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Vol. 2

Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design

Appendices

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Associate Directorate for Advanced Reactors and License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

ABSTRACT

This safety evaluation report (SER) documents the technical review of the U.S. Advanced Boiling Water Reactor (ABWR) standard design by the U.S. Nuclear Regulatory Commission (NRC) staff. The application for the ABWR design was initially submitted by the General Electric Company, now GE Nuclear Energy (GE), in accordance with the procedures of Appendix O of Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50). Later GE requested that its application be considered as an application for design approval and subsequent design certification pursuant to 10 CFR § 52.45.

The U.S. ABWR design is similar to the international ABWR design, which was being built at the Kashiwazaki Kariwa Nuclear Power Generation Station, at the time of the staff's review, by the Tokyo Electric Power Company, Inc. The ABWR is a single-cycle, forced-circulation, boiling water reactor (BWR) with a rated power of 3926 megawatts thermal (MWt) and a design power of 4005 MWt. Many features of the ABWR design are similar to those of BWR designs that the staff had previously approved. To the extent feasible and appropriate, the staff relied on earlier reviews for those ABWR design features that are substantially the same as those previously considered. The SERs for the other BWR designs have been published and are available for public inspection at the NRC Public Document Room, 2120 L Street, N.W., Washington, D.C. 20037. Unique features of the ABWR design include internal recirculation pumps, fine-motion control rod drives, microprocessor-based digital logic and control systems, and digital safety systems.

On the basis of its evaluation and independent analyses, the NRC staff concludes that, subject to satisfactory resolution of the confirmatory items identified in Section 1.8 of this SER, GE's application for design certification meets the requirements of Subpart B of 10 CFR Part 52 that are applicable and technically relevant to the U.S. ABWR standard design. A copy of the report by the Advisory Committee on Reactor Safeguards required by 10 CFR § 52.53 is provided in Chapter 21. A final design approval, issued on the basis of this SER, does not constitute a commitment to issue a permit or license, or in any way affect the authority of the Commission, the Atomic Safety and Licensing Board, and other presiding officers, in any proceeding pursuant to Subpart G of 10 CFR Part 2.

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FIGURES

Appendix A

LIST OF ABBREVIATIONS

— A —

ABWR	advanced boiling water reactor
AC	alternating current
ACC	accumulator
ACI	automatic closure and interlock
ACIWA	ac-independent water addition
ACRS	Advisory Committee on Reactor Safeguards
ACS	atmospheric control system
ACU	air conditioning units
ADS	automatic depressurization system
AHU	air handling units
AISC	American Institute of Steel Construction
ALARA	as low as is reasonably achievable
ALWR	advanced light water reactor
AM	accident management
ANL	Argonne National Laboratory
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOO(s)	anticipated operational occurrences
APR	automatic power regulator
APRM	average power range monitor
ARI	alternate rod insertion
ARS	amplified response spectra
ASB	Auxiliary Systems Branch
ASCE	American Society of Civil Engineers
ASD	allowable stress design
ASD	adjustable speed drive
ASF	automatic suppression function
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATIP	automatic transversing in-core probe
ATLM	automated thermal limit monitor
ATWS	anticipated transient without scram

— B —

BNL	Brookhaven National Laboratory
BPU	bypass unit
BPWS	blanked position withdrawal sequence
BTP	Branch Technical Position
BWR	boiling water reactor
BWROG	BWR Owners Group

— C —

CA	compressed air
CAMS	containment atmosphere monitoring system
CAV	cumulative absolute velocity
CBERU	contrbuilding emergency recirculation unit
CBRU	control-building recirculation unit
CBSREA	control building safety-related equipment area
CCDF	complementary cumulative distribution function
CCI	core concrete interaction
CCS	condensate cleanup system
CDF	core damage frequency
CDM	Certified Design Material
CDRL	core damage radiation level
CE	ABB-Combustion Engineering
CED	common engineering documents
CET	containment event trees
CF&CAE	condensate feedwater, and condensate air extraction
CFR	Code of Federal Regulations
CFS	condensate and feedwater system
CH	chugging
CIV	containment isolation valve
cm	centimeters
CMAA	Crane Manufacturers Association of America
CMP	configuration management plan
CMU	control room multiplexing unit
CO	condensation oscillation
COL	combined license
COPS	containment overpressure protection system
CPG	containment performance goal
CP	construction permit
CPU	central processing unit
CR	control room
CRHA	control room habitability area
CRD	control rod drive
CRDS	control rod drive system
CRHA	control room habitability area
CRT	cathode-ray tube
CS	control system
CS	core support
CS	crown and segment technique
CSNI	Committee on the Safety of Nuclear Installations
CST	condensate storage tank

— C —

CT	completion times
CTG	combustion turbine generator
CUW	reactor water cleanup
CVCF	constant voltage constant frequency
CWS	circulating water system

— D —

DAC	design acceptance criteria
DAL	design action list
DBA	design-basis accident
DBLOCA	design-basis loss-of-coolant accident
DBT	design basis tornado
DC	design certification
DCH	direct containment heating
DD	design description
DCC	damage control center
DCD	design control document
DCM	damage control measure
DCM	Tier 1 Design Certification Material for the GE ABWR
DCV	drywell connecting vent
DEPSS	drywell equipment and piping support structure
DET	decomposition event tree
DF	decontamination factor
DFSER	draft final safety evaluation report
DG	diesel generator
DGCW	diesel generator cooling water
DGL	diesel generator lubrication
DGSA	diesel generator starting air
DMC	digital measurement and control
DOD	Department of Defense
DOE	Department of Energy
dp	deltap
DRAP	design reliability assurance program
DSER	draft safety evaluation report
DSIL	drywell spray initiation limit
DTM	digital trip module
DTS	drain transfer system

— E —

EAB	exclusion area boundary
EB	electrical building
EBVS	electrical building ventilation system
ECCS	emergency core cooling system(s)
EDG	emergency diesel generator
EDO	Executive Director for Operations
EF	error factor
EFU	emergency filtration unit
EHR	extra hard rock
EMC	electronic magnetic compatibility
EMI	electromagnetic interference
EMS	essential multiplexing system
EOF	Emergency Operations Facility
EOP	emergency operating procedures
EPA	electrical protection assemblies
EPG	emergency procedure guidelines
EPRI	Electric Power Research Institute
ERM	Engineering Review Memorandum
EQ	environmental qualification
EQD	environmental qualification document
ESD	electrostatic discharge
ESF	engineered safety feature
ESW	essential service water

— F —

FATT	fracture appearance transition temperature
FCI	fuel-coolant interactions
FCS	flammability control system
FCU	fan cool unit
FDA	final design approval
FDDI	fiber distribution data interface
FDWC	feedwater control
FDDI	fiber distributed data interface
FIST	full integral simulation test
FIVE	fire-induced vulnerability evaluation
FMCRD	fine-motion control rod drive
FMEA	failure modes and effects analysis
FOST	fuel oil storage and transfer
FPC	fuel pool cooling and cleanup
FRS	floor response spectra
FS	full-scale
FSER	final safety evaluation report
ft	feet
FWLB	feedwater line break

— G —

GDC	general design criteria/criterion
GE	GE Nuclear Energy
GI	generic issue
GL	generic letter
GSI	generic safety issue(s)
GWd	gaseous waste management system

— H —

HCLPF	high confidence low probability of failure
HCTL	heat capacity temperature limit
HCW	high-conductivity waste
HCU	hydraulic control unit
HECW	HVAC emergency cooling water
HELB	high-energy line breaks
HELSA	high-energy line separation analysis
HEPA	high-efficiency particulate air
HF	human factors
HI	hydraulic institute
HFE	human factors engineering
HFPP	human factors program plan
HIC	high-integrity containers
HNCW	HVAC normal cooling water
HPCF	high-pressure core flooder
HPCS	high-pressure core spray
HPIN	high-pressure nitrogen gas supply
HPME	high-pressure core melt ejection system
HR	hard rock
HRA	human reliability analysis
HSD	hot shower drain
HSI	human system interface
HVAC	heating, ventilating, and air conditioning
HWC	hydrogen water chemistry
HWH	hot water heating

— I —

I&C	instrumentation and control
IA	instrument air
IBD	instrument block diagrams
ICC	inadequate core cooling
ICD	interface control diagram
IE	Inspection and Enforcement
IED	improvised explosive device
IEEE	Institute of Electrical and Electronics Engineers
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leakage rate tests
IN	information notice
in.	inch
IORV	inadvertent open relief valve
ISI	inservice inspection
ISM	independent support motion
ISO	isometric drawing(s)/International Systems Interconnection
IST	inservice testing
ITAAC	inspections, tests, analyses, and acceptance criteria
ITP	initial test program

— L —

LBB	leak-before-break
LCS	leakage control system
LCS	local control switches
LCW	low-conductivity waste
LD	lower drywell
LDF	lower drywell flooder
LDS	leak detection and isolation system
LER	licensee event reports
LLHS	light load handling system
LLNL	Lawrence Livermore National Laboratory
LLRT	local leak rate tests
LOCA	loss-of-coolant accident
LOOP	loss-of-offsite power
LOPP	loss-of-preferred power
LPCI	low-pressure coolant-injection
LPFL	low-pressure flooder
LPMS	loose parts monitoring system
LPRM	local power range monitor
LPZ	low-population zone
LRB	Licensing Review Bases
LRFD	load and resistance factor design
LTS	long term solutions
LVDT	linear variable differential transformers
LWMS	liquid waste management system
LWR	light water reactor

— M —

m	meters
M-O	Mononobe and Okabe
MACCS	melcor accident consequence code system
MAPLHGR	maximum average planar linear heat generation rate
MC	main condensers
MCAE	main control area envelope
MCC	motor control center
MCES	main condenser evacuation system
MCPR	minimum critical power ratio
MCR	main control room
MEB	Mechanical Engineering Branch
MG	motor-generator
ML	manufacturing license
MOV(s)	motor operated valves
MPL(s)	master parts lists
MPT	main power transformer
MRBM	multi-channel rod block monitor
MS	main steam
MSIV	main steamline isolation valves
MSL	main steamline
MSLB	main steamline break

— M —

MST	main steam tunnel
MTU	metric ton of uranium
MUWC	makeup water (condensate)
MUWP	makeup water system (purified)
MVA	megavolt amps
MWP	makeup water system
Mwt	megawatt thermal

— N —

NB	nuclear boiler
NBS	nuclear boiling system
NDE	non-destructive examination
NEMA	National Electrical Manufacturers Association
NEMS	non-essential multiplexor system
NFPA	National Fire Protection Association
NMS	neutron monitoring system
NNS	non-nuclear safety
NPB	nuclear power block
NPP	nuclear power plant
NPSH	net positive suction head
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
NRD	nonradioactive drain
NRHX	non-regenerative heat exchangers
NSSFC	National Severe Storm Forecast Center
NSSS	nuclear steam supply system(s)

— O —

OBE	operating basis earthquake
OER	operating experience review
OHLHS	overhead heavy load handling system
OLU	output logic unit
OL	operating license
OM	operations and maintenance
OPRM	oscillation power range monitor
O-RAP	operational reliability assurance process
ORNL	Oak Ridge National Laboratory
OSC	Operational Support Center
OSI	open systems interconnection

— P —

P&ID	piping and instrumentation diagram(s)
PASS	post-accident sampling system
PCHS	power cycle heat sink
PCP	process control program
PCPL	primary containment pressure limit
PCT	peak cladding temperature
PDA	preliminary design approval
PFD	process flow diagrams
PGA	peak ground acceleration
PGCS	power generation control system
PIP	plant investment protection
PM	preventive maintenance
POV	powered operated valves
PRA	probabilistic risk assessment
PRC	Piping Review Committee
PRM	process radiation monitor
PRM	Program Review Model
PRMS	process radiation monitoring system
PRNM	power range neutron monitor
PS	pressed and spun
PSA	probabilistic safety assessment
PSB	Power Systems Branch
PSD	power spectrum density
PSDF	power spectral density function
PSI	preservice inspection
PSIS	pounds per square inch gauge
PSS	process sampling system
PSTF	pressure suppression test facility

