



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

January 10, 1991

*Docket
 file*

Docket Nos. 50-277, 50-278, 50-324, 50-325,
 50-333, 50-371, 50-352, 50-353,
 50-354, 50-387, 50-388, 50-397
 and 50-410

MEMORANDUM FOR: L. B. Marsh, Director
 Project Directorate III-1
 Division of Reactor Projects III/IV/V

FROM: Robert Stransky, Project Manager
 Project Directorate III-1
 Division of Reactor Projects III/IV/V

SUBJECT: SUMMARY OF MEETING WITH GENERAL ELECTRIC (GE) AND BWR OWNER
 UTILITIES CONCERNING GUIDELINES FOR BWR POWER UPRATES

A meeting was held at NRC Headquarters on January 3, 1991 to discuss the generic guidelines proposed by GE Nuclear Energy for the submittal and review of individual BWR plant power uprate requests. These guidelines are presented in Topical Report NEDC-31897P, "Generic Guidelines for GE Boiling Water Reactor Power Uprate." GE representatives presented an overview of their proposed BWR power uprate guidelines and discussed the effects of core power increases on critical plant parameters. Additional presentations were made by the Power Authority of the State of New York and the Detroit Edison Company concerning the status of power uprate requests to be submitted in 1991 for both Fitzpatrick and Fermi 2. Other utilities announced plans to submit power uprate requests sometime after 1991. Enclosure 1 is a list of attendees and Enclosure 2 is a copy of the slides presented at the meeting.

According to the guidelines proposed by GE for power uprates, the existing plant licensing basis would be utilized, except that modifications to the plant made to support a power increase would need to meet all standards which are current at the time of the modification. Additionally, an environmental review or assessment may be necessary for those plants which would exceed the power level of the environmental assessment associated with the original license. (The technical staff will be working with OGC to determine the extent of environmental reviews needed to support an increase of the licensed maximum thermal power limit.)

The GE presentation also addressed other concerns related to core power uprate. Both reactor and containment LOCA responses need to be recalculated due to the increased source term and higher initial power level and reactor steam dome pressure associated with an uprate. GE stated that by using new, more realistic LOCA models, adequate margin to existing licensing limits could easily be maintained. The plant high-energy line break (HELB) analysis may also need to be reperformed due to increased flow through steam lines and feedwater piping. Additionally, individual plant responses to previous NRC Generic Letters and Bulletins need to be addressed to verify that these issues remain closed. Balance-of-plant (BOP) systems would also need to be analyzed to determine whether modifications would be needed to support increased plant thermal power.

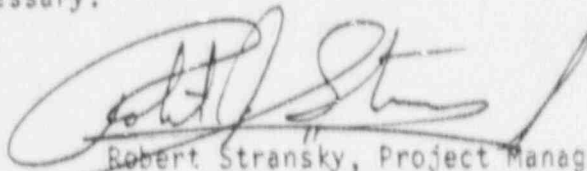
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 GE*

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The staff voiced concerns that NRC approval of a generic review plan for BWR power uprates might be viewed by licensees as precluding detailed review of emergent plant-specific items not found in the generic review plan. An agreement was made that the Topical Report did not represent an all-inclusive list of review topics and that the scope and depth of topics to be reviewed for a power uprate request would need to be determined by the individual licensees and the NRC staff. The staff agreed to review the Topical Report and to respond to GE with comments concerning the use of a generic BWR power uprate review process as a tool for better utilization of available manpower. GE agreed to incorporate NRC staff comments in a supplement to the Topical Report or to reissue the Topical Report if necessary.



Robert Stransky, Project Manager
Project Directorate III-1
Division of Reactor Projects III/IV/V

Enclosures:

1. List of Attendees
2. Meeting Slides

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/s/

Robert Stransky, Project Manager
 Project Directorate III-1
 Division of Reactor Projects III/IV/V

Enclosures:

1. List of Attendees
2. Meeting Slides

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LIST OF ATTENDEES
BWR POWER UPRATE MEETING

1/3/91

<u>NAME</u>	<u>AFFILIATION</u>
C. McCRACKEN	NRR/SPLB
C. CARPENTER	NRR/PD31
G. SOZZI	GE
K. BERRY	GE
E. ECKERT	GE
L. GIFFORD	GE
R. PENNY	NYPA
J. STANG	NRR/PD31
R. STRANSKY	NRR/PD31
A. THADANI	NRR/DST
G. HOLAHAN	NRR/DST
L. MARSH	NRR/PD31
L. GOODMAN	DECO
R. SALMON	DECO
W. MURRAY	CP&L
R. CHAU	NYPA
R. LAUMAN	NYPA
J. ELLMERS	NYPA
R. JONES	NRR/SRXB
G. OHLERMACHER	DECO
G. CRANSTON	DECO
J. BARTOS	PP&L
G. MILLER	PP&L
D. TANG	NRR/LRPD
T. COLLINS	NRR/SRXB
S. HOU	NRR/EMEB
E. GOODWIN	NRR/DST
G. HUBBARD	NRR/SPLB
D. SHUM	NRR/SPLB
S. JONES	NRR/SPLB
J. MONNIGER	R111/DRP
J. CARTER	NRR/EAB
M. YOUNG	OGC
D. LaBARGE	NRR/PD11
R. CAPRA	NRR/PD11
D. BRINKMAN	NRR/PD11
A. RIVERS	NMPC
C. WIEDERSON	PECO
T. FAY	NMPC
S. MAGINNIS	PSE&G
A. HO	PSE&G
D. ROBARE	GE
J. PATLOW	NRR/ADP

BWR POWER UPRATE

Introduction

D.J. Robare - GE

Utility Presentations

FitzPatrick Uprate Program

R. Penny - NYPA

Fermi Uprate Program

L. Goodman - DECo

Power Uprate Technical Overview

E.C. Eckert/G.L. Sozzi - GE

Power Uprate Licensing Overview

K.K. Berry - GE

Conclusion

D.J. Robare - GE

BWR POWER UPRATE

BWR Power Uprate Submittals to NRC

(1)	Unit	BWR/4	Region III	9/91
(1)	Unit	BWR/4	Region I	11/91
(1)	Unit	BWR/5	Region I	4Q91
(2)	Unit	BWR/4	Region I	3/92
(1)	Unit	BWR/5	Region V	92
(2)	Unit	BWR/4	Region II	92
(1)	Unit	BWR/4	Region I	-
(2)	Unit	BWR/4	Region I	-
(2)	Unit	BWR/4	Region I	-

Regulatory Approach

PLANT ASSESSMENT

- **Utilize Current Licensing Basis**
- **Address Power Dependent Issues**

LICENSING PLAN

- **Generic Licensing Topical Report**
 - o **Methods and Methodology**
 - o **Plant Assessment Scope**
- **Plant Unique Report References LTR**

UTILITY

PRESENTATIONS

NEW YORK POWER AUTHORITY

FITZPATRICK NUCLEAR PLANT POWER UPRATE PROGRAM

GOAL: TO ACHIEVE A FOUR (4) PERCENT INCREASE IN THERMAL POWER

IMPLEMENTATION DATE: NOVEMBER OF 1992

PHASE 1 - PRELIMINARY EVALUATION (1986-1989)

1. FEASIBILITY STUDY COMPLETED IN 1987 BY GENERAL ELECTRIC

STUDIED INCLUDED: NUCLEAR STEAM SUPPLY SYSTEM (NSSS)
BALANCE OF PLANT (BOP) SYSTEM
TURBINE-GENERATOR EQUIPMENTS

CONCLUDED A 4% POWER INCREASE IS FEASIBLE AND NO MAJOR
MODIFICATIONS ARE EXPECTED

2. REVIEWED PRIOR UPRATE PROGRAMS ON LESSONS LEARNED, FUNDING,
SCHEDULES, AND RESOURCE ALLOCATION (VENDOR AND UTILITY)

REVIEWED PLANT PERFORMANCE DATA. NO MAJOR PROBLEMS
IDENTIFIED

3. DEVELOP PHASE 2 WORKSCOPES

FUNDING APPROVED IN EARLY 1990 TO PROCEED WITH PHASE 2

PHASE 2 - ENGINEERING EVALUATION AND LICENSING REPORTS

ALL CONTRACTS ARE PRESENTLY IN PLACE. WORK HAS BEEN ONGOING
SINCE SEPTEMBER OF 1990

1. NUCLEAR STEAM SUPPLY SYSTEMS

SCOPE: PERFORM ENGINEERING EVALUATIONS AND SAFETY ANALYSIS
TO SUPPORT THE POWER UPRATE PROGRAM AT FITZPATRICK

CONTRACT AWARDED TO GENERAL ELECTRIC

WORK STARTED IN AUGUST OF 1990

SCHEDULE: REVISED TECH SPEC. - OCT. 91

LICENSING REPORT (NSSS) - NOV. 91

REVISED FSAR - NOV. 91

2. TURBINE GENERATOR

SCOPE: PERFORM THERMODYNAMIC AND MECHANICAL REVIEW OF THE
TURBINE GENERATOR INCLUDING MOISTURE-SEPARATOR
REHEATER SYSTEM TO SUPPORT A 4 PERCENT UPRATE

CONTRACT AWARDED TO GENERAL ELECTRIC
WORK STARTED IN OCTOBER OF 1990
EVALUATION TO BE COMPLETED BY JUNE OF 1991

3. BALANCE OF PLANT SYSTEMS

SCOPE: PERFORM THE EVALUATION OF THE BALANCE OF PLANT
SYSTEMS TO SUPPORT AN APPLICATION FOR AN INCREASE
IN LICENSED POWER OPERATIONS.

