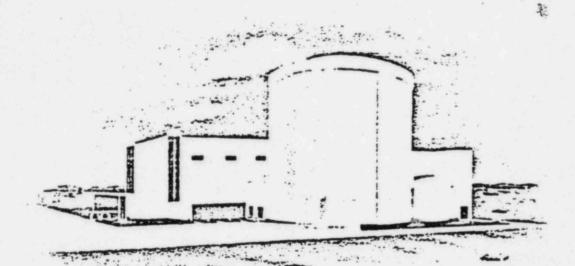
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Guide For Preparing
Nuclear Plant
Operating, Emergency,
And Maintenance Procedures

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GUIDE FOR PREPARING NUCLEAR PLANT OPERATING, EMERGENCY, AND MAINTENANCE PROCEDURES

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### 1. INTRODUCTION

Formal procedures have been used in nuclear power plants since their inception. The depth of such procedures increases rather than decreases with time as the nuclear plants become more sophisticated.

The formal requirement for operating procedures and administrative controls is contained in Section N. Appendix A. to 10 CFR 50, in which technical specifications have been required to describe the availability of detailed operating procedures and the manner whereby operating procedures are reviewed and approved for use. This subject is also covered in the proposed revision to 10 CFR 50, Section 50.36, dated August 17, 1966, and in recent AEC letters to plant owners who are converting a provisional facility operating license to a permanent license. The text of this letter, with emphasis added to portions concerning procedures is in Appendix C. This guide should be used in conjunction with B&W's guides<sup>1,2</sup> in order to integrate these three essentially concurrent and mutually dependent activities

One of the most significant nuclear plant documents will be the Technical Specifications, which are part of the operating license. Operation of the nuclear plant in a safe and efficient manner without exceeding plant limits, as defined in the Technical Specifications, is a key requirement of the operating procedures considered in this guide.

Guide for Planning and Executing the Nuclear Plant Field Testing and Startup Program.

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Guide for the Organization and Training of the Nuclear Plant Staff.

## 2. SCOPE OF PROCEDURES

### 2.1. General

This document presents a preliminary outline of the procedures to be provided by B&W for the nuclear plant. Changes will occur as designs are completed and specific components are selected which require procedural changes. Also included in the outline are some of the procedures required for the balance of plant, which the plant's owner will include as desired, or required by commitments to the regulatory agencies.

The outline is flexible enough to allow modification to fit the owner's normal practice. For instance, each major subdivision of the procedures outline may be a separate book or volume. The procedures numbering system is chosen to be compatible with a computer program used for administrative control of issue and review, and the system can easily be modified for the final plant procedures to conform with the owner's normal practice.

### 2.2. Definitions

Several terms are used herein which are defined below to avoid ambiguity later.

### 2.2.1. Draft Procedure

This procedure gives essential limits, precautions, major starting and securing sequences, and operating modes in order to remain within the design envelope. Valve-by-valve, switch-by-switch routines needed by an operator to execute the procedure are not included unless they are mandatory for clarity.

### 2.2.2. Operating Procedures

All normal operations expected in the plant are documented as operating procedures, which define the detailed steps, limits, and

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precautions to be followed by operators in operating their plants. Preparation of these procedures (including emergency and maintenance procedures) is the plant owner's responsibility. B&W provides drafts, as defined above, for the scope of supply.

### 2.2.3. Emergency Procedures

Potentially hazardous conditions that can occur, but are not part of the normal plant operating sequence, are covered by the emergency procedures which provide for recovery, safe shutdown, or minimization of the potential hazard.

### 2.2.4. Maintenance Procedures

As intended in this guide, the maintenance procedures place the plant or system, with appropriate overall limits on plant operation, in condition to execute the detailed component maintenance procedures found in the technical manuals.

### 2.2.5. Procedure Verification

A procedure is used during the field test and startup program to ensure its validity. Where necessary, such verification may be included in a field test.

# 3. DESCRIPTION OF PROCEDURES

In addition to the outline of nuclear plant procedures (Appendix B), examples of draft procedures are included which will be prepared or modified as necessary for a specific plant and application. For instance, under the operating procedures for the reactor coolant system, an example of the draft procedure 'Startup From Cold Conditions" is given (Appendix D). Appendix F is an example of an auxiliary system draft procedure for the Core Flooding System. A final specific example of a draft procedure is presented in Appendix E.

Administrative procedures, such as emergency plans involving off-site agencies, procedures for the control of plant maintenance, quality control, etc., may be included as chapters or sections of the manual as desired by the owner.

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#### 4. ADMINISTRATION

The sequence of preparation for these procedures is as follows:

1. Set scope of procedures.

- 2. Prepare procedures index.
- 3. Prepare schedule for issuing procedures.
- B&W prepares preliminary draft procedures for B&W scope of supply.
- The owner reviews and comments on B&W's draft.
- 6. B&W issues a final draft procedure.

Owner-originated procedures directly related to operation of the NSS will be reviewed by B&W in a similar manner.

Submission, review, and completion of the draft procedures will be handled in a manner similar to that used for field test specifications. As this work proceeds, the explicit listing of procedures for the plant will be included in a Test Spec/Procedures Index, which is a computer-printed listing devised to minimize administrative burdens. Unresolved questions concerning these draft procedures will be reviewed at meetings of the Test Working Group. In this connection, it should be noted that most operations during the test and startup program will, of necessity, use the plant operating procedures. The adequacy of procedures will also be verified during the plant field testing and startup program.

At a time consistent with the operator training program and the field test program, the prospective plant operators will prepare detailed step-by-step, valve-by-valve procedures for use in the plant. The draft procedures outlined herein will be used as the basis for these procedures. The latter phases of this activity should be executed at the plant site as a significant part of operator on-the-job training and plant familiarization.

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Of interest is the amount of time and effort required to prepare the plant procedures. No one specific statement is possible because of differences in the plant owner's practice, previous experience of personnel, and varying scopes of supply. As a minimum, it is estimated that 3 to 4 man-years of effort will be required to prepare the plant owner's scope of plant procedures.

Approval of procedures for use in the nuclear plant is covered in the Technical Specification submitted by the plant owner along with the operating license application. In general, this involves review by a Site Safety Committee and approval by the plant owner's Nuclear Safety Committee.

### 5. RESPONSIBILITY AND SCOPE OF SUPPLY

The procedures outline lists the parties responsible for preparing each procedure. If there is no ambiguity, responsibility is assigned to either B&W or the customer, or both. When variations are possible because of the scope of supply, responsibility is unassigned. The Test Working Group will make specific assignments consistent with the scope of supply.

The procedure outline given in Appendix B will be computer-printed as part of the plant Test Spec/Procedures Index when the scope of the contract is set.

### 6. RELATION OF PROCEDURES TO OTHER DOCUMENTS

The basic documentation for the nuclear plant includes SAR, drawings, design descriptions, field test specifications and procedures, operating procedures (including emergency and maintenance procedures), B&W and vendor instruction books and manuals, and plant technical specifications. These operating, emergency and maintenance procedures must be consistent with the design and licensing documents.

These procedures prepare the plant for component removal or replacement and for maintenance as specified in the technical manuals. In addition, the procedures account for the simultaneous application of various limits imposed by design documents and provide for the transitions from one state to another in plant operation.

### 7. SCHEDULE

Appendix A shows the relationship between key events in the plant schedule, training schedule, and these procedures. The preparation of these procedures depends on the development of basic engineering information for the various systems. The procedures must be completed in time for operator on-the-job training at the site and operator license examination. Completion is also required to permit performance of the test program and verification of the procedures during the field test and startup program.

As shown in Appendix A, B&W's draft procedure will be prepared over a period of approximately 18 months, in conjunction with the preparation of the field test program. The plant owner's scope of procedures should also be prepared during this period.