— Q —

Q	question
QA	quality assurance
QG	quality group

— R —

RAI	request for additional information
RAP	reliability assurance program
RB	reactor building
RBM	rod-block monitor
RBV	reactor building vibration
RBVS	reactor building ventilation system
RCCV	reinforced concrete containment vessel
RCIC	reactor core isolation cooling
RCIS	rod control and information system
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RCW	reactor building cooling water
RCWS	reactor building cooling water system
RFC	recirculation flow control
RFCS	recirculation flow control system
RG	Regulatory Guide
RH	relative humidity
RHR	residual heat removal

— R —

RICSIL	rapid communication service information letters
RIP	reactor internal pump
RMC	recirculation motor cooling
RMS	radiation-monitoring system
RMU	remote multiplexing units
RPCS	rod pattern control system
RPS	reactor protection system
RPT	recirculation pump trip
RPV	reactor pressure vessel
RSS	remote shutdown system
RSW	reactor service water
RTD	resistance temperature detectors
RT_{NDT}	nil ductility transition temperature
RTNSS	regulatory treatment of non-safety systems
RWCS	reactor water cleanup system
RWCU	reactor water cleanup
RWS	radwaste system

— S —

SA	service air
SAIC	Science Applications International Corporation
SAM	seismic anchor motions
SAMDA	severe accident mitigation design alternative
SB&PC	steam bypass and pressure control
SBO	station blackout
SC	safety class
SCG	startup coordinating group
SCAM	subcompartment analysis method
SCRAM	reactor trip (safety control rod axe man)
SCRRI	selected control rod run-in
SCSB	Containment Systems and Severe Accident Branch
SDC	shutdown cooling
SDS	system design specification
SER	safety evaluation report
SERG	Steam Explosion Review Group
SFA	spent fuel assemblies
SFP	spent fuel pool
SGTS	standby gas treatment system
SIL	service information letters
SIT	structural integrity test
SJAE	steam jet air ejector
SLU	system logic unit
SLC	standby liquid control
SLCS	standby liquid control system
SOMP	software operation and maintenance plan
SPCU	suppression pool cleanup
SPDS	safety parameter display system
SPTM	suppression pool temperature monitoring
SQA	software QA
SRI	select rod insert
SRM	staff requirements memorandum
SRNM	startup range neutron monitoring system
SRP	standard review plan
SRSS	square-root-of-sum-of-squares
SRV	safety relief valve
SS	shift supervisor
SS	sub-scale
SSAR	standard safety analysis report
SSC	structures, systems, and components
SSE	safe shutdown earthquake
SSI	seismic soil-structure interaction
SSLC	safety system logic and control
STS	self-test system
STS	standard technical specification
STUDH	Steel torispherical upper drywell head

— T —

TA	technical associate
TAF	top of the active fuel
TB	turbine building
TBS	turbine bypass system
TBVS	turbine building ventilation system
TCA	Technical Cooperation Agreement
TCW	turbine building cooling water
TEMA	Tank Equipment Manufacturers Association
TGS	turbine generator system
TGSS	turbine gland sealing system
TID	Technical Information Document
TIP	traversing incore probe
TLU	trip logic units
TMI	Three Mile Island
TS	technical specification(s)
TSC	Technical Support Center
TSW	service water system

— U —

UAT	unit auxiliary transformers
UBC	Uniform Building Code
UD	upper drywell
UHS	ultimate heat sink
URS	ultimate rupture strength
USI	unresolved safety issue(s)

— V —

V&V	verification and validation
V&VP	verification and validation plan
VDU	video display units
VPI	valve position indicatication

APPENDIX B

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1.23, "Onsite Meteorological Programs (Safety Guide 23)," (Rev. 0), February 1972.

1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants (for comment)," (Rev. 3) February 1976.

1.27, "Ultimate Heat Sink for Nuclear Power Plants (for comment)," March 1972, (Rev. 1) March 1974, (Rev. 2) January 1976.

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1.31, "Control of Ferrite Content in Stainless Steel Weld Metal," (Rev. 3), April 1978.

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1.43, "Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components," (Rev. 0), May 1973.

1.44, "Control of Sensitized Stainless Steel," (Rev. 0) May 1973.

1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," (Rev. 0) May 1973.

1.47, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems," May 1973.

1.49, "Power Levels of Nuclear Power Plants," (Rev. 1) December 1973.

1.50, "Control of Preheat Temperature for Welding of Low-Alloy Steel," (Rev. 0) May 1973.

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1.59, "Design Basis Floods for Nuclear Power Plants," (Rev. 2) August 1977.

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1.62, "Manual Initiation of Protective Actions," October 1973.

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1.65, "Materials and Inspections for Reactor Vessel Closure Studs," (Rev. 0) October 1973.

1.68.3, "Preoperational Testing of Instrument and Control Air Systems," April 1982.

1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants," November 1973, (Rev. 1) January 1977, (Rev. 2) August 1978.

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1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," (Rev. 2) November 1978.

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1.91, "Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," (Rev. 1) dated February 1978.

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1.94, "Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants," (Rev. 1) February 1976.

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NUREG-1296, "Thermal Overload Protection for Electric Motors on Motor-Operated Valves - Generic Issue II.E.6.1," June 1988.

NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," June 1990.

NUREG-1342, "A Status Report Regarding Industry Implementation of Safety Parameter Display Systems," 1989.

NUREG-1344, "Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants," April 1989.

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July 21, 1993, "SECY-93-087, 'Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs.'"

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APPENDIX C

CHRONOLOGY OF CORRESPONDENCE

This appendix contains a chronological listing of routine licensing correspondence between the U.S. Nuclear Regulatory Commission (NRC) staff and GE regarding the review of the Advanced Boiling Water Reactor (ABWR) under Project 671 and Docket Numbers 50-605 and 52-001.

ABWR AMENDMENTS

AMENDMENTS	DATE	AMENDMENTS	DATE
1	03/29/88	2	06/29/88
3	12/29/88	4	01/31/89
5	02/28/89	6	03/31/89
7	06/02/89	8	07/28/89
9	11/17/89	10	03/28/90
11	05/02/90	12	06/04/90
13	07/03/90	14	10/02/90
15	11/30/90	16	02/22/91
17	06/28/91	18	10/11/91
19	12/13/91	20	03/13/92
21	07/06/92	22	09/18/92
23	11/20/92	24	01/07/92
25	01/29/92	26	03/24/92
27	04/23/92	28	05/14/93
29	05/28/93	30	07/08/93
31	07/28/93	32	09/17/93
33	12/07/93	34	03/31/94
35	05/25/94		

August 7, 1987

T.E. Murley, NRC, letter forwarding, "GE Advanced BWR Reactor Licensing Review Bases." Report addresses review process, selected technical issues, and represents understanding of certain approaches proposed in design and licensing application.
Fiche: 42162:262-42162:287
acn: 8708140039

August 11, 1987

H.N. Berkow, meeting summary of August 5, 1987, with GE on plans for development and submittal of Technical Specifications for advanced BWR Standard plant design. GE to reconsider plans for technical specifications and continue to coordinate with owners group and NRC on item. List of attendees enclosed.
Fiche: 42171:073-42171:075
acn: 8708170023

August 31, 1987

Text-safety report--"GE Advanced BWR Licensing Review Bases."
Fiche: 42162:264-42162:287
acn: 8708140043

December 14, 1987

R. Artigas, letter advising that GE send advanced BWR standard SAR per NRC request. Chapters for report will be submitted in blocks according to established scheduled. Chapters 4, 5, 6, and 15 forwarded to ACRS at present.
Fiche: 43726:286-43726:286
acn: 8712150419

December 24, 1987

T.E. Murley, NRC, external memorandum directing staff to perform audit of GE advanced BWR design and design process in early 1988. Special emphasis will be placed on portions of design attributable to Toshiba and Hitachi for purpose of assuring quality and reliability of advanced BWR.
Fiche: 43953:350-43953:353
acn: 8801070170

February 22, 1988

D.C. Scaletti, NRC, letter forwarding requesting additional information regarding GE application for certification of advanced BWR design by April 30, 1988. Request addresses areas of SRP Chapters 4, 5, 6, and 15 reviewed by Mechanical Materials and Chemical Engineering Branches.
Fiche: 44499:123-44499:137
acn: 8802250119

February 29, 1988

D.C. Scaletti, NRC, letter submitting list of concerns to be addressed during February 23 through 25, 1988, preliminary design QA audit.
Fiche: 44558:310-44558:312
acn: 8803030075

March 15, 1988

L.S. Rubenstein, letter informing of relocation of NRR to stated address in Rockville, Maryland.
Fiche: 44746:350-44746:352
acn: 8803210431

March 24, 1988

B. Wolfe, letter requesting support in resolution of matter of fee to be incurred by GE in certification of advanced BWR. GE concerns would be resolved if Commission would confirm that review and fee both capped at present level and deferred.
Fiche: 45008:358-45008:360
acn: 8804060396

March 29, 1988 — D.C. Scaletti, NRC, letter advises that information on advanced BWR fuel design in Chapter 4 of Supplemental SAR will be withheld from public disclosures (Ref. 10 CFR 2.790) per September 29, 1988, request.
Fiche: 45029:177-45029:178
acn: 8804050408

March 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Amendment 1 Chapter 103 advanced BWR SSAR.
Fiche: 44953:262-44955:192
acn: 8803310029

March 29, 1988 — R. Artigas, forwards Revision A to Amendment 1 to Chapters 1, 2, and 3 of 23A6100AC, "Advanced BWR SSAR." Replacement of overhead HPCS sparger with high pressure flooder spargers initiated with enclosures. Chapters 4, 5, 6, and 15 to be updated with 7 through 9 and 11 through 13 submitted.
Fiche: 44953:260-44955:192
acn: 8803310018

April 29, 1988 — R. Artigas, letter forwarding responses to additional information on SSAR for advanced BWR per NRC February 22, 1988, request.
Fiche: 45505:093-45505:192
acn: 8805120071

June 3, 1988 — V. Stello, letter responding to March 24, 1988, letter regarding fee for design and approvals and certifications. Commission in process of examining fees for all types of reviews. GE concerns will be included in Commission review process.
Fiche: 45916:347-45916:347
acn: 8806240235

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 20, "Question and Response Guide," of Amendment 2 to GE Advanced BWR SSAR.
Fiche: 46024:194-46024:254
acn: 8807050014

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 17, "QA," of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46024:183-46024:193
acn: 8807050013

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 14, "Initial Test Program," of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46024:109-46024:182
acn: 8807050011

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 13, "Conduct of Operations," of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46024:095-46024:108
acn: 8807050010

June 29, 1988 — Test-safety report--reference safety analysis report and amendments (RSAR) Chapter 12, "Radiation Protection" of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46024:014-46024:094
acn: 8807050009

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 11, "Radwaste Management" of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46023:325-46024:013
acn: 8807050008

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 9, "Auxiliary Systems" of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46023:187-46023:324
acn: 8807050007

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 8, "Electric Power" of Amendment 2 to GE advanced BWR SSAR.
Fiche: 46023:126-46023:186
acn: 8807050006

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Chapter 7, "Instrumentation and Control System," Amendment 2 to GE advanced BWR SSAR.
Fiche: 46022:092-46023:125
acn: 8807050005

June 29, 1988 — Text-safety report--reference safety analysis report and amendments (RSAR) Amendment 2 to GE advanced BWR SSAR.
Fiche: 46022:091-46024:254
acn: 8807050004

June 29, 1988 — J.S. Gay, letter forwarding Amendment 2 to Chapters 7 through 9, 11 through 14, and 17 of SSAR for advanced BWR per NRC August 7, 1987, advanced BWR licensing review basis.
Fiche: 46021:047-46024:254
acn: 8807050003

July 6, 1988 — J.S. Gay, letter forwarding Figures 7.6-1 and 7.6-2 of Amendment 2 to GE advanced BWR SSAR. Figures withheld.
Fiche: 46175:300-46175:300
acn: 8807140283

July 7, 1988 — D.C. Scaletti, NRC, letter forwarding request for additional information regard GE application for certification of advanced BWR design. Responses requested by September 15, 1988.
Fiche: 46154:283-46154:314
acn: 8807120634