CONTRACT AWARDED TO STONE & WEBSTER ENGINEERING CORP.
WORK STARTED IN SEPTEMBER OF 1990

NO MAJOR PROBLEMS IDENTIFIED TO DATE. ENVIRONMENTAL PERMIT
WILL REQUIRE REVISION TO INCREASE DELTA TEMP. (< 1 DEG.F)

HELB ANALYSIS MAY REQUIRE REVISION.

ENGINEERING REPORT DUE FOR COMPLETION IN JULY OF 1991

LICENSING REPORT DUE FOR COMPLETION IN JULY OF 1991

BENEFIT/COST

POWER UPRATE PROGRAM IS A SIGNIFICANT BENEFIT TO THE AUTHORITY. PROJECTED 32 MWE AT AN INSTALLED COST OF LESS THAN \$200/KW.

OVERALL SCHEDULE

- DECEMBER 1990 - GE LICENSING TOPICAL REPORT SUBMITTAL
- NOVEMBER 1991 - FITZPATRICK UPRATE LICENSING SUBMITTAL
INCLUDES NSSS AND BOP LICENSING REPORTS
- NOVEMBER 1992 - IMPLEMENTATION (PHASE III)
IMPLEMENTS VARIOUS PROCEDURAL, SOFTWARE
AND HARDWARE CHANGES TO ACHIEVE THE
INCREASED POWER LEVEL

Overview

- **BACKGROUND**
- **EXTENDING OPERATING DOMAIN**
- **SAFETY MARGIN**

BWR PLANTS CURRENTLY LICENSED FOR UPRATE

<u>PRODUCT LINE</u>	<u>PLANT</u>	<u>POWER UPRATE (%)</u>
BWR/1	GKN	40
	Big Rock Point	10
BWR/2	Nine Mile Point 1	20
	Oyster Creek	20
BWR/3	Dresden 2/3	5
	Quad Cities 1/2	5
	Monticello	5
	Millstone	5
	Pilgrim	5
	Nuclenor	5
BWR/4	Duane Arnold	5
	KKM (Muhleberg)	5
BWR/6	Cofrentes	2
	KKL (Leibstadt)	5

BWR POWER UPRATE

OPERATING BASIS

SIGNIFICANCE

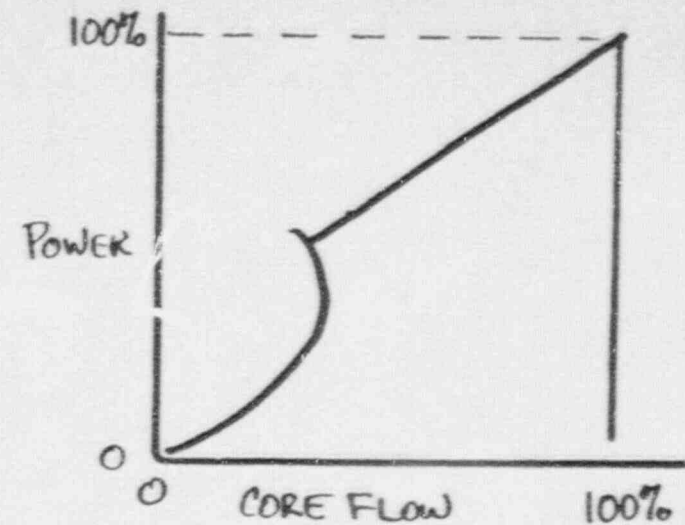
- Licensed Region for Operation
- Sets Initial Conditions/Boundary Conditions for Safety Analyses & Tech Specs