A computer-printed schedule for issue and review control during preparation of the test program and operating procedure is available. This may include procedures originated by the owner or B&W. The issue schedule must be based on the plant schedule and the engineering schedule. The Test Working Group will schedule this activity.

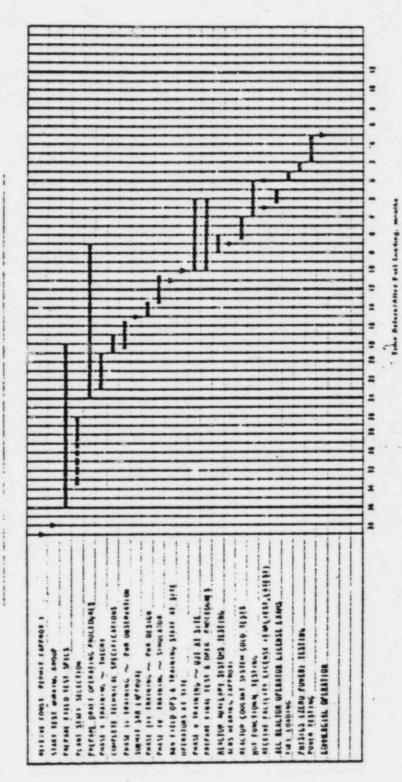
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APPENDIX A
Procedures Preparation Schedule

Schedule Illustrating Relation of Licensing, Teating & Training to Preparation of Field Test Specifications, Draft Operating Procedures, Test Procedures and Operating Procedures

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APPENDIX B
Nuclear Plant Procedures Outline

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1002. INTRODUCTION

1003. DEFINITIONS

1100. OPERATING PROCEDURES

1101. Limits and Precautions

02. Plant Operating Procedures

03. Reactor Coolant System Operating Procedures

04. Auxiliary System Operating Procedures

05. Instrumentation and Control System Operating Procedures

06. Steam System Operating Procedures

07. Electrical Systems Operating Procedures

1200. ABNORMAL AND EMERGENCY PROCEDURES

1201. Symptoms of Abnormal and Emergency Conditions

02. Plant Emergency Procedures 03. Abnormal Plant Procedures

1300. NUCLEAR PLANT TEST AND INSPECTION PROCEDURES

1301. Frequency of Tests and Inspections

02. Plant Calibration Procedures

03. Instrumentation Calibration Procedures

04. Periodic Test and Inspection Procedures

1400. MAINTENANCE PROCEDURES

1401. Reactor Coolant System Maintenance

02. Auxiliary System Maintenance

03. Instrumentation and Control System Maintenance

04. Steam System Maintenance 05. Electrical System Maintenance

1500. REFUELING PROCEDURES

1501. Limits and Precautions

02. Refueling Operation, Sequence of Events

03. Preparation for Refueling

04. Closure Head Removal and Replacement

05. Reactor Internals Removal and Replacement During Refueling

06. Fuel Handling

07. Incore Monitor Handling During Refueling

08. Failed Fuel Detection and Handling 09. Neutron Source Handling 10. Spent Fuel Shipment

1600. RADIOLOGICAL CONTROLS

1601. Limits and Precautions

02. Monitoring Procedures

03. Radiation Monitoring System

04. Decontamination

8000. FIGURES

9000. REFERENCES

#### 1002. INTRODUCTION

Procedures are included for the Nuclear Steam Supply System, its auxiliary systems, and associated instrumentation. The rest of the plant system procedures are indicated for inclusion by the customer. Procedures are written from the point of view of the console operator for overall plant procedures. Individual system procedures require on-scene local operation. Component operating procedures are found in component technical manuals and are included herein only to the extent necessary for clarity or when sequence may affect the safety of personnel or equipment.

Sections 1100 and 1500, operating procedures and refueling procedures, are arranged in order of normal use except for operations that can be performed independently of the main sequence.

Each procedure is based on initial conditions being met. The use of a procedure out of sequence or without verification of required initial conditions could inadvertently lead to abnormal or emergency situations. When situations arise that are not covered by these procedures, a procedure should be written based on plant limitations and precautions, technical specifications, and evaluation of the situation.

Immediate corrective action in the emergency procedures is based on the worst condition possible. Thus, a high-temperature alarm on a component assumes overheating rather than temperature detector malfunction. Action required by the condition should therefore be carried out unless immediate verification of instrument failure or other conditions is available.

#### 1003. DEFINITIONS

OPERABLE.

System or component is capable of performing all designed functions.

IN SERVICE

System is operable and in use.

SHUTDOWN

Term applies to reactor. All control rods are deenergized and fully inserted. Boron concentration is at or above that required for specified subcritical margin at the existing reactor coelant temperature and core lifetime.

In the event stuck (out) rods exist, boron concentration has been increased by an amount required to compensate for stuck rod(s).

STARTUP

Control rod drives are energized; hence, control rod motion is possible or in progress. Any intermediate condition between shutdown and critical, including testing of control rod drives with no intent of taking reactor critical.

Intent of definition is to require minimum safety system and safeguards readiness any time reactor could become critical because of being in a startup condition.

PRECRITICAL CHECK A comprehensive procedure involving functional tests, alignments (of instruments), system lineup checks, and administrative procedures to ensure safe startup of the reactor.

This forms part of the overall plant startup procedures. Extent of checks made for startup depends on length of shutdown, work performed, and reason for shutdown or trip.

CRITICAL Neutron level is steady or increasing (above shutdown level) with no rod motion or boron dilution in progress. UNCTIONAL Use of built-in test devices (instrumentation) or built-TEST in test capability (Decay Heat System recirculating line) to demonstrate operability, function, and for instrumentation alignment within specified operating tolerance of readout or control actions. ALIGNMENT Use of internal or external test signals to make adjustments to module, channel, or instrument string for readout, output, or action within specified tolerance. CALIBRATION Use of standards to align module, channel, or instrument system from sensor to readout, output, or required action within specified tolerance. Calibration of sensor may be independent of system alignment and provide data which are then used to complete system alignment. TEST A generic term which includes Functional Test, Alignment, Calibration, Periodic Tests, Physics Tests. and others.

# 1100. OPERATING PROCEDURES

# 1101. Limits and Precautions

Limits and precautions contained in this section are for overall plant control. Limits applicable to individual systems or components which are not observable or controllable by the reactor operator are included under system and component procedures or in component technical manuals.

1101 01.	Reactor coolant system pressure versus temperature limits, NDT, irradiation	BLW
1101 02.	Reactor coolant leakage limits	BLW
	Known paths Unknown (preaccident consideration)	
1101 03.	Heatup and cooldown pressure and rate limits	BŁW
1101 04.	OTSG shell-to-tube temperature limits (mass weighted temperature difference)	BLW
1101 05.	RCP operating limits (RCP motor limits by customer if not supplied by B&W)	BLW
	Pressure (NPSH) Temperature Seal water Cooling water Start, restart limits Number of pumps required or permitted	
1101_06.	CRD operating limits	B&W
	Min/max pressure & temperature	

With dropped CRD
With inoperative CRD
With misalignment within group

CRD position limits at function of lifetime, power, boron concentration

	1101 07.	CRD motion limits while shut down (nuclear safety)	BAW
Q	1101 06.	Reactor coolant boron concentration versus temperature for 1% shutdown versus rods inserted	B&W
Q	1101 09.	Minimum systems and components in service for operation or startup	BLW L Customer
Ų	1101 10.	Minimum systems and component in service while shut down	B&W & Customer
	1101 11.	Mimimum instrumentation for:	BAW &
T)		Operation Startup	
	1101 12.	Tank levels for operation and startup (including boron concentrations)	B&W &
$\cong$	1101 13.	Radiochemistry specifications and activity limits—from chemistry manual	B&W
		Gross activity Fission product activity (include preaccident limit)	
	1101 14.	Total gas & hydrogen limits in reactor coolant system-from chemistry manual	BEW
		During operation Before depressurization	
Ä	1101 15.	Reactor power, temperature, and pressure limits (DNB)	BAW
	1101 16.	Limits on reactor critical operation in subpower range	B&W
	1101 17.	Reactor vessel water level	Bi.W
	1101 18.	Syphoning precautions, reactor coolant system	B&W
	1101 19.	Containment integrity and access	Customer
		Operating . Hot standby Shut down & cooled down	
		RC system open to building atmosphere (refueling)	***
		B-7	Babcock & Wilcox

Internal pressure limits (positive or negative, affecting design values for containment under accident conditions)

1101 20. Limitations on use of decay heat removal system ...