July 28, 1988 — D.C. Scaletti, NRC, letter forwarding documents regarding NRC review of GE application for certification of advanced BWR design per February 1, 1988, meeting agreement. Without enclosures.
Fiche: 46467:132-46467:133
acn: 8808080089

September 12, 1988 — D.C. Scaletti, NRC, letter forwarding requesting additional information regarding GE application for certification of advanced BWR design for response by November 15, 1988.
Fiche: 46908:325-46908:337
acn: 8809160120

September 14, 1988 — P.W. Marriott, GE, letter forwarding with additional information regarding SSAR for advanced BWR per NRC July 7, 1988, request and committed responses to D.C. Scaletti February 22, 1988, request. Manufacturer will amend SSAR with responses in December.
Fiche: 46911:136-46911:249
acn: 8809160103

September 20, 1988 — D.C. Scaletti, NRC, letter forwarding requesting additional information regarding application for certification of advanced BWR design for response by November 21, 1988, in order to maintain review schedule.
Fiche: 46945:261-46945:276
acn: 8809230178

September 26, 1988 — D.C. Scaletti, NRC, letter forwarding requesting additional information regarding application for certification of advanced BWR design. Responses requested by November 30, 1988.
Fiche: 47015:284-47015:309
acn: 8810030333

September 28, 1988 — D.C. Scaletti, NRC, meeting minutes-internal (non-transcript) of September 14, 1988, meeting with GE postulated all pump trip for advanced BWR design. List of attendees and viewgraphs enclosed.
Fiche: 47070:221-47070:235
acn: 8810060008

September 29, 1988 — R. Artigas, letter requesting design certification of advanced BWR standard plant per NRC review and approval of enclosed proprietary SSAR Chapters 4, 5, 6, and 16. Chapters withheld.
Fiche: 42917:105-42917:111
acn: 8710060280

October 26, 1988 — D.C. Scaletti, NRC, letter requesting additional information regarding GE application for certification of advanced BWR design. Information includes suppression pool water condensate storage tank discharge line fill pump and standby liquid control system.
Fiche: 47408:214-47408:224
acn: 8811010278

November 14, 1988 — P.W. Marriott, GE, letter responding to D.C. Scaletti September 12, 1988, request for additional information on SSAR for advanced BWR. Responses principally pertain to Chapters 1, 2, and 3. Responses to NRC July 7, 1988, letter also enclosed.
Fiche: 47567:205-47567:265
acn: 8811170177

November 22, 1988 — D. Crutchfield, NRC, letter providing recently developed information regarding scope of future standard design applications and of staff review of advanced BWR.
Fiche: 47696:239-47696:254
acn: 8811300135

December 9, 1988 — P.W. Marriott, GE, letter responding to September 20, 26, and October 26, 1988, requests for additional information regarding SSAR for advanced BWR. GE proprietary information withheld.
Fiche: 47795:137-47795:302
acn: 8812130262

December 27, 1988 — L.S. Rubenstein, letter requesting additional information listed in enclosure regarding design goals addressing large radioactive releases resulting from severe accident. Response requested with 30 days of letter date.
Fiche: 44285:261-44285:263
acn: 8802080322

December 30, 1988 — Text-safety report--reference safety analysis report and Amendments (RSAR) Amendment 3 to "Advanced BWR Standard Plant," Chapter 10, "Steam and Power Conversion System."
Fiche: 48093:051-48093:126
acn: 8901040053

December 30, 1988 — P.W. Marriott, GE, letter forwarding Amendment 30 to GE advanced BWR SSAR Chapter 10, "Steam and Power Conversion System," with responses to request for additional information which were submitted but not yet incorporated by amendment.
Fiche: 48093:049-48093:126
acn: 8901040041

January 1, 1989 — P.W. Marriott, GE, letter forwarding responses to NRC requests for additional information submitted but not yet incorporated by amendment to SSAR for advanced BWR and Amendment 3 to advanced BWR SSAR.
Fiche: 48124:106-48125:324
acn: 8901100292

January 6, 1989 — Text-safety report--safety analysis report and amendments (RSAR) Amendment 3 to advanced BWR SSAR.
Fiche: 48125:019-48125:324
acn: 8901130338

January 24, 1989 — Legal transcripts and orders and pleadings of January 24, 1989, briefing in Rockville, Maryland regarding progress of GE advanced BWR standard plant review. Page 1 through 63. Supporting information enclosed.
Fiche: 48453:228-48453:327
acn: 8902090339

January 26, 1989 — D.C. Scaletti, NRC, letter discussing NRC plans for visit to GE offices during week of February 6, 1989, to complete audit of QA program applied to advanced BWR design process.
Fiche: 48347:092-48347:094
acn: 8902020378

January 31, 1989 — P.W. Marriott, GE, letter forwarding proprietary Chapter 19, "response to severe accident policy statement," and Appendix 20a, "responses to additional information" of Amendment 4 to GE advanced BWR SSAR. Chapter 19 and Appendix 20a withheld.
Fiche: 48414:015-48414:305
acn: 8902060235

February 3, 1989 — D.C. Scaletti, NRC, letter forwarding request for additional information regarding GE application for certification of advanced BWR design. Request addresses areas of SRP Chapters 9 and 11 to 13 and question regarding thermal hydraulic stability. Response requested by March 6, 1989.
Fiche: 48428:282-48428:302
acn: 8902080234

February 28, 1989

Text-safety report--reference safety analysis report and amendments (RSAR) nonproprietary Chapter 20 to Amendment 5 to "Advanced BWR SSAR."
Fiche: 48804:258-48805:233
acn: 8903100068

February 28, 1989

P.W. Marriott, GE, letter forwarding Amendment 5 to "Advanced BWR SSAR" consisting of nonproprietary Chapter 20 and proprietary Sections 7.2 and 7.5. Binders for Chapter 19 along with new tables for Chapters 1, 7 and 3 and affidavit also enclosed. Sections withheld.
Fiche: 48804:251-48805:233
acn: 8903100064

March 7, 1989

P.W. Marriott, GE, letter forwarding responses to NRC February 2, 1989, request for additional information regarding SSAR for advanced BWR. Response pertains to Chapters 9, 11, 12 and 13.
Fiche: 48805:234-48805:325
acn: 8903100033

March 31, 1989

Text-safety report--reference safety analysis report and amendments (RSAR). Nonproprietary Amendment 6 to GE advanced BWR SSAR.
Fiche: 49535:010-49536:339
acn: 8904250093

March 31, 1989

P.W. Marriott, GE, letter forwarding proprietary and nonproprietary portions of Amendment 6 to GE advanced BWR SSAR. Proprietary pages withheld.
Fiche: 49535:001-49536:339
acn: 8904250083

May 16, 1989

D.C. Scaletti, NRC, letter to P.W. Marriott, GE, requesting additional information regarding application for certification of advanced BWR design. Questions cover QA instrumentation and controls, electromagnetic compatibility qualification and design and performance information. Response requested by July 11, 1989.
Fiche: 49955:214-49955:274
acn: 8905300058

June 2, 1989

Test-safety report--nonproprietary Amendment 7 to GE advanced BWR SSAR.
Fiche: 50306:068-50308:010
acn: 8906270069

June 2, 1989

P.W. Marriott, GE, letter forwarding proprietary and nonproprietary sections of Amendment 7 to GE advanced BWR SSAR. Proprietary Sections 9, 11, 15, 19b, and 19c withheld.
Fiche: 50306:063-50308:010
acn: 8906270062

June 16, 1989

D.C. Scaletti, NRC, forwarding letter to GE, advising of intended visit to audit process of verification and validation for advanced BWR software development.
Fiche: 50290:072-50290:077
acn: 8906260161

June 16, 1989

C.L. Miller letter forwarding to P.W. Marriott, GE, with Director's Decision letter of transmittal and FR notice in response to OCRE petition filed under 10 CFR 2.206. Petitioner expressed concerns regarding March 9, 1989, power oscillation event at LaSalle Unit 2 and requested Commission action.
Fiche: 50291:038-50291:073
acn: 8906260026

June 19, 1989

C.L. Miller, NRC, letter forwarding to P.W. Marriott, GE, resolution of outstanding advanced BWR Standard SAR issues resulting from GE/NRC May 31 and June 1, 1989, meetings. Proposed new Chapter 15 analysis for events impacted by implementation of two motor-generator sets summarized.
Fiche: 50253:072-50253:132
acn: 8906220068

June 23, 1989

P.W. Marriott, GE, letter forwarding proprietary resolution of outstanding advanced BWR SSAR issue regarding LOCA calculational method and responses to QA Branch request for additionally information dated May 16, 1989. Enclosure withheld.
Fiche: 50363:132-50363:132
acn: 8906290006

June 23, 1989

P.W. Marriott, GE, letter forwarding with proposed technical specifications for advanced BWR SSAR Chapter 16 with exception of instrumentation Section 3.4. Changes listed.
Fiche: 50328:142-50329:275
acn: 8906280317

June 28, 1989

P.W. Marriott, GE, letter forwarding amended response to QA Branch on May 16, 1989, request for additional information regarding resolution of outstanding advanced BWR SSAR issues including compliance with quality-related regulatory guides and regulatory guides applicable to advanced BWR.
Fiche: 50418:017-50418:028
acn: 8907050305

June 30, 1989

D.C. Scaletti, NRC, letter dated June 5, 1989, from Director's Office of NRR acknowledging receipt of petition filed by Ecology Center of Southern California and stating that petition is being treated under 10 CFR 2.206.
Fiche: 50458:114-50458:120
acn: 8907100212

June 30, 1989

C.D. Gentillon, letter forwarding draft, "Component Failure Data Handbook," technical report.
Fiche: 70031:002-70031:167
acn: 8910250036
acn: 9201290130

July 13, 1989

J.S. Gay, letter forwarding additional information on SSAR for advanced BWR per D.C. Scaletti May 16, 1989, request. Responses principally pertain to Chapters 7 and 8.
Fiche: 50595:107-50595:154
acn: 8907190174

July 28, 1989

Text-safety report--reference safety analysis report and amendments (RSAR). Amendment 8 to GE advanced BWR SSAR.
Fiche: 50783:350-50785:039
acn: 8908030168

July 28, 1989

P.W. Marriott, GE, letter forwarding proprietary and nonproprietary Amendment 8 to GE advanced BWR SSAR. Chapter 19 amended to include internal events. Submittal concludes primary SSAR submittals on certification program. Proprietary Amendment 8 withheld.
Fiche: 50783:348-50783:349
acn: 8908030162

August 2, 1989

P.W. Marriott, GE, letter forwarding to NRC May 16, 1989, request for additional information on SSAR for advanced BWR Chapters 7 and 8 regarding topical reports to support design and safety system logic and control power supply respectively.
Fiche: 50861:331-50861:352
acn: 8908090359

August 4, 1989

R.C. Mitchell, letter forwarding corrected page 19.1-1 to Chapter 19, "Response to Severe Accident Policy Statement," of SSAR for advanced BWR correcting calculated core damage frequency from 4.27E-6 per year to 4.27E-7 per year. Proprietary page withheld.
Fiche: 50862:190-50862:191
acn: 8908090011

August 7, 1989

T.E. Murley, NRC, letter provides clarification and further guidance regarding containment design to assure that containment conditional failure probability less than 1 in 10 when weighted over credible core damage sequences. Goal of 0.1 possible.
Fiche: 50916:133-50916:134
acn: 8908140099

August 17, 1989

C.L. Miller, NRC, letter forwarding draft SER regarding final design approval and design certification of advanced BWR for use.
Fiche: 51045:279-51046:055
acn: 8908290025

August 23, 1989

R.C. Mitchell, letter forwarding response to NRC May 16, 1989, for additional information on SSAR for advanced BWR regarding Chapters 7 and 8. Panel internal environmental maintained to ensure that reliability goals achieved.
Fiche: 51035:326-51035:343
acn: 8908280230

August 25, 1989

R.C. Mitchell, letter forwarding Amendment 8 to advanced BWR SSAR Chapter 13, "Conduct of Operations," Subsection 13.6, "Physical Security." Amendment withheld (Ref. 10 CFR 73.21).
Fiche: 51180:238-51180:238
acn: 8909120028