OPERATING LIMITATIONS

- Fuel Cycle Economics
- PCI

PERFORMANCE/DESIGN IMPROVEMENTS IMPLEMENTED

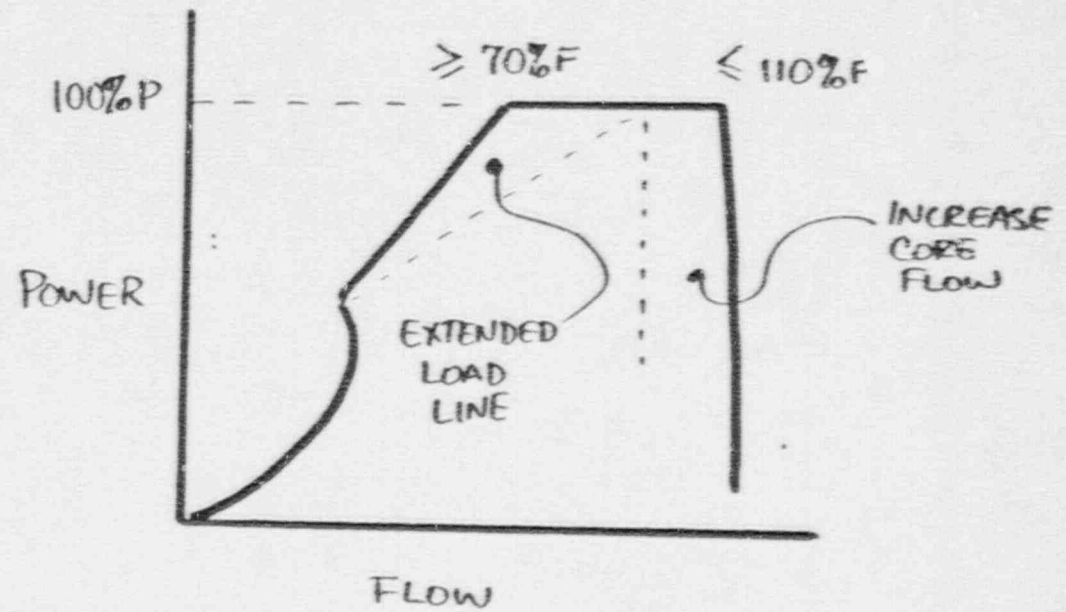
- Fuel Design/Core Design
- Extended Operating Domain
- Increased Core Flow