BLW

Decay heat rate Decay heat system NPSH requirements

1101 21. Availability of electrical power

Customer

Operating : Hot standby Shut down and cooled down Reactor coolant system open to atmosphere:

1101 22. Core neutron flux monitoring during refueling 

BLW

1101 23. Turbine-generator limits

Customer

Vibration Speed Vacuum Lube oil temperature, pressure Bearing temperature H2 temperature Minimum steam flow (power) for turbine cooling, maximum TG loading rate Exhaust trunk temperature Thrust bearing failure (rotor position) Differential expansion Phase differential

1101 24. Feed system limits

B&W & Customer

Pressure Flow Minimum feed temperature Emergency feed system limitations Feedwater chemistry limits and specifications-from chemistry manual

BLW

1101 25. Steam generator limits

BLW

Water level Temperature Pressure (secondary to primary AP)

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### 1101 26. Reactor power limits

RCP trip or unavailability
Feedwater chemistry upset
Excess OTSG fouling
Control rod drop or misalignment
Turbine trip
Feed flow (loss or partial loss)
Loss of generator stator cooling
Xenon oscillation
Xenon override
Turbine stop valve testing
Loss of controlling NI channel
OTSG tube leak
Reactor chemistry upset
Minimum turbine/generator load
Bypass load limits

#### 1101 27. Power rate limits

Turbine loading limit
Turbine temperature limits
Reactor limits

### 1102. Plant Operating Procedures

Plant operating procedures are arranged in sequence for normal startup from cold refueling or maintenance conditions to power operation.

Each individual procedure assumes that required auxiliary systems and services are in normal line up or an service. When startup of an auxiliary system is required other than by actions at the reactor operators console, the needed procedures are found under system operating procedures.

Each operating procedure contains the following sections:

- 1. Purpose
- 2. Limits and precautions
- 3. Initial conditions
- 4. Operation (procedure)
- 5. Final conditions

1102 01. Plant precritical check

B&W & Customer

1102 02. Startup from cold conditions

B&W &

1102 03.	Startup from hot conditions	BLW L
		Customer
1102 04.	Low power operation	BEM. F
		Customer
1102 05.	High power operation	BLW &
		Customer
1102 06.	Steady state-power operation	BLW &
		Customer
1102 07.	Xenon transient override	BEM. F
		Customer
1102 08.	Increasing load	B&W &
		Customer
1102 09.	Decreasing load	BLW &
		Customer
1102 10.	Shutdown:	
	Turbine	Customer
	Reactor	Bf.M.
1102 11.	Cooldown	Brm
1107 17	Degasification	BLW
1102 13.	Decay heat removal	Brw
1102 14.	Reactor building purging and	
** / *	venting	Customer
1102 15.	Fill and drain fuel transfer canal	BLW

# 1103. Reactor Coolant System Operating Procedures

Reactor coolant system operating procedures include all normal evolutions needed to support overall plant operating procedures. Also included are procedures for water level, pressure, and temperature control which are required for refueling and maintenance.

1103 01.

1103 02. Filling and venting reactor coolant system
Filling and venting instrument lines

BLW

4	1103 03. 1	fydrostatic and leak tests	B&W
$\nabla$		CRD caps Head seals Reactor coolant system	
No.	1103 04. S	olible poison concentration control Refueling Maintenance Startup Power operation Shutdown	B&W
1	1103 05. P	ressurizer operation	BLW
		Forming bubble	24
	1103 06. R	eactor coolant pump operation	BLW
	1103 07. R	eactor coolant pump heatup	BLW
16.3	1103 08. A;	pproach to criticality	BAW
	1103 09. C	ritical heatup	BLW
Ď	1103 10. Su	arting and stopping reactor coolant pumps at power	B&W
	1103 11. Dr	raining and purging the reactor coolant system	B&W &
		For refueling For steam generator maintenance For RC pump maintenance For pressurizer heater replacement	
	1103 12. Ste	am generator chemistry control	B&W
FZ		actor coolant system volume and purification control	B&W
F	1104. Auxiliary Sys	tem Operating Procedures	
	These proced	ures each include the following sections:	
4	1	m lineup for normal reactor operating	
1/2	2. Prest	art checks	

- 3. Starting
- 4. Operating modes
- 5. Securing
- 6. Infrequent operations

Operating procedures include the auxiliary systems instrumentation operating procedures.

1104 01.	Core flooding	B&W.
1104 02.	Makeup and purification	BLW
1104 03.	Chemical addition and sampling	BŁW
1104 04.	Low pressure injection and decay heat removal (decay heat removal)	BLW
	Decay heat removal operation	
1104 05.	Reactor building spray	B&W
1104 06.	Spent fuel cooling	BLW
1104 07.	Waste disposal	BLW
	Resin sluicing Waste evaporator	
1104 08.	Component cooling (intermediate cooling)	BŁW
1104 09.	Recirculated cooling water*	Customer
1104 10.	Low pressure service water*	Customer
1104 11.	High pressure service water	Customer
1104 12.	Condenser circulating water	Customer
1104 13.	Demineralized water	Customer
1104 14.	Reactor building ventilation	Customer
1104 15.	Reactor building cooling system	Customer
1104 16.	Penetration room ventilation	Customer
1104 17.		Customer
	Reactor building purge	Customer

Procedure names should be selected to fit plant nomenclature.

# 1105. Instrumentation and Control System Operating Procedures

Instrumentation and control system operating procedures include those operations beyond the scope of the technical manuals for the system. These operations are those affecting overall plant control.

	1105 01.	Nuclear instrumentation	B&W
	1105 02.	Reactor protection system	B&W
	1105 03.	Safeguards actuation system	B&W
	1105 04.	Integrated control system	BLW
		Reactor control Steam generator control Turbine control	
	1105 05.	Incore monitoring system	B&W
	1105 06.	Reactor nonnuclear instrumentation	BLW
	1105 07.		
	1105 08.	Radiation monitoring system	Customer
	1105 09.	Control rod drive system	BLW
	1105 10.	Computer	. Customer
1106.	Steam Sy	stem Operating Procedures	
	1106 01.	Turbine generator	Customer
	1106 02.	Condensate system	Customer
	1106 03.	Feed system	B&W &
	1106 04.	Auxiliary boiler	Customer
	1106 05.	Turbine bypass	Customer
	1106 06.	Emergency feed	B&W & Customer
1107.		1 Systems Operating Procedures	
	1107 01.	Reactor coolant pump electrical	Customer

1107 02. Auxiliary system

1107 03. Emergency power

Customer

Customer

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### 1200. ABNORMAL AND EMERGENCY PROCEDURES

### 1201. Symptoms of Abnormal and Emergency Conditions

- 1. Abnormal or emergency conditions are disclosed by:
  - a. Departure of instrument readings from normal.
  - b. Lack of agreement between redundant instruments.
  - c. Calculations showing inconsistency, such as different results on reactor primary and secondary heat balance.
  - d. Alarms.

- e. Visible and audible indications, such as leaks and sound of machinery in distress.
- 2. Table 1200-1, which follows, lists symptoms of emergency conditions and alarms in approximate order of urgency. The symptom or alarm is followed by set point or normal value, immediate corrective action, and possible cause. When a specific procedure applies, it is referenced.

