 808 809 810 pr 809 810 811 pr 810 811 812 pr 811 812 813 pr 812 813 814 pr 813 814 815 pr 814 815 816 pr 815 816 817 pr 816 817 818 pr 817 818 819 pr 818 819 820 pr 819 820 821 pr 820 821 822 pr 821 822 823 pr 822 823 824 pr 823 824 825 pr 824 825 826 pr 825 826 827 pr 826 827 828 pr 827 828 829 pr 828 829 830 pr 829 830 831 pr 830 831 832 pr 831 832 833 pr 832 833 834 pr 833 834 835 pr 834 835 836 pr 835 836 837 pr 836 837 838 pr 837 838 839 pr 838 839 840 pr 839 840 841 pr 840 841 842 pr 841 842 843 pr 842 843 844 pr 843 844 845 pr 844 845 846 pr 845 846 847 pr 846 847 848 pr 847 848 849 pr 848 849 850 pr 849 850 851 pr 850 851 852 pr 851 852 853 pr 852 853 854 pr 853 854 855 pr 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922 pr 921 922 923 pr 922 923 924 pr 923 924 925 pr 924 925 926 pr 925 926 927 pr 926 927 928 pr 927 928 929 pr 928 929 930 pr 929 930 931 pr 930 931 932 pr 931 932 933 pr 932 933 934 pr 933 934 935 pr 934 935 936 pr 935 936 937 pr 936 937 938 pr 937 938 939 pr 938 939 940 pr 939 940 941 pr 940 941 942 pr 941 942 943 pr 942 943 944 pr 943 944 945 pr 944 945 946 pr 945 946 947 pr 946 947 948 pr 947 948 949 pr 948 949 950 pr 949 950 951 pr 950 951 952 pr 951 952 953 pr 952 953 954 pr 953 954 955 pr 954 955 956 pr 955 956 957 pr 956 957 958 pr 957 958 959 pr 958 959 960 pr 959 960 961 pr 960 961 962 pr 961 962 963 pr 962 963 964 pr 963 964 965 pr 964 965 966 pr 965 966 967 pr 966 967 968 pr 967 968 969 pr 968 969 970 pr 969 970 971 pr 970 971 972 pr 971 972 973 pr 972 973 974 pr 973 974 975 pr 974 975 976 pr 975 976 977 pr 976 977 978 pr 977 978 979 pr 978 979 980 pr 979 980 981 pr 980 981 982 pr 981 982 983 pr 982 983 984 pr 983 984 985 pr 984 985 986 pr 985 986 987 pr 986 987 988 pr 987 988 989 pr 988 989 990 pr 989 990 991 pr 990 991 992 pr 991 992 993 pr 992 993 994 pr 993 994 995 pr 994 995 996 pr 995 996 997 pr 996 997 998 pr 997 998 999 pr 998 999 1000 pr 999 1000 1001 pr 1000 1001 1002 pr 1001 1002 1003 pr 1002 1003 1004 pr 1003 1004 1005 pr 1004 1005 1006 pr 1005 1006 1007 pr 1006 1007 1008 pr 1007 1008 1009 pr 1008 1009 1010 pr 1009 1010 1011 pr 1010 1011 1012 pr 1011 1012 1013 pr 1012 1013 1014 pr 1013 1014 1015 pr 1014 1015 1016 pr 1015 1016 1017 pr 1016 1017 1018 pr 1017 1018 1019 pr 1018 1019 1020 pr 1019 1020 1021 pr 1020 1021 1022 pr 1021 1022 1023 pr 1022 1023 1024 pr 1023 1024 1025 pr 1024 1025 1026 pr 1025 1026 1027 pr 1026 1027 1028 pr 1027 1028 1029 pr 1028 1029 1030 pr 1029 1030 1031 pr 1030 1031 1032 pr 1031 1032 1033 pr 1032 1033 1034 pr 1033 1034 1035 pr 1034 1035 1036 pr 1035 1036 1037 pr 1036 1037 1038 pr 1037 1038 1039 pr 1038 1039 1040 pr 1039 1040 1041 pr 1040 1041 1042 pr 1041 1042 1043 pr 1042 1043 1044 pr 1043 1044 1045 pr 1044 1045 1046 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1101 1102 pr 1101 1102 1103 pr 1102 1103 1104 pr 1103 1104 1105 pr 1104 1105 1106 pr 1105 1106 1107 pr 1106 1107 1108 pr 1107 1108 1109 pr 1108 1109 1110 pr 1109 1110 1111 pr 1110 1111 1112 pr 1111 1112 1113 pr 1112 1113 1114 pr 1113 1114 1115 pr 1114 1115 1116 pr 1115 1116 1117 pr 1116 1117 1118 pr 1117 1118 1119 pr 1118 1119 1120 pr 1119 1120

- 1a) Train operators to recognize importance of maintaining subcooling
- 2) Train operators on proper response to small break loss
- 3) Improve operator response & handling of small break loss

2) In a small break continued operation of RCP saturation will cause an increase in the amount of water exiting the break since H₂O becomes a liquid and steam only will be exiting.