BWR POWER UPRATE

EXTENDED OPERATING DOMAINS

LLL	ICF	FFWTR
ELLL	MEOD	
MELLL	ARTS	



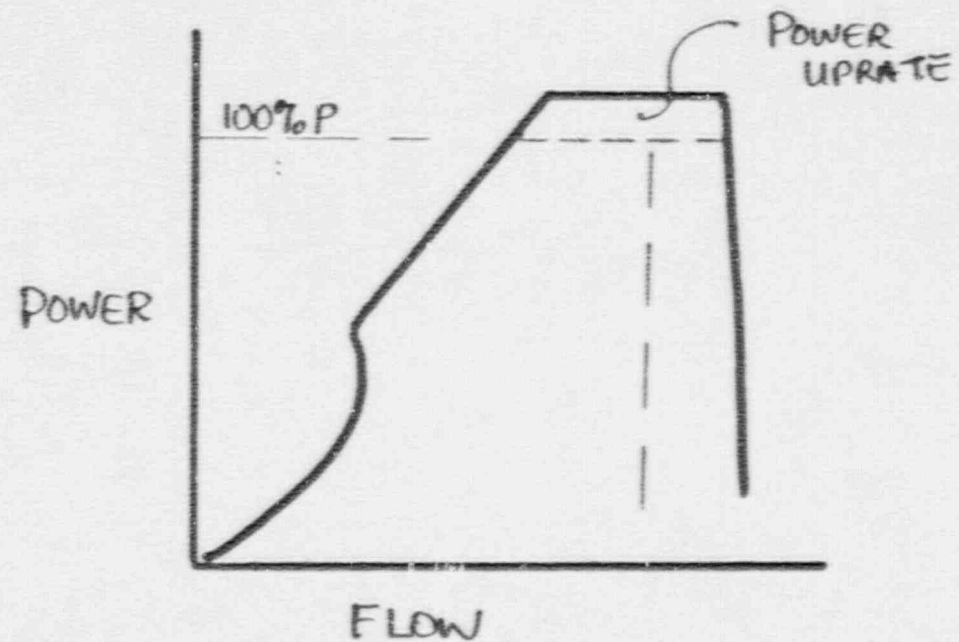
MOST BWRs HAVE IMPLEMENTED MANY OF THE FEATURES

- Generic Review
- Plant Specific Submittals

BWR POWER UPRATE

Approach to Power Uprate

EXTENSION OF P-F REGION



FLATTEN CORE RADIAL POWER

- Negligible Increase in Peak Bundle Power

Application of New BWR Methods

LOCA/ECCS

TRANSIENT EVENTS/ATWS

CONTAINMENT

DEGRADED PERFORMANCE

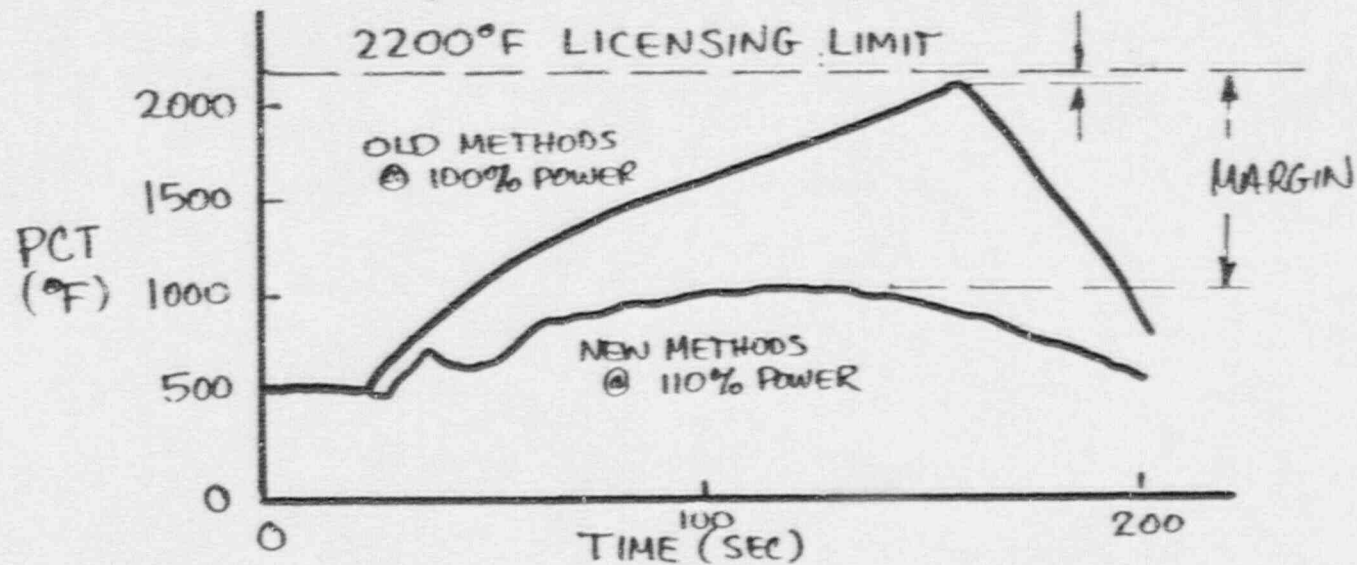
RELIABILITY BASED TECH SPEC

INSTRUMENT SETPOINT

BWR POWER UPRATE

New Methods (Cont.)