### Table 1200-1. Symptoms of Abnormalities and Emergencies

5. mptom 'alarm	Normal value!	Immediate corrective	Possible	Procedure
AC pressur.	2150	1. Check ML pressure	Aupture .	
_		2. Check PC .eve.	Leak	
		3. Check RC temp	Loss of M U	
		4. Tarn on HTRS	Excresive L/D	
		5. Stos = 3	Eucreeite etrem	
		6. S'op increasing	Roc crop	
		7. Increses MIC	Rod insertion (uncontrolled)	
Reactor trip	2053	1. Verily reactor	\	
		2. Verify urbine		
		BC level, temp		
		4 Tare or heaters		
		5. Stop L D		
		t. increase M'U		

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### 1202. Plant Emergency Procedures

Plant emergency procedures assume correct instrument indication and a worst case for immediate corrective action. Where an underlined symptom is known, immediate corrective action is mandatory to prevent further personnel or equipment hazards. In a case where an automatic action should have occurred, such as reactor trip, it is incumbent on the operator to manually initiate the action.

Each plant emergency procedure includes the following sections:

- 1. Symptoms
- 2. Discussion (possible causes)
- 3. Immediate action
- 4. Followup action

1202 01.	Load rejection (blackout)	Customer	
1202 02.	Turbine trip	Brw. r	
		Customer	
1202 03.	Turbine overspeed	Customer	
1202 04.	Reactor trip	BLW	
		BLW	
1202 05.	Reactor high startup rate	26#	
1202 06.	Unexplained loss of reactor coolant:	Bew	
	Leak		
	Relief valve lift OTSG tube leak		
	Rupture		
	High pressure in letdown piping.		
	LD storage tank, demineralizers		
1202 07.	Loss of boron (moderator dilution)	BLW	
1202 08.	CRD's fail to respond	B&W.	
1202 09	CRD movement improper	BLW	
1202 10.	Dropped control rod	B&W.	
1202 11.	High activity in reactor coolant	B&W.	
	Gross activity		

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Fission product activity

1202 12.		Customer
	Reactor building Auxiliary building	
1202 13.	High station vent activity	Customer
1202 14.	Loss of reactor coolant flow	B&W
	RCP trip	
1202 15.	Loss of reactor coolant makeup	BEW
1202 16.	Loss of seal water	BLW
	RCP	
1202 17.	Component (intermediate) cooling	
	system failure	Bew
1202 18.	Recirculated cooling system failure*	Customer
1202 19.	Low pressure service water system	Customer
1202 20.	High pressure service water system failure*	Customer
1202 21.	Condenser circulating water system	Customer
1202 22.	Loss of condenser vacuum	Customer
1202 23.	Steam generator/feed/condensate	Customer
	High salinity or conductivity	
1202 24.	Steam system leak/rupture	.B&W
1202 25.	Feed system leak/rupture	Customer
1202 26.	Loss of SG feed	Bew
1202 27.	Dry steam generator	B&W
1202 28.	Reactor component high temperature	BAW
	RC pump and motor CRD Letdown	

Cooling water systems should be named based on individual plant design.

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W L

ner 3&W

1&W

1&W

ILW.

14W

15W.

1202 29. Pressurizer spray valve failure (open, closed)

BLW

1202 30. Earthquake

Customer

1202 31. Fire

Customer

### 1203. Abnormal Plant Procedures

Abnormal plant procedures may be used during equipment malfunction with otherwise normal plant operation continuing. The plant may be started up intending to use these procedures, or the equipment malfunction or outage may occur during operation. Each procedure assumes the latter, which is generally the more demanding condition. The procedures contain the following sections:

- 1. Symptoms
- 2. Discussion (of causes)
- 3. Procedure (action to be taken)
- 4. Operation (in abnormal mode)
- 5. Restoring normal operation

1203 01. ICS abnormal operations

BLW

Manual reactor control
Manual feed control
Manual turbine generator control

1203 02. Reactor coolant system abnormal operation

BLW

Manual pressurizer level and makeup control Manual pressure control Idling a steam generator Returning idle steam generator to service

1203 03. Auxiliary systems abnormal operation

BLW

1203 04. Turbine generator abnormal operation

Customer

1203 05. Feed system abnormal operation

Customer

# 1300. NUCLEAR PLANT TEST AND INSPECTION PROCEDURES

Nuclear plant test and inspection procedures include inspections and tests carried out while operating, shutdown, after repairs or refueling, and as part of planned preventive maintenance. Tests (which include alignments, calibrations, functional tests, periodic tests, physics tests, etc.) are those necessary to ensure plant integrity, operability of systems and safety devices, and those required by facility license and good engineering practice.

### 1301. Frequency of Tests and Inspections

Requirements for tests are shown in Table 1300-1 and for inspections in Table 1300-2. This section covers test and inspection procedures which are not included in component or system technical manuals.

Table 1300-1. Required Tests

System 'component	Test	Procedure reference	Frequency
Nuclear instrumentation			
1. Power range	Calibration - by heat belance	1102 01	Every full
			At first power operation fol- lowing refuel-
	Alignment	Nuclear instrument technical manual	1
	Ground & resistance test of detectors and cables	NI technical manual	
2. Intermediate range	Alignment Compression test	NI rechnical manual	
	General & resistance test of detectors and cables	Ni technical	

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# Table 1300-2. Required Inspections

Svet	em/componer	11	Inspection	Procedure	Frequency
	ctor vessel	pump	In-service inspection Seal inspection	1304 01	Annually or as indicated by ex- perience
1302.	Plant Cal	ibrati	on Procedures		
	1302 01.		tor coolant system h	eat	B&W
	1302 02.		ear steam supply sys	tem heat	Baw & Customer
	1302 03.	in	eration of source ran strument by neutron ource		BLW
1303.	Instrumer	ntation	Calibration Procedu	ures	
	1303 01.		ear instrumentation a	and safety	B&W
	1303 02.	Integ	rated control system		BLW
	1303 03.	Read	tor nonnuclear instru	umentation	B&W
	1303 04.	Rod	control system		B&W
	1303 05.	Radi	ation monitoring syst	tem	Customer
	1303 06.	Auxi	liary system instrum	entation	Customer
1304.	Periodic	Test :	and Inspection Proces	dures	
	1304 01.		tor coolant system in spection	n-service	
	1304 02.	Post	refueling physics ter	sts	Bew
	1304 03.	Read	tivity depletion vers	us burnup	BLW
	1304 04.	CRD	trip response		B&W
	1304 05.	Pres	surizer relief valve	(shop test)	B&W

1304 06. Reactor protection system trip response time

BAW

1304 07. Reactor protection system trip logic response

Baw

1304 08. Reactor building leak rate test

Customer

### 1400. MAINTENANCE PROCEDURES

Maintenance procedures include instructions for clean areas, layup of affected systems and components, and sequence of operations. Detailed removal, replacement, and disassembly instructions are found in the referenced vendor and component technical manuals.