August 31, 1989

Text-safety report--licensing and related issues; draft SER regarding final design approval and design certification of advanced BWR.
Fiche: 51045:282-51046:055
acn: 8908290027

September 29, 1989

Text-safety report--"Summary of In-Plant Test of Fine Motion CRD."
Fiche: 51545:317-51545:332
acn: 8910180231

October 12, 1989 — D.J. Robare, letter forwarding, "Summary of In-Plant Test of Fine Motion CRD," in response to Question 440.8 of July 7, 1989, request regarding final report on Fine Motion CRD In-Plant test program.
Fiche: 51545:316-51545:332
acn: 8910180217

November 17, 1989 — Text-safety report--nonproprietary Amendment 8 to Advance BWR SSAR.
Fiche: 51853:095-51855:278
acn: 8911280344

November 17, 1989 — P.W. Marriott, GE, letter forwarding nonproprietary Amendment 9 to advanced BWR SSAR.
Fiche: 51853:093-51855:278
acn: 8911280341

November 17, 1989 — P.W. Marriott, GE, letter forwarding proprietary Amendment 9 to advanced BWR SSAR. Amendment withheld.
Fiche: 51830:080-51830:083
acn: 8911220239

November 27, 1989 — P.W. Marriott, GE, letter forwarding proprietary section of Chapter 8 responses to May 16, 1989, request for additional information regarding SSAR for advanced BWR.
Fiche: 51918:185-51918:185
acn: 8912050202

November 27, 1989 — P.W. Marriott, GE, letter forwarding Chapter 8 responses to D.C. Scaletti May 16, 1989, request for additional information on SSAR for advanced BWR.
Fiche: 51896:200-51896:287
acn: 8912010101

November 28, 1989 — D.C. Scaletti, NRC, letter forwarding request for additional information regarding GE application for certification of advanced BWR design addressing severe accident review information provided in Appendix 19d of advanced BWR SSAR by January 8, 1990.
Fiche: 51890:004-51890:015
acn: 8912010069

December 12, 1989 — E.E. Nichols, letter forwarding advanced BWR master index and Amendment 8 changes per request. Without enclosures.
Fiche: 52758:110-52758:125
acn: 9002270223

January 4, 1990 — E.E. Nichols, letter forwarding C.E. Buchholz December 27, 1989, letter to I. Madni floppy disk for files and printout of Readme filed from floppy. Without floppy disk.
Fiche: 52758:112-52758:125
acn: 9002270227

January 9, 1990 — P.W. Marriott, GE, letter forwarding proprietary Chapter 19 responses to November 28, 1989, request for additional information on SSAR for advanced BWR. Responses withheld.
Fiche: 52290:104-52290:104
acn: 9001110137

January 11, 1990 — E.E. Nichols, letter forwarding floppy disk containing data files from CAFTA fault tree program in response to Question 44 of November 28, 1989, letter. Enclosure withheld.
Fiche: 52758:111-52758:111
acn: 9002270224

January 11, 1990 — R.C. Stirn, letter forwarding response to items discussed during December 4 and 6, 1990, telcons on reactor systems regarding SER input for advanced BWR SSAR Chapters 4, 5, 6, 9, and 15. Proprietary responses provided under separate cover.

January 17, 1990 — P.W. Marriott, GE, letter forwarding page status listing dated December 11, 1989, for nonproprietary pages of SSAR for advanced BWR. Listing identifies latest amendment number applicable for each page of SSAR.
Fiche: 52343:209-52343:251
acn: 9001190118

January 18, 1990 — C.P. Tan, trip report of November 28 through 30, 1989, visit to GE office in San Jose, California regarding audit of seismic design of advanced BWR and to resolve other outstanding issues as identified in advanced BWR draft SER in areas of branch review.
Fiche: 70141:149-70141:173
acn: 9002070111

January 26, 1990 — D.C. Scaletti, NRC, letter requesting additional information regarding GE application for certification of advanced BWR design. Response requested by February 28, 1990.
Fiche: 52542:014-52542:018
acn: 9002050031

January 31, 1990 — J.N. Singh, text-procurement and contracts, "Advanced BWR Standard Plant Seismic Design Review," informal report.
Fiche: 70141:154-70141:173
acn: 9002070112

February 9, 1990 — D.C. Scaletti, NRC, letter notifies of preliminary audit scheduled for February 14 and 15, 1990, regarding advanced BWR design. Audit team members listed.
Fiche: 52776:107-52776:107
acn: 9002280162

February 28, 1990 — D.C. Scaletti, NRC, letter notifies of March 6 and 7, 1990, meetings to discuss advanced BWR control room design regarding Chapter 18 review and human factors assumptions used in advanced BWR PRA. Agenda enclosed.
Fiche: 52894:043-52894:047
acn: 9003080256

February 28, 1990 — R.C. Mitchell, letter forwarding response to January 26, 1990, request for additional information on SSAR for advanced BWR. Licensee will amend SSAR with response in future amendment.
Fiche: 52798:119-52798:144
acn: 9003020238

March 13, 1990 — A.H. Hsia, meeting summaries-internal (non-transcript) summary of November 28 through 30, 1989, meetings with GE in San Jose, California regarding seismic and soil-structure issues in draft SER and seismic design audit on GE advanced BWR. List of attendees handouts presented at meeting and trip report enclosed.
Fiche: 53958:149-53958:180
Fiche: 70208:238-70208:295
acn: 9003210165

March 14, 1990 — D.C. Scaletti, NRC, letter forwarding request for additional information regarding application for certification of advanced BWR design.
Fiche: 53079:018-53079:023
acn: 9003200064

March 28, 1990 — P.W. Marriott, GE, letter forwarding proprietary sections of Chapters 6, 8, 9, 12, 19, and 20 of Amendment 10 to SSAR for advanced BWR. Sections withheld.
Fiche: 53265:068-53265:069
acn: 9004020088

March 28, 1990 — Text-safety report--Amendment 10 to advanced BWR SSAR.
Fiche: 53254:020-53256:035
acn: 9004030278

March 28, 1990 — P.W. Marriott, GE, letter forwarding non-proprietary information consisting of Amendment 10 to GE advanced BWR SSAR. Submittal also includes response to TMI Action Item II.B.2 regarding plant shielding and descriptions of combustion turbine-generator and lower drywell flooder.
Fiche: 53254:018-53256:035
acn: 9004030276

April 5, 1990 — S.S. Dua, letter forwarding draft amendment to SSAR updating Section 4.6, "Functional Design of Reactivity Control System," to incorporate electro-mechanical brake replacing original centrifugal brake. Proprietary enclosure withheld.
Fiche: 53372:010-53372:022
acn: 9004090346

April 16, 1990 — P.W. Marriott, GE, letter forwarding response to March 14, 1990, request for additional information regarding SSAR for advanced BWR Chapters 7 and 10 covering hardware-software constraints, performance constraints, system and equipment levels, and oxygen system injection.
Fiche: 53524:030-53524:057
date: 900416

May 1, 1990 — D.C. Scaletti, NRC, letter forwarding preliminary draft safety evaluation regarding GE application for certification of advanced BWR design. Requests schedule that is consistent with resolving identified outstanding issues by end of May 1990.
Fiche: 53732:180-53732:233
acn: 9005070389

May 1, 1990 — D.C. Scaletti, NRC, letter forwarding preliminary draft safety evaluation regarding staff review of utility application for certification of advanced BWR design. Requests schedule consistent with resolving outstanding issues by end of May 1990.
Fiche: 53789:140-53789:193
acn: 9005100142

May 1, 1990 — D.C. Scaletti, NRC, letter forwarding request for additional information regarding GE application for certification of advanced BWR designs. Response requested by May 30, 1990.
Fiche: 53745:034-53745:043
acn: 9005070353

May 2, 1990

Text-safety report--nonproprietary sections of Amendment 11 to GE advanced BWR SSAR covering response to standby gas treatment system questions addition of initial test program for turbine island and radwaste facilities and draft SER open items.
Fiche: 53900:094-53900:229
acn: 9005220232

May 2, 1990

G.L. Sozzi, corrected letter forwarding listed nonproprietary sections of Amendment 11 to GE advanced BWR SSAR including Chapter 1, "Introduction and General Description of Plant," and Chapter 3, "Design of Structures Components Equipment and System...".
Fiche: 53900:092-53900:229
acn: 9005220228

May 2, 1990

Text-safety report--nonproprietary Amendment 11 to GE advanced BWR SSAR with May 23, 1990, letter.
Fiche: 53749:207-53751:018
acn: 9005080015

May 2, 1990

G.L. Sozzi, letter forwarding proprietary and nonproprietary sections of Amendment 11 to GE advanced BWR SSAR. Proprietary version withheld.
Fiche: 53749:205-53751:018
acn: 9005080013

May 4, 1990

D.C. Scaletti, NRC, letter forwarding request for additional information regarding application for certification of advanced BWR design. Response requested by May 30, 1990.
Fiche: 53742:347-53742:356
acn: 9005070352

May 10, 1990

D.C. Scaletti, NRC, letter forwarding NRC summary of November 28 through 30, 1989, meeting in San Jose, California regarding outstanding seismic and soil-structure issues. Schedule requested consistent with resolving outstanding issues by May 31, 1990.
Fiche: 53958:146-53958:205
acn: 9005300013

May 14, 1990

D.C. Scaletti, NRC, notification of May 16 and 17, 1989, meeting with GE in San Jose, California to discuss NRC review of advanced BWR including drywell head failure containment overpressure protection source term and shutdown risk. Agenda enclosed.
Fiche: 53865:148-53865:152
acn: 9005170166

May 16, 1990

R.C. Mitchell, provides additional information regarding automatic despressurizer system (ADS) timer concerning engineering operating procedures. Advs actuation should be allowed to occur and quickly depressurize vessel if high pressure ECCS cannot control water level.
Fiche: 53920:359-53920:359
acn: 9005240043

May 16, 1990

R.C. Mitchell, NRC, letter forwarding response to outstanding issues and request for additional information from November 28 through 30, 1989, advanced BWR seismic design audit at GE offices in San Jose, California. Information resolves Sections 2 and 3 to draft SER and action items.
Fiche: 53902:106-53902:195
acn: 9005220234

May 31, 1990	P.W. Marriott, GE, letter forwarding Chapter 12 responses to May 4, 1990, request for additional information on SSAR for advanced BWR. Chapter 11 responses are GE proprietary and will be submitted under separate cover. Fiche: 54086:086-54086:087 acn: 9006060323
May 31, 1990	P.W. Marriott, GE, letter forwarding proprietary responses to resolve safety evaluation issues for advanced BWR SSAR Chapters 3, 6, and 11 per D.C. Scaletti May 1, 1990, request. Responses withheld. Fiche: 54000:004-54000:004 acn: 9006040321
May 31, 1990	P.W. Marriott, GE, letter forwarding proprietary responses to D.C. Scaletti May 1, 1989, request for additional information regarding SSAR Chapter 19. SSAR will be amended with responses in future amendment. Responses withheld. Fiche: 54000:003-54000:003 acn: 9006040314
May 31, 1990	P.W. Marriott, GE, letter forwarding proprietary response to D.C. Scaletti May 1, 1989, request for additional information regarding Amendments 4 and 8 to GE advanced BWR SSAR. With proprietary fragility calculations and 25 oversize proprietary drawings. Proprietary calculations and drawings withheld. Fiche: 54112:166-54112:167 acn: 9006070191
June 4, 1990	Text-safety report--nonproprietary Chapters 1, 3, 4, 6, 9, 10, 15, and 20 of Amendment 12 to GE advanced BWR SSAR. Fiche: 54065:280-54066:042 acn: 9006060294
June 4, 1990	P.W. Marriott, GE, letter forwarding nonproprietary Chapters 1, 3, 4, 6, 9, 10, 15, and 20 of Amendment 12 to GE advanced BWR SSAR. Fiche: 54065:278-54066:042 acn: 9006060283
June 4, 1990	P.W. Marriott, GE, letter forwarding proprietary Figure 4.6-6 of Amendment 12 to GE advanced BWR SSAR. Figure withheld. Fiche: 54088:358-54088:358 acn: 9006070057
June 7, 1990	S.S. Dua, letter forwarding Chapter 11 responses to D.C. Scaletti May 31, 1990, request for additional information on SSAR for advanced BWR. Responses withheld. Fiche: 54201:195-54201:195 acn: 9006120098
June 7, 1990	S.S. Dua, letter forwarding proprietary drawings providing additional information regarding GE advanced BWR SSAR per D.C. Scaletti May 4, 1990, request. Material regarding Chapter 11 proprietary information sent to NRC per Amendment 6 to SSAR. With 38 proprietary drawings. Drawings withheld. Fiche: 54192:064-54192:065 acn: 9006140139