TYPICAL BWR DBA RESPONSE



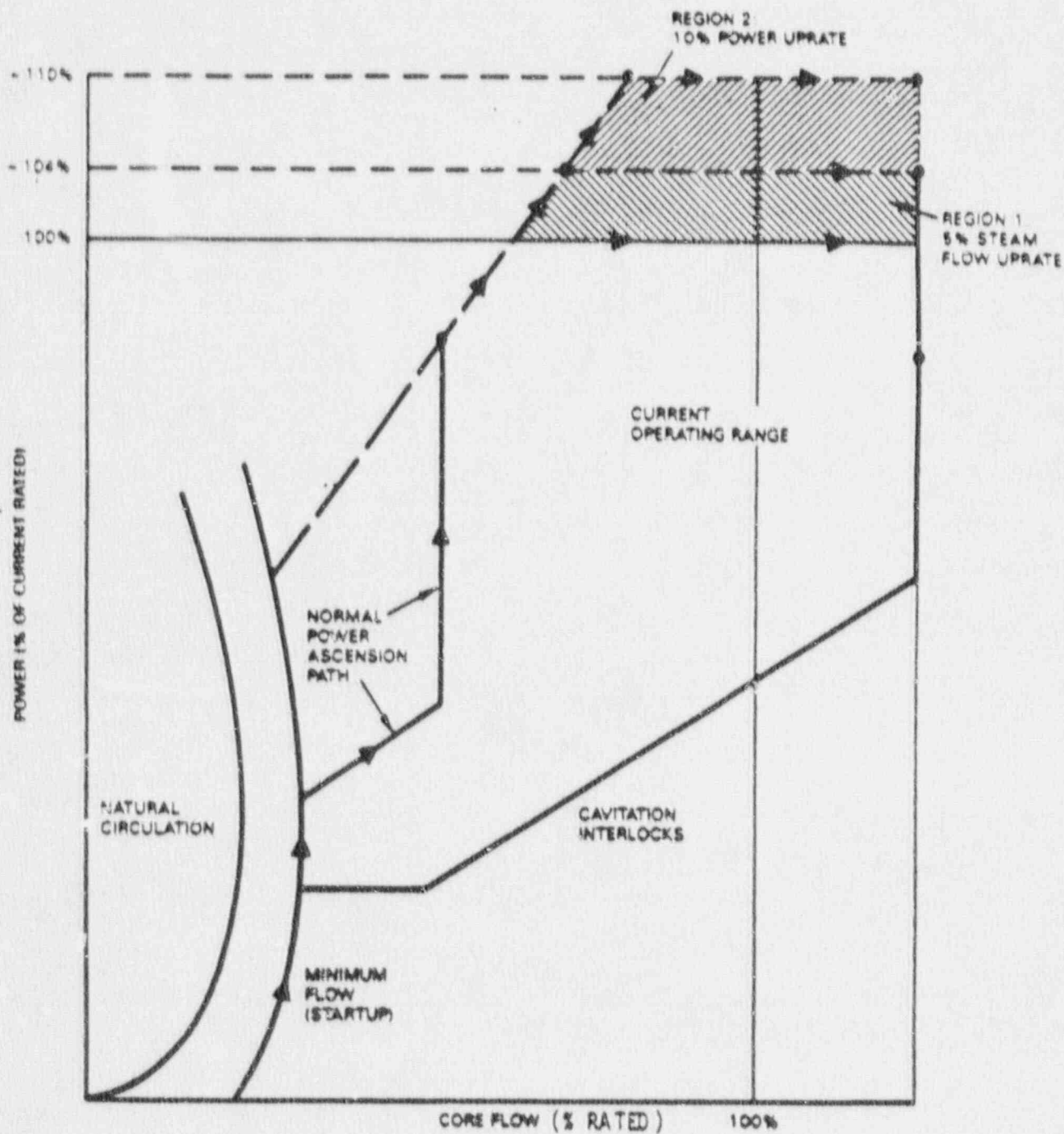
QUANTIFY REAL SAFETY MARGIN

Technical Overview

- **STRATEGY FOR UPRATE**
- **OPERATIONAL ASPECTS**
- **SAFETY ASPECTS**
- **SCOPE OF ANALYSIS AND METHODOLOGY**
- **UPRATE TESTING**

Strategy for Uprate

- **Primarily Extensions of Current Flow Control/Rod Lines**
- **System Pressure Increases (small) to Achieve Adequate Turbine Flow Capability**
- **Operating Modes Similar to Current Procedures**



Primary Technical Evaluations

OPERATIONAL AREAS


- **Reactor and Turbine-Generator Match**
- **Feedwater/Condensate System Capability**
- **Condenser/Cooling Water/Tower Capability**
- **Instrumentation Settings/Ranges**
- **Maintain Adequate Trip Avoidance**

Key Operational Evaluation (Example)