Each maintenance procedure contains the following sections:

- 1. Purpose
- 2. Limits and precautions
- 3. Initial conditions
- 4. Services and equipment required
- 5. Quality control required
- 6. Radiological controls required
- 7. Procedure (sequential steps)
- 8. Final conditions

1401.	Reactor Coolant System Maintenance			
	1401 01.	Reactor coolant pumps		BEW
	1401 02.	Pressurizer relief valves		BLW
	1401 03.	Steam generator	* ***	Bew
		Tube plugging Cleaning		
	1401 04.			
	1401 05.	NDT sample removal		Bew
	1401 06.	Incore monitor removal and replacement		BLW
	1401 07.	Pressurizer heater removal and replacement		Baw
	1401 08.	CRD removal and replacement		BLW

	1401 09.	SG relief valve removal and replacement	Customer
	1401 10.		Customer
	1401 11.	Reactor internals removal and replacement	B&W
	1401 12.	Reactor internals vent valve removal and replacement	BLW
	1401 13.	Reactor coolant temperature detector removal and replacement	BLW
	1401 14.	Pressure and differential pressure detector removal and replacement	BLW
	1401 15.	Use of freeze seals	Customer
1402	. Auxiliary	System Maintenance	
	1402 01.	HP injection ad purification filter replacement	B&W
1403		ntation and Control System Maintenance	
	1403 01.	Nuclear detector removal and replacement (includes electrical checkout)	B&W
1404	. Steam Sys	tem Maintenance	Customer
1405	Electrical	System Maintenance	Customer
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#### 1500. REFUELING PROCEDURES

The reactor is refueled approximately once each year. At that time, as dictated by the fuel management schedule, about one-third of the core fuel elements are removed, the remainder are rearranged, and new elements are inserted. The refueling procedure includes those operations unique to refueling. They do not duplicate such operations as cooldown and reactor building purging, which are found in the plant operating procedures. These procedures are arranged in normal sequence except for those that can be performed independently of the main refueling sequence.

Operating procedures for fuel handling equipment are found in the technical manuals for fuel handling equipment. Equipment operations beyond the scope of the technical manuals are included herein.

1501.	Limits and Precautions	BLW
1502.	Refueling Operation, Sequence of Events	Bew
1503.	Preparation for Refueling	B&W
	Equipment Building and services New fuel transfer and inspection Seal plate installation Instrumentation	
1504.	Closure Head Removal and Replacement	B&W

Electrical & fluid system
connection & disconnection
Control rod latching & unlatching
Stud removal and replacement
Head removal and replacement
Head seal leak test

1505.	Reactor Internals Removal and Replacement	B&W
1506.	Fuel Handling	B&W

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1507.	Incore Monitor Handling During Refueling	BLW
1508.	Failed Fuel Detection and Handling	B∻W
1509.	Neutron Source Handling	BLW
1510.	Spent Fuel Shipment	BLW

1600. RADIOLOGICAL CONTROLS

Customer

1601. Limits and Precautions

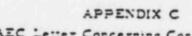
1602. Monitoring Procedures

1603. Radiation Monitoring System

Set points
System operating procedures
System calibration procedures

1604. Decontamination

Personnel decontamination Equipment decontamination Area decontamination



AEC Letter Concerning Conversion of Provisional to Permanent License

C-1

# FACILITY LICENSING ACTIONS (From AEC Public Document Room)

Letters similar to that below are being sent out by the Division of Reactor Licensing in connection with conversion of provisional operating licenses to a full-term license:

"In anticipation of the time when you will be ready to convert your provisional license to a full-term license, we offer the following guidance and comments for your consideration in preparing an application for such a license:

- "I. The application should provide detailed consideration of the facility operating history, including confirmation of design bases and objectives, the significance of any plant problems that may have occurred and the remedial actions taken. In addition, it should support the adequacy of the performance and competence of the licensee's organization during the Provisional Operating License period, including onsite staff, technical support groups and advisory committees. Further, it should discuss significant changes that have been made to the facility since the Final Safety Analysis Report was prepared; however, extensive detail is generally not required regarding design and analysis of changes that already have been submitted to the Commission for approval. Comments and recommendations contained in past letters of the Advisory Committee on Reactor Safeguards concerning Unit No. I should be considered in your application.
- in consideration of the criteria now being used by the Commission in evaluating new applications for nuclear power plants. Specifically, your analysis should compare Unit No. 1 with the General Design Criteria for Nuclear Power Plant Construction Permits published as a proposed amendment to 10 CFR Part 50 in the Federal Register on July 11.

1967, and with the Proposed IEEE Standard for Nuclear Power Plant Protection Systems.

- "3. We have specific interest in the topics listed on the enclosure. Accordingly, your analysis should consider each of these topics to the extent applicable to your facility. For those topics not adequately considered under items 1 and 2 above, your analysis should discuss the adequacy of the facility with respect to each topic and indicate what reasonably could be done to approach more nearly current design criteria and to improve overall operational safety.
- "4. It is also requested that you include with your application proposed technical specifications, including bases, in the new form as set forth in the proposed amendment to 10 CFR Part 50 published in the Federal Register on August 16, 1966\* \*\*

'In order for the staff to complete its evaluation of your application, information is required on the following specific subjects:

- "1. Your plans and schedules for periodic inspections of the primary system and of containment;
- '2. The methods by which you detect and cope with reactivity and power distribution anomalies:
- "3. Your methods and criteria for determining excessive primary system leakage and procedures regarding response to detected and suspected leakage;

Y [ Y [ Y [ Y ] Y ] Y [ Y [ X ] X ] X [ X ] X

- "4. Your program for insuring the adequacy of the safety system with regard to current design and performance criteria, and the justification for any deviations therefrom;
- "5. If your control and safety systems share components or subsystems, a detailed review of functional, preoperational and inservice tests performed to provide assurance that this situation is acceptable, including the bases for selection of the faults assumed for purposes of analysis:
- "6. Your program for materials surveillance for the pressure vessel:

- "7. A description of on-site and off-site emergency radiation instrumentation and of proposed emergency procedures for implementation during and following an accident:
- "8. Methods for providing independent review of proposed changes to procedures, plant modifications, and audit of plant operations;
- . "10. Provisions for monitoring discharge of radioactivity to the environment and for limiting such discharges to acceptable levels;
- "11. An analysis of the effects of the loss of off-site power and a description of provisions for emergency power;
- ence to detailed written procedures including, as a minimum, startup, normal and abnormal operation, and shutdown of the plant and major systems, abnormal and emergency conditions, refueling, and maintenance operations which could affect the safety of the plant:
- "13. A description of the minimum acceptable functional operating organization and provisions for prevention of degradation of staff competence over the service life of the facility; and
- "14. Identification of items that require further analysis, testing and/or review subsequent to the licensing action."

APPENDIX D
Startup From Cold Conditions

D-1

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#### 1102-02. STARTUP FROM COLD CONDITIONS

#### 02.1. Purpose

The procedure defines the major steps involved in taking the reactor plant from a cold condition to a hot critical condition at 15% power. The procedure assumes a startup following refueling.

Reactor coolant pumps are the source of heat for the heatup. An auxiliary source of steam is required.

#### 02.2. Limitations

- 02.2.1. The maximum heating and cooling rate of the reactor coolant system, including the steam generators, is 100 F/hr. The operator will observe reactor coolant system average temperature readings for loops A and B on the console and carry out necessary actions to prevent excessive heating or cooling rates.
- 02.2.2. At reactor inlet loop A and B temperatures less than 450 F, no more than three primary pumps may be operated. This is to prevent core lifting due to pressure difference across the core.
- 02.2.3. During heatup the temperature differential based on average tube temperature and average shell temperature shall not exceed 40 F. This is determined from primary system temperature loops. A and B indication on the consoler and computer and from readout of thermocouples (SS2-TE-1 through 5) located on the shell of each steam generator. Shell temperature data are inputs to the plant computer.
- 02.2.4. When the reactor is operating in the range between 0 to 15% power, reactor produced steam may be used for turbine warming, rolling, and synchronization. Any steam used for auxiliary functions below the no load temperature will reduce the heating rate.
- 02.2.5. Reactor system pressure shall not exceed 500 psig until the reactor system temperature is equal to the nil-ductility

temperature plus 60 F. Charts are to be provided to the operator which show updated pressure temperature limitations.