June 8, 1990 — D.C. Scalett, NRC, meeting summaries-internal (non-transcript) summary of May 15 and 17, 1990, meeting with GE in San Jose, California regarding advanced BWR.
Fiche: 54194:066-54194:078
acn: 9006140231

June 12, 1990 — D.R. Wilkins, NRC, letter forwarding comparison of advanced LWR requirements document and GE advanced BWR SSAR design.
Fiche: 55005:127-55005:136
acn: 9008220012

June 15, 1990 — J. Taylor, NRC, compares GE advanced LWR SSAR design with current advanced LWR requirements document. GE advanced LWR SSAR design provides unique opportunity to demonstrate new 10 CFR Part 52 standard plant licensing process.
Fiche: 54370:144-54370:145
acn: 9007020036

June 29, 1990 — P.W. Marriott, GE, letter forwarding proprietary Chapter 11 responses to D.C. Scaletti May 4, 1990, reqtest for additional information on SSAR for advanced BWR. Responses withheld.
Fiche: 54426:337-54426:337
acn: 9007060022

July 3, 1990 — P.W. Marriott, GE, Text-safety report Amendment 13 to GE advanced BWR SSAR. With July 3, 1990, letter.
Fiche: 54435:036-54436:038
acn: 9007090031

July 3, 1990 — P.W. Marriott, GE, letter forwarding proprietary sections of Amendment 13 to GE advanced BWR SSAR consisting of Chapters 11 and 18 through 20. Enclosure withheld.
Fiche: 54433:310-54433:311
acn: 9007090316

July 12, 1990 — G.W. Ehlert, general external technical reports, "Advanced BWR Control Building Seismic Report."
Fiche: 54646:067-54646:104
acn: 9007200234

July 12, 1990 — P.W. Marriott, GE, letter forwarding, "Advanced BWR Control Building Seismic Report," per request. GE will amend SSAR with response in future amendment.
Fiche: 54646:065-54646:104
acn: 9007200228

July 12, 1990 — P.W. Marriott, GE, letter forwarding proposed modifications to zinc injection system described in Subsection 9.3.11 of SSAR for advanced BWR. Modification will provide necessary plant features so that zinc injection to feedwater may be added if advisable.
Fiche: 54626:307-54626:312
acn: 9007190246

July 13, 1990 — P.W. Marriott, GE, letter forwarding responses to resolve safety evaluation issues per D.C. Scaletti May 1, 1990, request. Issues cover method of attachment of level instruments that facilitate automatic switch over of pumps from condensate storage tank to suppression pool.
Fiche: 54604:006-54604:011
acn: 9007180280

July 16, 1990

P.W. Marriott, GE, letter forwarding draft of modified advanced BWR SSAR Figure 9.2-5 Sheet 1 and new advanced BWR SSAR Figure 9.2-5 Sheet 3 regarding description of remaining makeup water system within scope of SSAR. With two oversize figures.
Fiche: 54607:188-54607:189
acn: 9007180271

July 23, 1990

P.W. Marriott, GE, letter forwarding fuel pool cooling and cleanup system clarifications and draft revisions to SSAR for advanced BWR.
Fiche: 54704:331-54704:339
acn: 9007260054

July 27, 1990

D.C. Scaletti, NRC, letter forwarding request for additional information regarding GE application for certification of advanced BWR design.
Fiche: 54805:335-54805:348
acn: 9008020005

August 8, 1990

P.W. Marriott, GE, letter provides schedule for providing responses to Chapter 18 request for additional information. GE will provide 20 percent of responses regarding request for additional information by September 28, 1990.
Fiche: 54953:359-54953:359
date: 900808

August 9, 1990

P.W. Marriott, GE, letter forwarding responses to discussion items from May 16 and 17, 1990, meetings including drywell head failure containment overpressures protection source term and fire and seismic risk.
Fiche: 54956:311-54956:322
acn: 9008130232

August 15, 1990

D.C. Scaletti, NRC, letter forwarding request for additional information regarding GE application for certification of advanced BWR design. Responses to Enclosure 1 requested by August 31, 1990, and responses to Enclosures 2 and 3 by September 28, 1990.
Fiche: 55015:314-55015:339
acn: 9008230027

August 22, 1990

P.W. Marriott, GE, letter forwarding Chapter 10, "Steam and Power Conversion System," draft revisions to SSAR for advanced BWR. Information provided to clarify portions of SSAR Subsections 10.4.4 and 10.4.5 regarding turbine bypass system and circulating water system respectively.
Fiche: 55060:350-55060:353
acn: 9008290069

August 22, 1990

P.W. Marriott, GE, letter forwarding response to August 15, 1990, request for additional information regarding SSAR for advanced BWR. Licensee will amend SSAR with responses in future amendments.
Fiche: 55060:009-55060:030
acn: 9008280004

August 22, 1990

P.W, Marriott, GE, letter forwarding proprietary Chapter 9 responses to D.C. Scaletti letter dated August 15, 1990, requesting additional information on SSAR for advanced BWR.
Fiche: 55054:230-55054:230
acn: 9008240119

August 23, 1990 — P.W. Marriott, GE, letter forwarding proprietary Chapter 18, "Human Factors," draft revisions to standard SAR for advanced BWR. Enclosure withheld.
Fiche: 55076:150-55076:150
acn: 9008310014

September 14, 1990 — P.W. Marriott, GE, letter forwarding balance of proprietary Chapter 11 responses to D.C. Scaletti May 4, 1990, request for additional standards SAR for advanced BWR. Enclosure withheld.

September 19, 1990 — D.C. Scaletti, NRC, letter forwarding request for additional for certification of advanced BWR design.
Fiche: 55294:338-55294:353
acn: 9009260234

September 28, 1990 — R.C. Stirn, letter forwarding Chapter 9 responses to request for additional information on SSAR for advanced BWR per D.C. Scaletti letter dated August 15, 1990.
Fiche: 55498:159-55498:255
acn: 9010160153

September 28, 1990 — R.C. Stirn, letter forwarding drafts of modified advanced BWR SSR proprietary Figures 9.3-6 and 9.3-7 per D.C. Scaletti letter dated August 15, 1990. With three oversize figures. Figures withheld.
Fiche: 55513:100-55513:101
acn: 9010170040

September 28, 1990 — R.C. Stirn, letter forwarding Chapter 9 proprietary responses to request for additional information on SSAR for advanced BWR per D.C. Scaletti letter dated August 15, 1990. Responses will be used in future amendments of SSAR. Enclosure withheld.
Fiche: 55498:054-55498:054

October 2, 1990 — D.J. Robare, letter forwarding proprietary Amendment 14 to GE advanced BWR SSAR. Amendment 14 withheld.
Fiche: 55490:118-55490:119
acn: 9010160159

October 2, 1990 — Text-safety report--Amendment 14 to advanced BWR SSAR.
Fiche: 55413:052-55414:106
acn: 9010090076

October 2, 1990 — D.J. Robare, letter forwarding nonproprietary Amendment 14 to advanced BWR SSAR.
Fiche: 55413:050-55414:106
acn: 9010090072

October 9, 1990 — P.W. Marriott, GE, letter forwarding response to NRC July 27, 1990, request for additional information on SSAR for advanced BWR. Response to Questions 620.3, 620.7, 620.13, 620.16, 620.19, 620.25, and 620.29. Contain proprietary information and will be submitted under separate cover.
Fiche: 55552:090-55552:092
acn: 9010240040

October 9, 1990 — P.W. Marriott, GE, letter forwarding proprietary responses to additional information requested in NRC letter dated July 27, 1990.
Fiche: 55528:187-55528:187
acn: 9010220184

October 17, 1990

P.W. Marriott, GE, letter forwarding proprietary response to NRC/GE May 16 and 17, 1990, meeting Discussion Topics 4 and 5 regarding shutdown risk and lower drywell flooder. Enclosures withheld.
Fiche: 55558:188-55558:189
acn: 9010230066

October 26, 1990

P.W. Marriott, GE, letter forwarding responses to D.C. Scaletti August 15, 1990, request for additional information regarding SSAR Chapter 9.
Fiche: 55739:317-55739:330
acn: 9011060144

October 26, 1990

P.W. Marriott, GE, letter forwarding revised Chapter 11 responses to Questions 430.157 and 430.165B per May 4, 1990, request for additional information regarding SSAR. Clarifications regarding onsite radwaste storage and SSAR modifications also enclosed. Proprietary enclosures withheld.
Fiche: 55685:121-55685:121
acn: 9011010211

October 28, 1990

P.W. Marriott, GE, letter forwarding Chapter 9 proprietary information response to Question 430.215 per August 15, 1990, request for additional information regarding SSAR.
Fiche: 55674:170-55674:170
acn: 9011010224

November 2, 1990

P.W. Marriott, GE, letter forwarding response to NRC July 27, 1990, request for additional information on SSAR for advance BWR. Response to Question 620.28 contains information which is proprietary and will be submitted under separate cover.
Fiche: 55776:071-55776:086
acn: 9011130179
Fiche: 55757:062-55757:062
acn: 9011090101

November 5, 1990

R.C. Mitchell, NRC, letter forwarding Chapter 11, "Radwaste Management," draft revisions per March 31, 1989, submittal or Amendment 6 to advanced BWR SSAR. Enclosure withheld.
Fiche: 55844:023-55844:023
acn: 9011130053

November 13, 1990

P.W. Marriott, GE, letter forwarding proprietary information of preliminary update of fuel related portions of SSAR for advanced BWR. Enclosures withheld.
Fiche: 55877:251-55877:251
acn: 9011160204

November 15, 1990

P.W. Marriott, GE, letter forwarding proprietary additional information regarding Chapter 9 responses on fire protection diesel generator and station blackout concerning standard SAR for advanced BWR. Enclosures withheld.
Fiche: 55949:032-55949:032
acn: 9011260065

November 30, 1990

Text-safety report--Amendment 15 to advanced BWR SSAR
Fiche: 56008:003-56009:271
acn: 9012060054

November 30, 1990 — P.W. Marriott, GE, letter forwarding Amendment 15 to advanced BWR SSAR.
Fiche: 56008:001-56009:271
acn: 9012060038

November 30, 1990 — P.W. Marriott, GE, letter forwarding proprietary Amendment 15 to advanced BWR SSAR. Amended sections include: Chapter 2, "Site Characteristics;" Chapter 3, "Design of Structures Components Equipment and System;" Chapter 4, "Reactor;" and Chapter 6, "ESF."
Fiche: 56028:279-56028:281
acn: 9012060029

November 30, 1990 — P.W. Marriott, GE, letter forwarding revised portions of Subsections 13.6, "Physical Security," of Amendment 15 to Advanced SSAR Chapter 13, "Conduct of Operations," and 20.3, "Questions and Response Guide." Enclosures withheld.
Fiche: 59563:052-59563:052
acn: 9110300217

December 17, 1990 — P.W. Marriott, GE, letter forwarding final submittal of Chapter 18 proprietary information in response to July 27, 1990, request for additional information on standard SAR for advanced BWR. Enclosures withheld.
Fiche: 56182:282-56182:282
acn: 9012210011

December 17, 1990 — P.W. Marriott, GE, letter submitting final response to July 27, 1990, request for additional information on standard SAR for advanced BWR Chapter 18. Proprietary responses being submitted separately.
Fiche: 56154:146-56154:156
acn: 9012200121

December 20, 1990 — D.C. Scaletti, NRC, letter forwarding request for additional information regarding application for certification of advanced BWR design.
Fiche: 56251:146-56251:168
acn: 9101020308

December 20, 1990 — R.C. Stirn, letter forwarding proprietary responses to Chapter 9 of SSAR regarding fire protection emergency diesel generators and station blackout per D.C. Scaletti September 19, 1990, request. Enclosures withheld.
Fiche: 56225:299-56225:300
acn: 9012270291