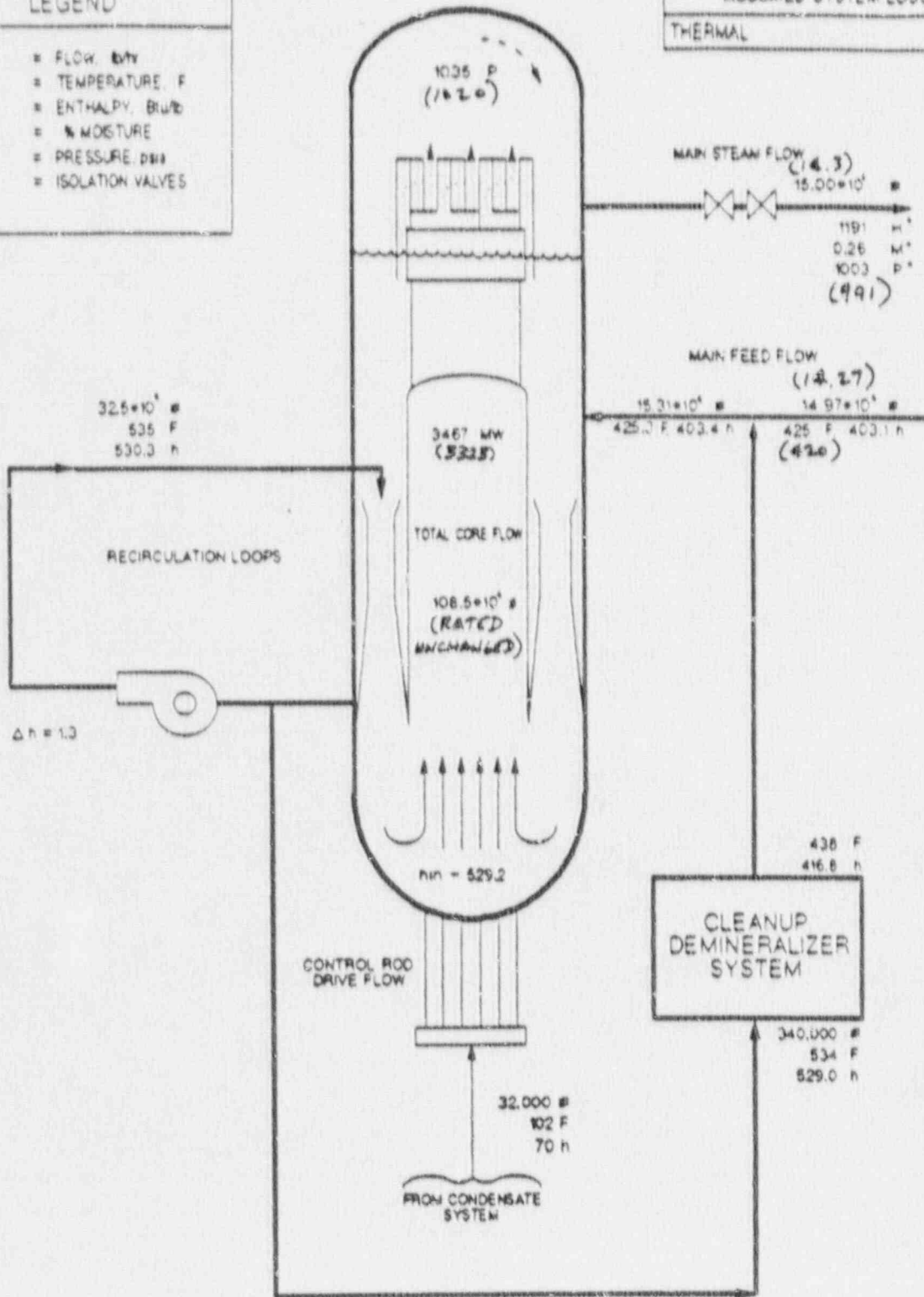
REACTOR TO TURBINE-GENERATOR CAPABILITY MATCHUP

- **Steam Flow vs. Inlet Pressure Capability of Turbine**
- **Maintain Adequate Pressure Control Margin (Operating Basis is ~3% Flow Margin from Valves-Wide-Open)**
- **Include As-Measured Steamline Pressure Drop (Vessel to Turbine)**
- **Impact on Feedwater Temperature and Heat Balance Match (Reactor and Turbine)**
- **Generator Capability and Increased Cooling Requirements**
- **Usually Necessary to Raise Reactor Pressure (15 to 30 psi) with Potential Impact on Reactor Transients**

TYPICAL UPRATED HEAT BALANCE (+5% STEAM FLOW)
(KEY PARAMETERS BEFORE UPRATE)