## 02.3. Plant Heatup Procedures

- 02.3.1. Initial conditions are assumed to be as follows:
  - 1. Head installed and gaskets leak-tested.
  - 2. Reactor coolant water level 6 inches below flange.
  - 3. Reactor temperature =100 F.
  - 4. Na blanket in loop high points.
  - 5. Incore instrumentation installed.
  - Steam generator secondary side water level .
     =30 feet with N<sub>2</sub> blanket.
  - 7. Decay heat system in operation.
- 02.3.2. Open vent lines as follows:
  - 1. At top of inlet piping bend to steam generators (two vents on 36 inch pipe).
  - 2. Center control rod drive housing.
  - 3. Incore monitor tubes at pressure flange.
  - 4. RC pump vents.
- 02.3.3. Check out all instrumentation; fill vent or drain lines and elements as required. Conduct precritical check of safeguards instrumentation. Actuate ECCS bypasses as necessary. Conduct N1 source check.
- 02.3.4. Establish that there are \_\_\_\_ppm H,BO, in borate storage tank for initial filling. On subsequent fill, establish that concentration in bleed holdup tank is \_\_\_\_ ppm. This verification is obtained from a sample analysis.
- 02.3.5. Line up high pressure injection system from letdown storage tank to injection lines on CRD seals and pump seals. Line up reactor coolant system bleed transfer pump to letdown storage tank.

  Line up suction of RC bleed transfer pump to appropriate bleed holdup tank.
  - 02.3.6. Line up feedwater cleanup system.

- 02.3.7. Start RC bleed transfer pump and establish maximum level in letdown storage tank. Line up bleed transfer pump via bypass around makeup pumps.
- 02.3.8. Start bleed transfer pump\* to start filling reactor coolant system and to apply seal water to CRD seals and pump seals. Close RC pump vents when water runs out.
- 02.3.9. Start auxiliary boiler or line up auxiliary steam supply and line up to startup steam header.
  - 02.3.10. Start condenser cooling water flow.
- 02.3.11. Line up steam supply to steam seal regulator and establish turbine seals with turbine on turning gear.
- 02.3.12. Start hot well or booster feed pump(s) and establish 25%. " flow through the feedwater cleanup circuit. During cleanup of feed train, establish startup steam at about \_\_\_\_ psig to shell of feed heaters \_\_\_ and/or \_\_\_ to maintain feedwater outlet temperature at about 200 F.
- 02.3.13. Start condenser air ejectors and/or vacuum pump. Establish approximately 26 inches Hg vacuum in condenser.
- ondary vent lines on each steam generator, and fill steam generators to 30-foot level indication by opening startup valve to each steam generator. (Condensate booster and/or hot well pump(s) running.) Close vent when startup level is obtained. (This step will not be required if initial condition 6 is met; if required, observe OTSG temperature limits.)
- 02.3.15. Open turbine bypass valves to obtain condenser vacuum above water level in steam generators. (This step is not required if reactor average system inlet loops temperatures as read on RC5-TR on

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Do not use makeup pump to fill reactor coolant system since its shutoff head is above nil-ductility limits on reactor coolant system pressure.

<sup>25%</sup> flow is based on a minimum of 2 fps flow in the feed train. 200 F is based on converting hydrated oxides of iron to magnetite and deaeration of feedwater.

all four 25 inch loops is above 220 F with decay heat system flow, if steam generator downcomer temperature is above 220 F, and if the mass weighted average OTSG shell temperature is not more than 40 F less than reactor coolant temperature.)

- 02.3.16. Close reactor coolant system vents that were opened in step 3.2 when system fills and water issues from vents on 36 inch pipe. Fill until pressurizer level is \_\_\_\_\_ feet or pressure is 50 psi. Vent each CRD housing and instrument connections.
- 02.3.17. Energize all pressurizer heaters (manual) and establish 135 psig pressure (RC3-PR2) for NPSH on RC pumps. (This requires about 2-1/2 hours from 70 F.) Periodically vent pressurizer at 15 minute intervals to purge nitrogen and other noncondensibles.
- 02.3.18. Start cooling water systems required for reactor coolant pump operation. Conduct cold preoperational physics tests and CRD line tests. Bump RC pumps and vent lines at top of 36 inch pipe. (Observe-RCP start-restart limits.)
- 02.3.19. Start. in sequence, three reactor coolant pumps when property psig pressure (RC3-PR2) is obtained and required services (cooling water, etc.) are in operation.
  - 02.3.20. Stop and isolate the decay heat removal system.
- 02.3.21. Sample and establish RC system chemistry, including H2 addition to letdown storage tank.
- 02.3.22. Check RC system temperature-pressure NDTT chart to establish maximum pressure, and hold pressure above minimum NPSH and below NDT limit until RC system temperature is above NDTT + 60 F. Start raising pressure to normal operating pressure (2200 psig) by placing heaters in automatic control (to insure cutoff at 2200 psig).

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Visible water flow out atmospheric vents or visible through sight ports of vent lines.

Minimum NPSH for RCP's.

- 02.3.23. When reactor coolant system pressure reaches 800 psig or 350 F (RC3-PR2) start seal water flow and cooling water flow to reactor coolant pumps. Line up core flooding tanks.
- 02.3.24. When steam generator temperature reaches 220 F. close all turbine bypass valves. Set bypass valves to open at 900 psig and transfer bypass valves to automatic.
- . 02.3.25. When pressurizer pressure reaches 2200 psig. place pressurizer spray valve on automatic pressure control. Maintain pressurizer level at minimum by adjusting letdown flow (manually by HP3-MIC) and the makeup flow by placing pressurizer level controller (RC1-LIC) setpoint at least 1 foot above pressurizer heaters.
- 02.3.26. When steam generator pressure (SS6-P1) reaches 400 psig. line up and start one boiler feed pump, set to minimum speed and place startup feedwater valves on automatic in the ICS system.
- 02.3.27. Open turbine warming valves and drains. Pressurize turbine with auxiliary steam for warming.
- 02.3.28. When reactor coolant system reaches 450 F start fourth reactor coolant pump.
- 02.3.29. When reactor coolant system reaches temperature above 532 F, turbine bypass system will pass steam to condenser to maintain reactor coolant temperature. Steam produced may also be used for feed train heating and turbine warming. Establish normal pressurizer H.O level and set letdown flow at > \_\_\_\_ gpm.
  - 02.3.30. Conduct hot precritical testing including CRD testing.
  - 02.3.31. Check nuclear instrumentation for proper functioning.
  - 02. 3. 32. Take reactor critical as follows:
    - 1. Using known values of core lifetime, fuel loading, time, shutdown, and temperature; predict critical rod position and required boron
      concentration.

Select letdown flow to permit heatup from 532 F to 579 F at 0.57/minute without further adjustment of LD flow.

- 2. Withdraw rod groups 1 4.
- 3. Deborate to precalculated concentration.
- Withdraw rod group 5 until criticality is achieved.
- 5. If not critical on group 5, insert this group and deborate an additional \_\_\_\_ ppm.

Caution: Make certain that all rods of groups
1-5 are operable.

6. Withdraw rod group 5 for criticality.

Caution: If reactor is not critical, return all rods to bottom and determine why predicted values fail to cause criticality.

- 02.3.33. At this point, reactor control is on hand at rod drive part of console. All selector stations in integrated control system should be on hand except for startup valves in feed train, and turbine bypass valves. Check and/or set all limits in ICS.
- 02.3.34. 1. Near end of turbine warming period, bring reactor to 10% and about 565 F. Transfer the reactor control to ICS by placing CRD system on auto.
  - 2. Bring turbine to speed.
- Synchronize and initial-load the turbine to minimum block load established by turbine manufacture normally between 5-8% load.
- 4. Hold initial turbine load for 30 minutes (turbine minimum warmup period).
- 5. Raise turbine generator power to 10% in hand, at a maximum rate not to exceed the temperature limits established by turbine manufacturer.
- o2.3.35. Raise reactor and steam generator load to 15%. Line up and load second feed pump, place both main feed pumps on automatic control at ICS to hold at minimum speed. Line up emergency feed pump, place on auto starting. (Second feed pump may be delayed if not required for load capability.)
  - 02. 3. 36. Place main feedwater valves on automatic control.