December 21, 1990 — Text-safety report--Amendment 15 to GE advanced BWR SSAR consisting of Chapter 5, "Figures."
Fiche: 56433:002-56433:089
acn: 9101080339

December 21, 1990 — R.C. Stirn, letter forwarding Amendment 15 to GE advanced BWR SSAR consisting of Chapter 5, "Figures."
Fiche: 56433:001-56433:089
acn: 9101080237

January 1, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-4 Power Ascension and Power Changes."
Fiche: 56389:104-56389:114
acn: 9101110234

January 8, 1991 — Text-safety report--nonproprietary replacement figures for GE advanced BWR SSAR.
Fiche: 56431:341-56431:362
acn: 9101140028

January 8, 1991 — D.J. Robare, letter forwarding nonproprietary replacement figures for GE advanced BWR SSAR. Page size changed from 8 1/2 x 11 to 11 x 17.
Fiche: 56431:340-56431:362
acn: 9101140026

January 8, 1991 — D.J. Robare, letter forwarding proprietary replacement figures for GE advanced BWR SSAR. Page size changes from 8 1/2 x 11 to 11 x 17. Enclosures withheld.
Fiche: 56369:039-56369:041
acn: 9101100034

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision to "IOP-10 Unit On-Line from Hot Standby or Hot Shutdown."
Fiche: 56389:155-56389:162
acn: 9101110246

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision to "IOP-9 Maintaining Hot Standby or Hot Shutdown."
Fiche: 56389:148-56389:154
acn: 9101110245

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-8 Unit Off-line to Hot Standby or Hot Shutdown."
Fiche: 56389:141-56389:147
acn: 9101110244

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-7 Cooldown to Cold Shutdown Main Condenser Not Available."
Fiche: 56389:131-56389:140
acn: 9101110240

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-6 Cooldown to Cold Shutdown Main Condenser Available."
Fiche: 56389:121-56389:130
acn: 9101110239

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-5 Unit Shutdown to Unit Off-line Main Condenser Available."
Fiche: 56389:115-56389:120
acn: 9101110236

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-3 Turbine Startup and Generator Synchronization."
Fiche: 56389:093-56389:103
acn: 9101110233

January 9, 1991 — W.B. Torres, text-specifications and test reports Revision A to "IOP-2 Heatup and Pressurization."
Fiche: 56389:082-56389:092
acn: 9101110230

January 9, 1991	W.B. Torres, text-specifications and test reports Revision A to "IOP-1 Approach to Criticality." Fiche: 56389:075-56389:081 acn: 9101110229
January 9, 1991	W.B. Torres, text-specifications and test reports Revision A to "RCIC System Operating Procedures SOP-E51." Fiche: 56389:054-56389:074 acn: 9101110225
January 9, 1991	W.B. Torres, text-specifications and test reports Revision A to "RHR System Operating Procedures SOP-E11." Fiche: 56389:023-56389:053 acn: 9101110223
January 9, 1991	D.J. Robare, letter forwarding revised response to Question 620.8 to clarify position regarding standardized training materials per NRC July 27, 1990, and September 2 letters. Samples of ABWR Operating Procedure and Integrated Operating Procedures also enclosed. Fiche: 56389:021-56389:162 acn: 9101110211
January 11, 1991	R.C. Stirn, letter forwarding proprietary information responses to discussion items regarding telcons concerning SER input for advanced BWR SSAR Chapters 4, 5, 6, 9, and 15 on reactor systems. Responses withheld. Fiche: 56516:273-56516:274 acn: 9101280128
January 17, 1991	D.J. Robare, letter forwarding proprietary response to Question 430.162 and Revised Response to Question 430.166F regarding Chapter 11 of SSAR for advanced BWR per May 4, 1990, request for additional information. Response withheld. Fiche: 56506:134-56506:134 acn: 9101240071
February 5, 1991	S.S. Dua, letter forwarding response to discussion Item 1 of January 1, 1991, GE/NRC telcon regarding seismic review portion of advanced BWR SSAR including impact of changes in seismic hazard function on seismic screening procedure. Fiche: 56660:184-56660:186 acn: 9102110001
February 20, 1991	P.W. Marriott, GE, letter forwarding proprietary response to December 20, 1990, NRC request for additional information regarding SSAR for advanced BWR. Enclosures withheld. Fiche: 56924:134-56924:134 acn: 9103070196
February 20, 1991	P.W. Marriott, GE, letter responding to NRC December 20, 1990, request for additional information regarding SSAR for advanced BWR. Fiche: 56922:215-56922:298 acn: 9103070037

February 21, 1991 — D. Crutchfield, NRC, letter discusses severe accident mitigation design alternatives for certified standard designs. Licensees to inform NRC regarding plans to consider severe accident mitigation design alternatives for proposed designs.
Fiche: 56857:178-56857:181
acn: 9102280120

February 22, 1991 — P.W. Marriott, GE, letter forwarding proprietary response to February 1, 1991, conference call regarding safeguards per February 6, 1989, submittal of Amendment 7 to advanced BWR SSAR.
Fiche: 56847:356-56847:356
acn: 9102280094

February 22, 1991 — Text-safety report--analysis report and amendments (RSAR) Amendment 16 to advanced BWR SSAR
Fiche: 56854:081-56855:202
acn: 9102280049

February 22, 1991 — P.W. Marriott, GE, letter forwarding Amendment 16 to advanced BWR SSAR.
Fiche: 56854:077-56855:202
acn: 9102280031

February 22, 1991 — P.W. Marriott, GE, letter forwarding proprietary Amendment 16 to advanced BWR SSAR consisting of sections of Chapters 1, 4, 6, 9, 11, 15, and 20. Enclosures withheld.
Fiche: 56850:207-56850:211
acn: 9102280021

February 22, 1991 — P.W. Marriott, GE, letter forwarding responses to safeguards discussion items from February 1, 1991, telcon. Responses withheld (Ref. 10 CFR 73.21).
Fiche: 57219:170-57219:170
acn: 9104010347

March 25, 1991 — C.L. Miller, NRC, letter requesting that GE review STS and make appropriate revisions to documents to reflect proposed technical specifications regarding advanced BWR.
Fiche: 57280:131-57280:133
acn: 9104050129

March 28, 1991 — C. Poslusny, NRC, summary of March 4 through 6, 1991, meetings with GE in San Jose, California regarding selected open items from review of SSAR for advanced BWR. List of meeting attendees enclosed.
Fiche: 57250:204-57250:208
acn: 9104040176

March 28, 1991 — P.W. Marriott, GE, letter forwarding response to open items from March 4 through 6, 1991, meetings on plant systems.
Fiche: 57242:042-57242:150
acn: 9104020307

March 28, 1991 — P.W. Marriott, GE, letter forwarding proprietary information responses to open items regarding App 3i and Section 11.4 of advanced BWR SSAR per summary status of GE-NRC March 4 through 6, 1991, meeting on plant system open items dated March 28, 1991, and March 31, 1991, submittal of Amendment 6. Enclosures withheld.
Fiche: 57242:321-57242:321
acn: 9104020277

April 1, 1991

P.W. Marriott, GE, letter forwarding responses to discussion items of February 19, 1991, GE-NRC Reactor Systems Branch conference call. GE will amend SSAR where appropriate with response in future.
Fiche: 57319:014-57319:116
acn: 9104090196

April 1, 1991

P.W. Marriott, GE, letter forwarding response to discussion item of March 29, 1991, GE-NRC Performance and Quality Evaluation Branch conference call. GE will amend SSAR where appropriate with response in future.
Fiche: 57318:201-57318:205
acn: 9104090190

April 10, 1991

D.J. Robare, letter forwarding proprietary responses to discussion items of April 3, 1991, GE-NRC Reactor Systems Branch conference all per July 3, 1990, submittal of Amendment 13 to advanced BWR SSAR Chapter 18. Enclosures withheld.
Fiche: 57418:311-57418:315
acn: 9104150190

April 12, 1991

V.M. McCree, NRC, summary of February 28, 1991, meeting with GE in Rockville, Maryland regarding GE Advance BWR control room design. List of attendees and meeting agenda enclosed.
Fiche: 57452:184-57452:189
acn: 9104190303

April 16, 1991

G.L. Sozzi, letter forwarding foldout drawing identified for later delivery in 910222 submittal of Amendment 16 to GE advanced BWR SSAR.
Fiche: 57576:104-57576:218
acn: 9104290285

April 26, 1991

P.W. Marriott, GE, letter forwarding responses to open items from March 4 through 6, 1991, meeting on plant systems.
Fiche: 57627:227-57627:314
acn: 9105030120

May 3, 1991

P.W. Marriott, GE, letter forwarding draft amendment to Chapter 12 of advanced BWR SSAR addressing GE responses to discussion items of November 15, 1990, and GE-NRC Radiation Protection Branch conference call. GE will amend SSAR with changes in future.
Fiche: 57703:210-57703:265
acn: 9105100147

May 10, 1991

P.W. Marriott, GE, letter forwarding advanced BWR SSAR figures in response to NRC August 15, 1990, letter consisting of NRC Questions 430.243A and 430.239. With five oversize drawings.
Fiche: 57872:249-57872:251
acn: 9105170100

May 10, 1991

P.W. Marriott, GE, letter forwarding modified advanced BWR SSAR proprietary figures regarding NRC Questions 430.243.A and 430.239 of 900815 request for additional information. With seven proprietary oversize drawings. Drawings withheld.
Fiche: 57783:294-57783:295
date: 910510

May 10, 1991

P.W. Marriott, GE, letter forwarding responses to GE-NRC materials and chemical engineering branch conference call of April 30, 1991, regarding material selection fracture toughness high temperature properties and turbine design. Responses will be incorporated in future amendments.
Fiche: 57811:271-57811:282
acn: 9105160128

May 10, 1991

P.W. Marriott, GE, letter forwarding response to discussion items regarding QA during design and construction per April 12, 1991, conference call with NRC. Response will be incorporated into future amendments.
Fiche: 57796:071-57796:072
acn: 9105150015

May 16, 1991

P.W. Marriott, GE, letter forwarding modifications to Table 5.2-1 of ABWR SSAR eliminating ASME inservice inspection code case N-322 and N-390 incorporated to Regulatory Guide 1.147.
Fiche: 57870:309-57870:313
acn: 9105280049

May 20, 1991

R.C. Mitchell, letter forwarding responses to GE and NRC May 7, 1991, meeting regarding open items on advanced BWR SSAR Chapter 14. Response to open items 2.1.4, 2.1.6, 2.1.7, and 2.1.9 will be transmitted by the end of June.
Fiche: 57877:307-57877:360
acn: 9105290118

May 22, 1991

T.J. Kenyon, NRC, summary of May 14, 1991, meeting with NUMARC, EPRI, GE, ABB-CE, and Westinghouse regarding schedules for review of future LWR projects.
Fiche: 57917:279-57917:334
acn: 9106040123

May 22, 1991

T.J. Kenyon, NRC, meeting summary of May 14, 1991, meeting with NUMARC, EPRI, GE, ABB-CE, and Westinghouse regarding schedules for review of future LWR projects.
Fiche: 57917:279-57917:334
acn: 9106040123

June 10, 1991

D. Crutchfield, NRC, letter forwarding draft safety evaluation report regarding review of application for certificate of advanced BWR design. Copies of report sent to ACRS for review and placed in PDR.
Fiche: 58158:082-58159:087
acn: 9106140092

June 21, 1991

D. Crutchfield, NRC, letter discussing review of Chapter 12 of advanced BWR SSAR. Recommends that viable options to resolve radiation protection issues be discussed as soon as possible.
Fiche: 58217:338-58217:341
acn: 9106260266

June 26, 1991

R.C. Mitchell, letter forwarding responses to discussion items regarding flood protection new and spent fuel storage light load handling system ultimate heat sink turbine building cooling water system reactor SVC water and turbine SVC water system per June 3 and 5, 1991, conference calls.
Fiche: 58336:318-58336:344
acn: 9107090128