In addition Feedwater either normal or emergency is required during a small break to provide a heat sink in the generators for the RCS to insure subcooling is maintain and/or no condense steam is generated in the RCS.

ECCS can't handle cooling in small break - need OTSG heat removal

3) T_h versus RCS pressure

Req of 5 higher - means RCS pressure

Para Temp versus T_h

RCPump behavior - \downarrow in flow

increased vibration

increased temp

Increasing SR ops - due to voiding/steam formation in core

4) 20 to 40 ΔT ($T_h - T_c$)

T_h decreases

OTSG pressure & saturation for T_h and sloping

Incore thermocouple temperature accuracy

5) The para level increases since the top of the para was at less than RCS pressure so that water was forced from RCS to Pressurizer due to pressure increase

6) maintain clad temp $< 2200^\circ\text{F}$

prevent $> 1\%$ H_2 generation from Zircaloy clad oxide

Maintain core in a coolant regime

provide long term decay heat removal & remove H_2 s/c

prevent $> 1\%$ oxidation of cladding

ISOLATE & COOL RB TO CONTAIN ACTIVITY

7) FW flow rate - IF RCP T & P are

steam pressure - constant = LOCA

ΔT ($T_h - T_c$)

IF DECRATING, SUBCOOLING
likely

Subcooling margin

m T W T F S S

3

Nov

m	1	1	1	1	1	0	0
J	3	3	3	3	3	0	0

10

m	0	0	1	1	1	1	1
J	0	0	1	2	2	2	2

17

m	1	0	0	2	2	2	2
J	1	0	0	2	2	2	2

24

m	2	2	2	0	0	3	3
J	2	2	2	0	0	0	0

3

4

3

J

8) ITC flow indication (to be made on) ✓

OTSG level ✓ + pressure ✓

OTSG position ✓

OTSG level ✓ + pressure ✓

9) OTSG level open + operation not following tail pipe high
feeding ITC

OTSG level open + operation not following tail pipe high

over feeding of OTSG when empty in reactor

Leaving OTSG on high (> 2 minutes) & then turning
them after system was empty

Not recognizing system was @ low level

PB Sump to out building not isolated

1.2

SEPT

	m	T	W	T	F	S	S
1	1						
2	2	2	2	0	0	0	0
3	3	3	3	3	3	0	0
4	4	0	1	1	1	1	1
5	5	0	1	1	1	1	1
6	6	0	1	1	1	1	1
7	7	0	1	1	1	1	1
8	8	0	1	1	1	1	1
9	9	0	1	1	1	1	1
10	10	0	1	1	1	1	1
11	11	0	1	1	1	1	1
12	12	0	1	1	1	1	1
13	13	0	1	1	1	1	1
14	14	0	1	1	1	1	1
15	15	0	1	1	1	1	1
16	16	0	1	1	1	1	1
17	17	0	1	1	1	1	1
18	18	0	1	1	1	1	1
19	19	0	1	1	1	1	1
20	20	0	1	1	1	1	1
21	21	0	1	1	1	1	1
22	22	0	1	1	1	1	1
23	23	0	1	1	1	1	1
24	24	0	1	1	1	1	1
25	25	0	1	1	1	1	1
26	26	0	1	1	1	1	1
27	27	0	1	1	1	1	1
28	28	0	1	1	1	1	1
29	29	0	1	1	1	1	1
30	30	0	1	1	1	1	1
31	31	0	1	1	1	1	1

OCT

1	1	0	0	2	2	2	2
2	2	0	1	2	2	2	2
3	3	0	1	2	2	2	2
4	4	0	1	2	2	2	2
5	5	0	1	2	2	2	2
6	6	0	1	2	2	2	2
7	7	0	1	2	2	2	2
8	8	0	1	2	2	2	2
9	9	0	1	2	2	2	2
10	10	0	1	2	2	2	2
11	11	0	1	2	2	2	2
12	12	0	1	2	2	2	2
13	13	0	1	2	2	2	2
14	14	0	1	2	2	2	2
15	15	0	1	2	2	2	2
16	16	0	1	2	2	2	2
17	17	0	1	2	2	2	2
18	18	0	1	2	2	2	2
19	19	0	1	2	2	2	2
20	20	0	1	2	2	2	2
21	21	0	1	2	2	2	2
22	22	0	1	2	2	2	2
23	23	0	1	2	2	2	2
24	24	0	1	2	2	2	2
25	25	0	1	2	2	2	2
26	26	0	1	2	2	2	2
27	27	0	1	2	2	2	2
28	28	0	1	2	2	2	2
29	29	0	1	2	2	2	2
30	30	0	1	2	2	2	2
31	31	0	1	2	2	2	2