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- 02.3.37. 1. Balance steam generator load ratio in feedwater controls and place steam generator control station on auto.
- 2. Balance reactor coolant temperature set point at 579 F, line up steam generator-reactor control station and transfer reactor controls in ICS to auto.
- 3. Balance feedwater controls to reactor and transfer feedwater demand control station to automatic. All stations in nuclear steam supply system are on auto and load is established by steam generator-reactor control station.
- 4. Transfer steam generator-reactor control station to auto. The NSS will hold a minimum 15% load which is a preset minimum level in the ICS.
- 02.3.38. Check dispatch system (Dispatch Frequency Control) for operability. Check that all track/runbacks are clear.
- 02.3.39. Set load demand to 10% at unit load control station and place turbine control on auto. (This transfers turbine from Electro-Hydraulic control to ICS.) Plant control is now on hand from unit load control station.
- oz. 3.40. Increase load demand from 10 to 15%, bring the turbine up to NSS load. As turbine consumes steam the bypass system will close to control the turbine header pressure at 900 psia.
- 02.3.41. At 15% load, the plant is ready for power operation, either manual by the operator or auto from the Dispatch Frequency Control.
- 02.3.42. Set load and rate limits for plant in ICS for specified power range response.
- 02.3.43. Concurrent with power operation at least one day prior to scheduled shutdown, degas reactor coolant system by stopping addition of H<sub>2</sub> at LD tank, and periodically venting accumulated H<sub>2</sub> and other gases to WD system.

APPENDIX E
Filling and Draining Fuel Transfer Canal

E-1

## 1102-15. FILLING AND DRAINING THE FUEL TRANSFER CANAL

## 15.1. Filling

#### 15.1.1. Initial Conditions

- RC system ready for fill to refueling level, reactor vessel head removed, RV water level below flange.
- 2. Seal plates installed between RV flange and fuel transfer canal floor.
- 3. Borated water storage tank filled with reactor-grade water.
- 4. Flanges removed from canal end of fuel transfer tubes.
  - 5. Refueling canal cleaned and ready for fill.

## 15.1.2. Pre-Start Checks

- 1. Decay heat removal system operational.
- 2. Core flooding system 14 inch isolation valves shut.
- 3. Spent fuel cooling system operational.
- 4. Boric acid concentration in BWST > \_\_\_ ppm.
- 5. High pressure injection system operational.
- 6. Bleed holdup tank full of reactor grade water, borated to boric acid, and bleed transfer pump(s) operational.
  - 7. Waste disposal system vents and drains operational.
- CRD seal water injection lines in RV head area blanked, or associated valves shut.
  - 9. Fuel transfer canal drain to RV cavity blanked.

## 15.1.3. Operation

 Line up from bleed holdun tank and bleed transfer pump, through the letdown filters, to the HP injection piping and reactor coolant pump seal injection piping.

Note: Scal water must be injected to reactor coolant pump seals during canal fill to prevent particulates in reactor coolant system from entering pump seals. Seal water injection must continue until the 'fuel transfer canal is filled.

- Open high point vents in pressurizer and steam generators (primary side) to provide a leak-off path for the purge gas in these components.
- Start the bleed transfer pump(s) to fill the reactor vessel through normal makeup injection and reactor coolant pump seal injection lines.
- 4. Line up the spent fuel cooling pump(s) from the borated water storage tank to the fuel transfer canal via valves ISF-V9 and ISF-V10.
- 5. When the water level in the reactor vessel reaches the reactor vessel flange, start the spent fuel cooling pump(s) to fill the fuel transfer canal.
- 6. When the canal is filled to the desired level, stop the spent fuel cooling and bleed transfer pumps.
  - 7. Restore refueling valve lineup.

#### 15.1.4. Final Conditions

- Reactor coolant system filled to refueling level with water of proper purity and boric acid concentration.
- 2. Fuel transfer canal filled with water containing refueling concentration of boric acid.
  - 3. Decay heat removal system in operation as required.
  - 4. Spent fuel cooling system in operation as required.

#### 15.2. Draining

## 15.2.1. Initial Conditions

- 1. Fuel handling operations complete.
- 2. Reactor coolant system and fuel transfer canal filled to refueling level with water of \_\_\_\_ppm concentration boric acid.
- 3. Borated water storage tank ready to receive \_\_\_\_\_
- 4. Refueling equipment and instrumentation removed from canal and bagged, or suspended around canal for spray decontamination during draining operation.

## 15.2.2. Pre-Start Checks

- 1. Decay heat removal system operational.
- 2. Spent fuel cooling system operational.
- 3. Component drain system operational.
- 4. Regulated nitrogen supply available to pressurizer and steam generator primary-side vents.
- 5. Demineralized water available in canal area (for washing down canal and equipment during draining operation).
  - . 6. Constant air monitoring equipment operational.

## 15.2.3. Operation

- 1. Close the stop valves in the fuel transfer tubes.
- 2. Line up the spent fuel cooling pump(s) to take suction on the fuel transfer canal, through valves ISF-V9, ISF-V10, and ISF-V11, and deliver to the borated water storage tank.
- 3. Start nitrogen purge of pressurizer and steam generator primary side.

Caution: During the canal draining operation, it is important that the pressurizer and steam generators be maintained at or near RB pressure. A very small positive pressure in these components at

the end of the draining cycle could result in loss of decay heat removal capability upon equalization of pressure with RB atmosphere.

- 4. Start the spent fuel cooling pump(s) and drain the refueling canal. Interrupt draining at approximately 10-foot intervals and determine true water level by venting pressurizer and steam generators.
- 5. When the borated water storage tank is filled, or before the deep end of the canal is completely drained, stop the spent fuel cooling pumps. Drain the remainder of the water to the reactor building normal sump through valves ISF-V2 and ISF-V3. Commence recirculation of BWST through SF system purification loop.
- 6. During the draining operation, wash down the canal walls, refueling equipment, and canal floor using demineralized water and working toward the deep end of the canal. Drain this water to the RB normal sump.

Note: Continuous washdown of the canal and equipment during draining operation is not required, however, washing intervals must be timed so that the canal and equipment are not allowed to dry before they are washed the first time.

7. When the canal water level is reduced to RV flange level, lower the reactor vessel water level to 6 inches below the flange by opening a primary coolant loop drain and pumping to waste disposal through the component drain pump. Accurate determination of water level before and after this operation is particularly important.

- Secure the spent fuel cooling, component drain waste disposal, and nitrogen purge systems and the RB normal sump.
  - 9. Install blank flanges on fuel transfer tubes.
- 10. Complete cleanup and decontamination of fuel transfer canal, refueling equipment and RV flange area. Remove seal plates from RV annulus.

#### 15.2.4. Final Conditions

- 1. Fuel transfer canal drained, clean.
- 2. RV water level 6 inches below flange.
- 3. Decay heat system in operation as required.
- 4. Spent fuel cooling system in operation as required.
- 5. Borated water storage tank full.
- 6. Recirculation of BWST water through spent fuel cooling system purification loop in progress as required.
- 7. Void space in pressurizer and steam generators blanketed with nitrogen.
- 8. Decontamination and storage of refueling equipment in progress.

## 15.3. Infrequent Operations

## 15.3.1. Adjusting Water Level

 Water level is adjusted using the instructions of paragraphs 15.1 and 15.2 as applicable.