June 28, 1991 — RSAR reference safety analysis report and Amendments (RSAR) Amendment 17 to advanced BWR SSAR.
Fiche: 58406:003-58407:228
acn: 9107150349

June 28, 1991 — J.S. Charnley, letter submitting Amendment 17 to SSAR including update on HVAC in reactor building update on HVAC in control building fire hazard analysis methodology update and selected responses to SER open items and amendments to Chapter 20.
Fiche: 58406:001-58407:228
acn: 9107150301

June 28, 1991 — J.S. Charnley, letter forwarding Amendment 17 to proprietary information to GE advanced BWR SSAR. Enclosures withheld.
Fiche: 58408:044-58408:044
acn: 9107120057

July 22, 1991 — D. Crutchfield, NRC, letter requesting list of assumptions used to develop schedules for certification of advanced BWR and standard BWR reactor designs by November 4, 1991.
Fiche: 58590:159-58590:161
acn: 9107260038

July 26, 1991 — J.N. Wilson, NRC, summary of February 5, 1991, meeting with GE in San Jose, California to tour testing and training facilities and to discuss design certification review issues for advanced BWR.
Fiche: 58708:227-58708:277
acn: 9108080110

July 29, 1991 — P.W. Marriott, GE, letter forwarding response to radiation protection branch request at GE/NRC July 17, 1991, meeting regarding advanced BWR fuel bundle source term information and geometry of drywell.
Fiche: 58612:356-58612:359
acn: 9107310180

July 31, 1991 — V.M. McCree, NRC, letter forwarding summary of issues related to staff review of Chapter 7, "Instrumentation and Control System," advanced BWR SSAR. Information should form basis for timely discussions and meetings to resolve issues.
Fiche: 58700:052-58700:064
acn: 9108080005

August 16, 1991 — P.W. Marriott, GE, letter forwarding proprietary advanced BWR documents regarding issues identified in reference to August 8, 1991, draft SER summary for Chapter 7.
Fiche: 58898:161-58898:165
acn: 9108220045

August 19, 1991 — A.E. Rogers, letter forwarding GE proposal pertaining to methodology to confirm adequacy of advanced BWR seismic design.
Fiche: 58890:263-58890:267
acn: 9108230259

August 20, 1991 — D. Crutchfield, NRC, letter forwarding draft SER regarding review of application for certification of advanced BWR design. Draft SER discusses results of review of GE standard SAR Chapters 3, 9, 10, 11, and 13.
Fiche: 58982:316-58983:151
acn: 9109040463

August 21, 1991

D. Scaletti, NRC, summary of July 16, 1991, meeting with GE in Rockville, Maryland regarding certification review of ABWR design. Meeting notice agenda and list of attendees enclosed.
Fiche: 58893:028-58893:046
acn: 9108270045

August 28, 1991

R.W. Borchardt, NRC, meeting summary of August 22, 1991, meeting with GE and NUMARC regarding inspections test analysis and acceptance criteria. List of attendees and handouts enclosed.
Fiche: 59040:044-59040:108
acn: 9109090074

August 30, 1991

P.W. Marriott, GE, letter requesting that F.A. Ross (advanced LWR program manager for DOE) be added to service list. Address listed.
Fiche: 59029:244-59029:244
acn: 9109050199

August 30, 1991

D. Scaletti, NRC, letter forwarding summary of issues developed during course of NRC review of Chapter 18 of SSAR for advanced BWR design. Issues should be resolved prior to issuance of FSAR.
Fiche: 59069:262-59069:269
acn: 9109110058

September 4, 1991

D.J. Robare, letter forwarding GE proprietary responses to advance BWR SSAR Chapter 18 draft SER open items. Enclosures withheld.
Fiche: 59060:001-59060:001
acn: 9109100169

September 4, 1991

D.J. Robare, letter forwarding proprietary responses to advanced BWR SSAR Chapter 8 draft SER open items. Enclosures withheld.
Fiche: 59051:153-59051:154
acn: 9109100118

September 5, 1991

V.M. McCree, NRC, meeting summary of August 6, 1991, meeting with utilities in Rockville, Maryland regarding status and preliminary findings from staff review of Chapter 19 of GE ABWR SSAR-PRA. Copy of meeting agenda attendees list and handouts enclosed.
Fiche: 59121:272-59121:325
acn: 9109170308

September 6, 1991

D. Scaletti, NRC, letter forwarding summary of issues identified as a result of review of GE application for design certification of advanced BWR including Reactor Systems Branch concerns regarding intersystem LOCAs shutdown risk and BWR stability.
Fiche: 59098:338-59098:344
acn: 9109120242

September 11, 1991

C. Poslusny, letter forwarding information not included in previous letter regarding identification of new issues for GE advanced BWR review.
Fiche: 59118:023-59118:030
acn: 9109170330

September 11, 1991 — C.L. Miller, letter providing industry with NRC initial reaction and comments to draft submittals. Draft ITAAC lacked level of detail and specific acceptance criteria appropriate for inclusion in Tier 1 ITAAC. Without enclosures.
Fiche: 59114:287-59114:287
acn: 9109160343

September 12, 1991 — C. Poslusny, letter requesting information regarding identification of design differences between advanced BWR and BWR-6 and resulting changes to draft statistical technical requirements.
Fiche: 59139:063-59139:065
acn: 9109180190

September 13, 1991 — C. Poslusny, meeting summaries-internal (non-transcript) summary of August 20, 1991, meeting with GE in San Jose, California regarding piping design for advanced BWR. Viewgraphs enclosed.
Fiche: 59191:144-59191:150
acn: 9109230068

September 16, 1991 — D. Crutchfield, NRC, letter informing licensee of three items that may affect NRC schedule for advanced BWR design certification review.
Fiche: 59157:267-59157:269
acn: 9109200082

September 19, 1991 — C.L. Miller, letter discussing resolution of issues regarding Chapter 19k of standard SAR for advanced BWR design. Scheduled consistent with resolving issues.
Fiche: 59257:123-59257:127
acn: 9109300225

September 20, 1991 — General external technical reports, "Tier 1 Design Certification Material Pilot ITAAC Examples for GE Advanced BWR Design."
Fiche: 59245:270-59245:339
acn: 9109300071

September 20, 1991 — P.W. Marriott, GE, letter forwarding, "Tier 1 Design Certification Material Pilot ITAAC Examples for GE Advanced BWR Design."
Fiche: 59245:268-59245:339
acn: 9109300070

September 24, 1991 — C. Poslusny, NRC, letter forwarding preliminary staff evaluation of shutdown risk assessment for advanced BWR.
Fiche: 59288:001-59288:006
acn: 9110030143

September 27, 1991 — A.E. Rogers, letter forwarding proprietary response to discussion item regarding Amendment 17 to advanced BWR SSAR (Table 1.8-21 Page 1.8-58) which deleted NQA-2 from list of industrial codes and standards applicable to advanced BWR. Response withheld.
Fiche: 59313:346-59313:346
acn: 9110070137

September 27, 1991 — A.E. Rogers, letter forwarding proprietary response to discussion regarding Chapter 19 of draft SER concerning QA program prevention of core damage protection from external threats and ultimate heat sink models and reliability. Response withheld.
Fiche: 59313:347-59313:347
acn: 9110070107

September 27, 1991 — R.W. Strong, letter forwarding advanced BWR SSAR Chapter 8 status report and closure action plan as followup to September 16 through 18 1991, meetings in San Jose, California.
Fiche: 60211:250-60211:349
acn: 9201060166

September 30, 1991 — Text-safety report--draft SER on Chapter 19 of GE application for certification of advanced BWR design.
Fiche: 59942:119-59942:328
acn: 9112100195

October 1, 1991 — P.W. Marriott, GE, letter forwarding support documents regarding resolution of issues related to Chapter 18 of STD SAR for advanced BWR reactor design per request in September 10 and 11, 1991, meeting in San Jose, California. Enclosures withheld (Ref. 10 CFR 2.790).
Fiche: 59323:354-59323:358
acn: 9110090173

October 1, 1991 — P.W. Marriott, GE, letter forwarding proprietary responses to Chapter 18 of SSAR issues per September 10 and 11, 1991, meetings. Enclosures withheld.
Fiche: 59317:035-59317:035
acn: 9110080063

October 1, 1991 — J.M. Taylor, NRC, letter informing of intent to issue Chapter 19 of draft SER on GE advanced BWR design. Fiche:59444:004-59444:215
Fiche: 59940:165-59940:166
Fiche: 70988:186-70989:037
Fiche: 71031:001-71031:003
acn: 9110070046

October 4, 1991 — D. Crutchfield, NRC, letter forwarding draft SER regarding review of Chapter 7 of licensee application for certification of advanced BWR design.
Fiche: 59445:225-59445:320
Fiche: 59444:001-003
acn: 9110250101

October 4, 1991 — D. Crutchfield, NRC, letter forwarding DSER regarding review of application for certification of advanced BWR design. Report discusses results of review of licensee SSAR Chapter 19, "Response to Severe Accident Policy Statement."
Fiche: 59444:001-59444:003
Fiche: 59942:116-59942:328
acn: 9110250061

October 9, 1991 — P.W. Marriott, GE, letter forwarding responses to enable resolution of issues regarding advanced BWR SER Chapters 1 through 6 and 17 (SECY-91-152). Issues includes control room habitability reactor building cooling water and TMI Action Item II.k.3.18 regarding ADS logic.
Fiche: 59403:247-59403:260
acn: 9110170138

October 11, 1991 — P.W. Marriott, GE, letter forwarding proprietary information to advanced BWR SSAR amendment 18 consisting of sections of Chapters 9, 11, 19, and 20. Information withheld.
Fiche: 59407:339-59407:341
acn: 9110180212

October 11, 1991

General external technical reports--Amendment 18 to advanced BWR SSAR Chapters 1 through 7, 9 through 12, and 14 through 20.
Fiche: 59416:007-59417:011
acn: 9110180201

October 11, 1991

P.W. Marriott, GE, letter forwarding nonproprietary information to advanced BWR SSAR amendment 18 consisting of section of Chapters 1 through 7, 9 through 12, and 14 through 20 regarding site characteristics design structures components equipment and systems and RCS and connected systems.
Fiche: 59416:001-59417:011
acn: 9110180195

October 11, 1991

P.W. Marriott, GE, letter forwarding responses inadvertently omitted from October 9, 1991, transmittal of licensee responses to resolution of issues regarding advanced BWR SER Chapters 1-6 and 7 (SECY-91-152).
Fiche: 59406:353-59406:358
acn: 9110180135

October 15, 1991

J.M. Taylor, NRC, letter informing Commission of staff intent to issue Section 18 of draft SER on GE advanced BWR design.
Fiche: 59680:014-59680:085
acn: 9110300123

October 16, 1991

D. Scaletti, NRC, meeting summaries-internal (non-transcript) summary of September 10 and 11, 1991, meetings with GE in San Jose, California regarding advanced BWR human factors engineering design.
Fiche: 59419:199-59419:224
acn: 9110210188

October 22, 1991

R. Stransky, summary of August 29, 1991, meeting with GE and BWR utilities regarding licensing topical report NEDC-31984p, "Generic Evaluations of GE BWR Power Uprate." List of meeting attendees and proprietary viewgraphs enclosed. Proprietary viewgraphs withheld.
Fiche: 59570:056-59570:058
acn: 9111080104

October 23, 1991

D. Crutchfield, NRC, letter providing initial reaction and general comments on proposed preliminary review of pilot inspection test analysis and acceptance criteria (ITAAC) for advanced BWR submittal. Proposal lacks level of detail and acceptance criteria for inclusion in material.
Fiche: 59511:168-59511:171
acn: 9111010275

October 24, 1991

P.W. Marriott, GE, letter forwarding, "Advanced BWR Control Room Design Implementation Process" per September 1991, meetings in San Jose, California regarding Chapter 18 of advanced BWR STD SAR. Table and figures withheld.
Fiche: 59483:283-59483:287
acn: 9110300089

October 24, 1991

P.W. Marriott, GE, letter forwarding proprietary portion of comprehensive program plan for design development implementation and validation of ABWR man-machine interface. Enclosures withheld (Ref. 10 CFR 2.790).
Fiche: 59461:171-59461:174
acn: 9110280363