LEGEND	
#	= FLOW, LBM
F	= TEMPERATURE, F
H/H	= ENTHALPY, Btu/lb
M	= % MOISTURE
P	= PRESSURE, PSIA
	= ISOLATION VALVES

ASSUMED SYSTEM LOSSES	
THERMAL	1.1 MW



* These represent conditions before the turbine stop valves

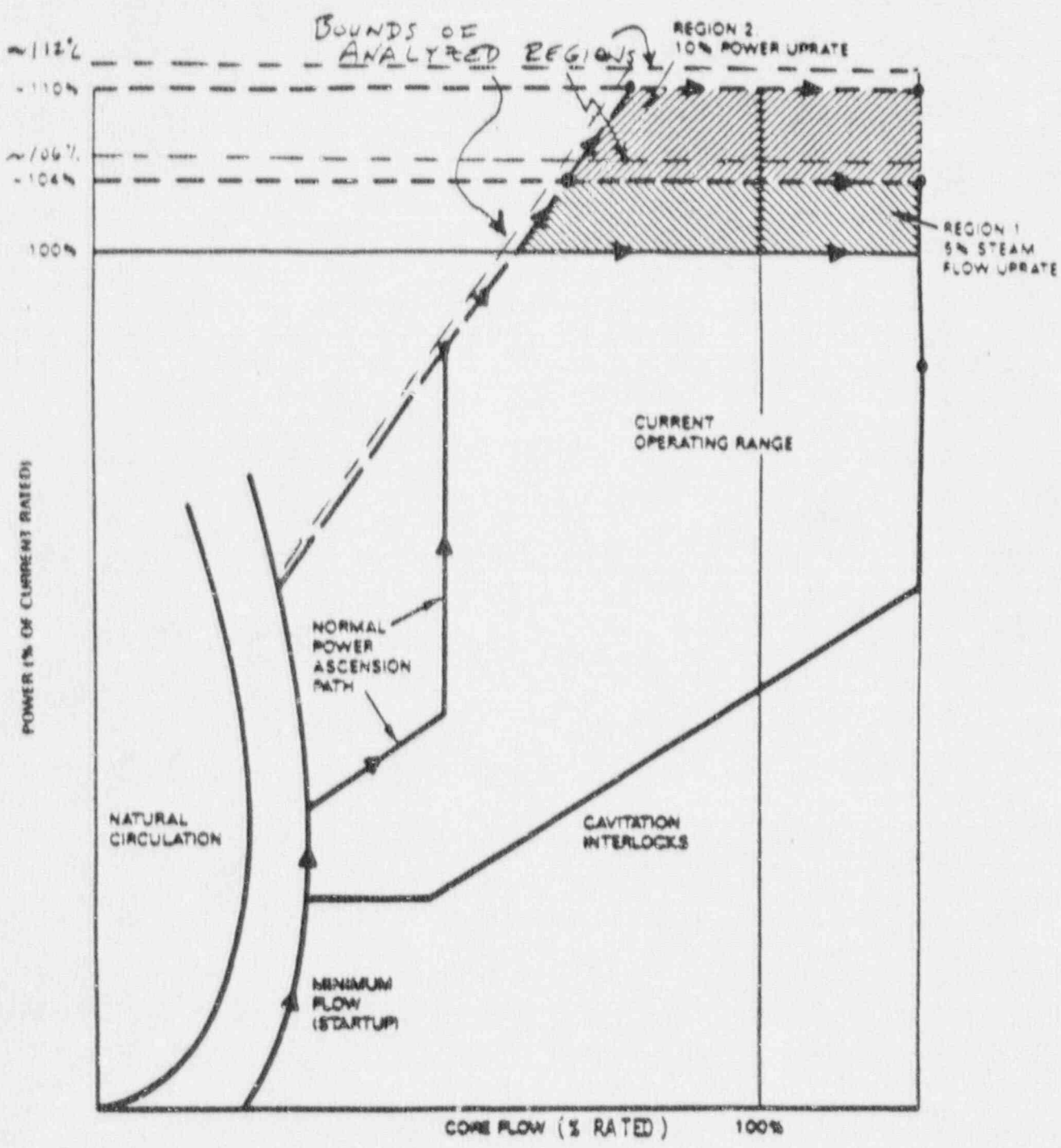


Figure Typical Power Uprate Examples for a Plant with Maximum Extended Operating Domain.

Primary Safety Evaluations

- **Maintain Current Plant Safety Limits**
- **Demonstrate Compliance for:**
 - o **Core Thermal Margin**
 - o **Vessel Overpressure Protection**
 - o **Radiological Source Terms and Doses**
 - o **Containment Loads and Cooling**
 - o **Equipment Capability (e.g., Vessel, Pumps, etc.)**

Primary Safety Evaluations (Cont.)

- **Areas Most Impacted by Power Uprate**
- **Limiting Transient Events That Set OLMCPR**
- **Limiting Overpressure Protection Events**
- **Loss of All Normal Feedwater Transients**
- **Power Uprate Consistent with Resolution of Reactor Thermal-Hydraulic Stability Concerns**
- **Loss-of-Coolant Accident (Fuel Thermal-Hydraulic Evaluation and Impact on Containment and Radiological Analyses)**
- **Other Accidents (e.g., Fuel Handling)**

Scope of Analysis and Related Methodology

STEADY-STATE CONDITIONS

- **Design Methods Augmented by Plant Data**

TRANSIENT ANALYSIS

- **Accepted Methods (e.g., GE Codes ODYN or REDY)**
- **All MCPR and Overpressure Limiting Cases**
- **Additional Transients If Affected Significantly by Uprate**

ACCIDENT ANALYSIS

- **LOCA Analysis of Full Spectrum of Break Sizes Using Accepted Methods**
- **Evaluation of Containment and Radiological Consequences**
- **Other Accidents Affected by Uprate/Higher Source Terms**

Uprate Testing

- **Operating Margin Data Taken up to Old Rating to Protect Adequacy of Margins Toward Up-rated Power**
- **Power Increases in 5% (or less) Increments**
- **Retesting of All Operational Controls to Assure Adequacy at Higher Power (Primarily for Trip Avoidance)**
- **Turbine-Generator Trip Test at New Rating only if Power Increase is Greater than 5% (to Demonstrate Safe Shutdown and Pressure Relief)**

Stand-alone, Plant Unique Reports

FORM AND CONTENT SIMILAR TO BASIC TOPICAL REPORT

PLANT UNIQUE DISCUSSION AND ANALYSES

- **Thorough Docket Review for Power Uprate Impact**
- **As-Built Plant Unique Equipment/Systems/Structures**
- **Plant Unique Analyses Of Bounding Criteria**
- **Limiting SAR Analyses Addressed**
- **Justification Or Analyses Of Non-Limiting Events**

BWR POWER UPRATE

LICENSE AMENDMENT REQUEST SUBMITTAL

- **Technical Specification Changes**
- **Safety Evaluation**
- **Plant Specific Licensing Report**

USAR REVISION ON REGULAR UPDATE SCHEDULE

LTR TO ESTABLISH METHODOLOGY AND

SCOPE AGREEMENT

PRIOR TO PLANT SUBMITTALS