## 15.3.2. Cleanup/Purification of Canal and SF Pool Water

1. Instructions are included in Spent Fuel Cooling System Operating Procedure.

APPENDIX F Core Flooding System Operating Procedure

#### 1104-01. CORE FLOODING SYSTEM OPERATING PROCEDURE

## 01.1. Core Flooding (CF) System Description

This engineered safeguard system provides a volume of borated water, under nitrogen pressure, for injection into the reactor coolant system in the event that reactor coolant pressure is inadvertently reduced to less than 600 psig during operation. It is a passive system because no operator action is required to effect this injection. The CF system may be isolated from the reactor coolant system during reactor shutdown, and must be isolated from the reactor coolant system any time the reactor coolant pressure is intentionally reduced below 650 psig. CF system pressure is maintained at \_\_\_\_\_ psig, maximum, when reactor coolant temperature is below (NDTT +60) F.

System parameters are:

		Operational		
	Design	Maximum	Nominal	Minimum
Pressure, psig	700	615	600	585
Temperature, F°	300	120	104	75
Level, ft**	14	12	11.5	11
H <sub>1</sub> BO <sub>1</sub> concen- tration, pom	13.000	20,000	13,000	13,000

No temperature-sensing instrumentation is installed on CF tanks. Use reactor building ambient temperature.

Level instrumentation is of the dry-reference-leg type. Any time that the level reading is suspect, the reference-leg trap should be drained to assure that water in the reference leg is not causing a false level indication.

## 01.2. Normal Operation

#### 01.2.1. Initial Conditions

- 1. CF tanks filled to 11.5 = 0.5 ft with reactor grade water, borated to 13,000 ppm boric acid.
  - 2. CF tanks pressurized to 600 : 15 psig with nitrogen.
- 3. CF tank level indicators on each tank agree within 3 inches.
  - 4. CF valves CF-VIA and CF-VIB shut.
  - 5. CF tank vent, drain, fill, and sample valves shut.
  - 6. Reactor coolant pressure 650 : 10 psig, increasing.

## 01.2.2. Starting

- With reactor coolant pressure at 650 = 10 psig. increasing, open valves CF-VIA and CF-VIB.
- 2. Monitor CF tank level and pressure. An abrupt increase when the tank valves are opened is an indication that the CF 14 inch check valves are leaking, and shall be cause for shutting valves CF-V1A and CF-V1B for corrective action.
- 3. The SF system has no active function during reactor plant operation. Therefore, the following evolutions involving the CF system are performed only to maintain required CF system status.

#### 01.2.3. Securing

1. Shut valves CF-VIA and CF-VIB when reactor coolant pressure is 650 : 10 psig. decreasing, during plant cooldown and depressurization.

> Note: Isolation of a CF tank during plant operation may be required due to a malfunction in the CF system. "Reactor Plant Operating Procedures" contains instructions for plant operation with reduced CF system protection.

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Open quench tank vent valve and reduce CF tank
pressure to \_\_\_\_\_ psig by alternately opening valves CF-V3A and CF-V3B.
venting to the quench tank. Close quench tank vent and valves CF-V3A
and CF-V3B.

## 01.3. Initial Fill

#### 01.3.1. Initial Conditions

- The CF system has been cleaned to the requirements
  of reactor coolant system cleanliness.
  - 2. Valves CF-VIA and CF-VIB are shut.
- Reactor grade water available to CF system through high pressure injection fill line.
- 4. Borated reactor grade water available to CF system from chemical addition or waste disposal systems. Borated water is normally available as follows: Source of boric acid must be sampled prior to fill for determination of actual concentration.
  - Boric acid mix tank (CA system) up to 7 weight percent concentrated boric acid.
  - Concentrated boric acid storage tank (WD system) 5 weight percent boric acid.
  - Miscellaneous waste holdup tank (WD system) <1.3 weight percent boric acid.</li>
    - 5. CF and associated systems operational.

#### 01.3.2. Starting

Two methods are available to fill the CF tanks with unborated, reactor grade water:

- Bleed transfer pump, from bleed holdup tank, deborated water through fill line on HP pump outlet piping.
  - 2. HP pump(s), from bleed holdup tank deborated water.

A flow restrictor in the tank fill line limits fill rate to 100 gpm.

1. Line up the CF tanks to receive unborated water using method 1 or 2 above. Line up source of boric acid to CF tanks. Open tank vent valves CF-V3A and CF-V3B.

Caution: First, open quench tank vent.

2. Fill the tanks according to the following tabulation. Relative volumes are determined by the source of boric acid selected and are calculated to result in 13,000 ppm boric acid in the CF tanks.

wt , H,BO,.	Unborated water, ft <sup>3</sup>		Boric acid. ft3	
1.3	0 (0' ind)	+	940 (11.5")	
5	695 (8'-6" ind)	٠	245 (3")	
7	765 (9'-4-1/4" ind)	+	175 (2'-1-3/4')	

## 01.3.3. Securing

- 1. Shut CF tank fill and vent valves. Secure fill pumps.
- Restore normal lineup on systems used for fill (HP, CA and/or WD).
- Sample CF tank contents and adjust water chemistry per section 01.7, if required.

## 01.4. Venting (Depressurization)

#### 01.4.1. Initial Conditions

1. CF tanks at greater than required pressure.

## . 01.4.2. Starting

 Open quench tank vent. Open valves CF-V3A and CF-V3B, allowing CF tanks to vent to the quench tank until pressure is reduced to required value.

#### 01.4.3. Securing

1. Shut valves CF-V3A and CF-V3B.

## 01.5. Nitrogen Addition (Pressurization)

#### 01.5.1. Initial Conditions

- 1. CF tanks at less than required pressure.
- 2. Nitrogen available to CF tanks (approximately\_\_\_\_\_\_
  SCF at 600 = 15 psig per tank for initial charge).
- 3. CF system may be in normal operation (valves CF-VIA and CF-VIB open. RC pressure >650 psig) or preparations underway for plant operation (valves CF-VIA and CF-VIB shut).

## 01.5.2. Starting

Open nitrogen fill valve. Observe tank pressure change.

## · 01.5.3. Securing

1. Shut nitrogen fill valve when CF tank pressure reaches 600 = 15 psig.

## 01.6. Draining

#### 01.6.1. Initial Conditions

1. Reduction of CF tank water level required .-

Note: This procedure applies to adjusting CF tank water level (bleed) or complete draining, and may be accomplished with the CF system in operating or standby status. CF tank pressure of at least 100 psig is recommended for draining operation.

2. WD system available to receive required quantity of borated water.

#### 01.6.2. Starting

- 1. Line up the WD system to receive water from CF tanks.
- 2. Open valve(s) CF-V2A and/or CF-V2B and drain the CF tank(s). Continuously monitor CF tank level while draining.

## 01.6.3. Securing

- 1. Shut valve(s) CF-V2A and/or CF-V2B when required CF tank water level is reached.
  - 2. Restore normal WD system lineup.

## 01.7. Sampling

The frequency and method of CF tank sampling and analysis are included in section \_\_\_\_ of the Water Chemistry Manual.

## 01.8. Adjusting System Parameters

When it is necessary to change CF tank level, pressure or water chemistry, use applicable portions of sections 01.3, 01.4, 01.5, and 01.6 of this procedure. During plant operation, makeup water must be added through the high pressure injection pumps (section 01.3).

#### 01.9. Infrequent Operations

#### 01.9.1. Hydrostatic Test

- Fill the CF tanks solid with water, using the bleed transfer pump and venting to the quench tank through valves CF-V3A and CF-V3B.
- 2. Initial and, if required, subsequent hydrostatic tests will be conducted in accordance with TS/ / /201/1.
- 3. Following the hydrostatic test, drain the CF tanks to normal operating level, admitting nitrogen to the tanks as the water level is reduced. Open the drain valve on the CF tank level indicator dry leg and purge nitrogen through this piping until no water remains in effluent gas.

## 01.9.2. Functional Test

 A periodic CF system functional test will be performed in accordance with TS/ / /201/2, at intervals specified in the Reactor Plant Operating Manual.