October 25, 1991 — J.S. Charnley, letter forwarding report providing update of in-reactor surveillance programs and overall GE BWR fuel experience through December 1990.
Fiche: 59565:001-59565:013
acn: 9111060207

October 25, 1991 — P.W. Marriott, GE, letter forwarding additional documents in response to NRC August 30, 1991, letter regarding resolution of issues related to Chapter 18 of SSAR for advanced BWR design. Documents withheld.
Fiche: 59502:121-59502:124
acn: 9110300260

October 29, 1991 — C. Poslusny, NRC, summary of October 8 through 10, 1991, meeting with GE in San Jose, California regarding open issues identified by NRC staff review of licensee SSAR for advanced BWR. List of attendees and meeting agenda enclosed.
Fiche: 59640:094-59640:182
acn: 9111130187

October 30, 1991 — D. Crutchfield, NRC, letter forwarding DSE report regarding review of licensee applications for certification of advanced BWR design attached to enclosure SECY-91-320. Without SECY.
Fiche: 59680:012-59680:085
acn: 9111140145

October 31, 1991 — T.H. Boyce, NRC, summary of October 16 and 17, 1991, meetings with utilities in Rockville, Maryland regarding issues concerning inspections, tests, analyses, and acceptance criteria for advanced BWR. List of meeting attendees enclosed.
Fiche: 59546:001-59546:006
acn: 9111060310

October 31, 1991 — J.M. Taylor, NRC, letter informing Commission of NRC intent to issue selected sections of draft SER on GE advanced BWR design.
Fiche: 59987:118-59988:047
acn: 9112130022

November 1, 1991 — D.J. Robare, letter forwarding proprietary GE responses to staff position regarding GE BWR power upgrade program dated September 30, 1991. Responses in reference to licensing topical report NEDC-31897p-1, "Generic Evaluations of GE BWR Power Uprate June 1991." Responses withheld.

November 1, 1991 — P.W. Marriott, letter forwarding summary of major advanced BWR design differences assessment of how TS differ from improved TS including summary of new different or inapplicable and example of how TS would be written where TS differ from improved TS.
Fiche: 59565:111-59565:124
acn: 9111070083

November 7, 1991 — P.W. Marriott, GE, letter forwarding response to discussion Item 7, September 6, 1991, conference call regarding rod block algorithm and setpoint.
Fiche: 59649:263-59649:266
acn: 9111120264

November 12, 1991 — P.W. Marriott, GE, letter forwarding draft writeup for fire protection probabilistic risk assessment requested in draft SER on advanced BWR probabilistic risk assessment. GE will amend SSAR to include information when finalized.
Fiche: 59790:263-59790:280
acn: 9111190373

November 12, 1991 — P.W. Marriott, GE, letter forwarding proprietary draft writeup for fire protection PRA as requested in draft SER on advanced BWR PRA per SECY-91-309 dated October 1, 1991. Enclosure withheld.
Fiche: 59839:012-59839:015
acn: 9111250054

November 13, 1991 — D. Crutchfield, NRC, letter submitting scheduled projection for closure of draft SER issues. Process involves frequent and effective dialogue and licensee near-term actions.
Fiche: 59879:131-59879:135
acn: 9112030458

November 18, 1991 — V.M. McCree, NRC, letter forwarding draft of safety evaluation regarding review of GE advanced BWR SSAR Chapter 19, "Response to Severe Accident Policy Statement." Proprietary version of draft SE transmitted to licensee on October 4, 1991.
Fiche: 59912:067-59912:282
acn: 9112060224

November 21, 1991 — D. Crutchfield, NRC, requests submittal of design certification of assess severe accident mitigation design alternatives and impact on safety of design.
Fiche: 59918:351-59918:354
acn: 9112060223

November 25, 1991 — A.E. Rogers, letter forwarding tables regarding significant new open issues included in final draft SER significant open items included in all draft SERs GE future submittals and proposed issues for discussion at December meeting per NRC November 13, 1991, letter.
Fiche: 59867:330-59867:337
acn: 9112020128

November 27, 1991 — A.E. Rogers, letter forwarding proprietary responses to Open Issues 8.3.3.6 and 8.3.5 for advanced BWR SSAR Chapter 8 per commitment at September 16 through 18, 1991, meeting in San Jose. Enclosures withheld.
Fiche: 59953:102-59953:102
acn: 9112090242

November 27, 1991 — A.E. Rogers, letter forwarding responses to open issues in GE advanced BWR SSAR Chapter 8 regarding offsite power and protective systems for reactor internal pumps per September 16 through 18, 1991, meeting with NRC. Proprietary versions of response withheld.
Fiche: 59954:077-59954:217
acn: 9112090240

December 2, 1991 — P.W. Marriott, GE, letter describing plan for submitting advanced BWR technical specs to NRC per November 8, 1991, meeting. First submittal of noninstrumentation and control systems will be submitted by December 13, 1991. Third submittal regarding 65 unchanged ICOS will be submitted by January 31, 1992.
Fiche: 59954:260-59954:262
acn: 9112090224

December 4, 1991

V.M. McCree, NRC, letter requesting listed information to complete review of advanced BWR SSAR regarding incorporation of operating information into design. Response requested by January 6, 1992.
Fiche: 59984:335-59984:337
acn: 9112130052

December 9, 1991

R.L. Nease, NRC, meeting summaries-internal (non-transcript) summary of meeting with GE regarding forthcoming submittal of advanced BWR technical specs for NRC staff review.
Fiche: 60097:309-60097:311
acn:9112240035

December 9, 1991

C. Poslusny, NRC, meeting summaries-internal (non-transcript) summary of December 17 through 19, 1991, meeting with GE in San Jose, California regarding open issues concerning Chapter 9 of GE SSAR on electrical systems design.
Fiche: 60097:312-60097:316
acn: 9112240028

December 12, 1991

Text-specifications and test reports--proposed advanced BWR technical specs covering control rod accumulators reactor internal pumps - operating RHR suppression pool cooling ECCS - operating UHS and reactor building cooling water and reactor building SVC water system.
Fiche: 60088:173-60088:201
acn: 9112190169

December 12, 1991

P.W. Marriott, letter forwarding proposed advanced BWR technical specifications per vendor December 2, 1991, letter to NRC. Specifications will be documented via amendment to Chapter 16 of advanced BWR SSAR once specifications are finalized.
Fiche: 60088:172-60088:201
acn: 9112190166

December 13, 1991

P.W. Marriott, GE, letter forwarding sections of Chapter 9, "Auxiliary System and Chapter 18 - Human Factors Engineering," of SSAR for advanced BWR Amendment 19 including update of control building fire protection drawings. Enclosures withheld.
Fiche: 60083:043-60083:043
acn: 9112230044

December 13, 1991

Text-safety report--Amendment 19 to advanced BWR SSAR.
Fiche: 60097:318-60098:006
acn: 9112190171

December 13, 1991

P.W. Marriott, GE, letter forwarding Amendment 19 to advanced BWR SSAR.
Fiche: 60097:317-60098:006
acn: 9112190168

December 16, 1991

R.L. Nease, NRC, meetings summaries-internal (non-transcript) summary of December 6, 1991, meeting with GE in Rockville, Maryland regarding ODYNA and REDYA computer codes that GE is using for transient analyses of advanced BWR. Attendees list and GE presentation enclosed.
Fiche: 60109:171-60109:185
acn: 9112260191

December 16, 1991 — R.L. Nease, NRC, meeting summaries-internal (non-transcript) summary of December 5, 1991, meeting with GE in Rockville, Maryland regarding current design of advanced BWR. List of attendees and GE presentation material enclosed.
Fiche: 60165:065-60165:182
acn: 9201020127

December 17, 1991 — J. Palomar, letter forwarding text-procurement and contracts draft of, "Defense-in-Depth and Diversity Assessment of GE Advanced BWR Protection System."
Fiche: 60341:086-60341:208
acn: 9201220287

December 19, 1991 — General external technical reports, "Advanced BWR Design Reliability Assurance Program."
Fiche: 60193:201-60193:228
acn: 9201030280

December 19, 1991 — P.W. Marriott, GE, letter forwarding nonproprietary responses to resolution of issues regarding advanced BWR draft SER.
Fiche: 60131:153-60131:181
acn: 9112260268

December 19, 1991 — P.W. Marriott, GE, letter forwarding proprietary responses to resolution of issues regarding advanced BWR draft SER.
Fiche: 60131:182-60131:182
acn: 9112260264

December 19, 1991 — Text safety report--nonproprietary Revision B to update App 9a, "Reactor Building Fire Hazard Analysis."
Fiche: 60102:287-60102:301
acn: 9112260100

December 19, 1991 — P.W. Marriott, GE, letter forwarding proprietary and nonproprietary versions of Revision B to update of Appendix 9a, "Reactor Building Fire Hazard Analysis."
Fiche: 60102:286-60102:301
acn: 9112260094

December 20, 1991 — P.W. Marriott, GE, letter confirming that licensee advanced BWR application should be processed as application for Part 52 Final Design Approval and Subsequent Design Certification per 10 CFR 52.45.
Fiche: 60224:094-60224:094
acn: 9201070246

December 30, 1991 — R.C. Pierson, NRC, letter forwarding Generic Letter 82-39, "Problems with Submittals of 10 CFR 73.21 Safeguards Information for Licensing Review."
Fiche: 60237:180-60237:184
acn: 9201070307

December 30, 1991 — V.M. McCree, NRC, letter forwarding draft NUREG-CR-567P BNL-NUREG-52276p, "Review of Advanced BWR Probabilistic Risk Assessment Vol. 1: Internal and External Events Core Damage and Frequency," and proprietary Vol. 2 of subject report. Volume withheld.
Fiche: 60281:016-60281:320
acn: 9201080121

December 31, 1991 — A.J. James, letter forwarding general external technical reports, "Advanced BWR Design Certification Guidelines for Preparation of Inspection Tests Analysis and Acceptance Criteria (ITAAC)."
Fiche: 60006:084-60006:140
acn: 9112160050

January 2, 1992 — V.M. McCree, NRC, letter providing supply list of shutdown risk issues applicable to GE advanced BWR.
Fiche: 60226:354-60226:360
acn: 9201080230

January 3, 1992 — C. Poslusny, letter forwarding meeting summary of December 9 and 10, 1991, with utilities in San Jose, California regarding open issues based on NRC staff review of licensee SSAR for advanced BWR. List of attendees and meeting agenda enclosed.
Fiche: 60302:114-60302:313
acn: 9201130174

January 3, 1992 — P.W. Marriott, GE, letter forwarding proprietary NEDE-30822, "User Testing of REDYA01 Computer Program," and NEDE-30690, "REDYA01 Technical Description," to support January 1992, ODYNA-REDYA Audit. Reports withheld.
Fiche: 60334:178-60334:181
acn: 9201150127

January 6, 1992 — P.W. Marriott, GE, letter forwarding response to NRC request for additional information regarding incorporation of operating experience in advanced BWR.
Fiche: 60240:059-60240:074
acn: 9201080099

January 6, 1992 — P.W. Marriott, GE, letter forwarding proprietary tables to App 18f to Chapter 18 regarding human factors engineering. GE will amend SSAR to include subject information in future amendments. Enclosure withheld.
Fiche: 60334:182-60334:185
acn: 9201150092

January 6, 1992 — P.W. Marriott, GE, letter forwarding response to issue raised at GE/NRC December 9 and 10, 1991, meetings regarding inservice inspection of requests for reactor pressure vessel bottom head weld and reactor pressure vessel bottom head-to-shell weld.
Fiche: 60282:345-60282:360
acn: 9201130255

January 9, 1992 — C. Poslusny, NRC, letter forwarding meeting summaries-internal (non-transcript) summary of November 12, 1991, meeting with UNTIL regarding engineering design issues for advanced BWR. List of attendees enclosed.
Fiche: 60261:350-60261:358

January 10, 1992 — C. Poslusny, NRC, letter discussing staff effort to develop final SER Section discussing design aspects of advanced BWR. Additional information requested. Specific questions enclosed. Response requested no later than March 1, 1992, with preliminary conference call on January 22, 1992.
Fiche: 60329:127-60329:142
acn: 9201170191

January 10, 1992 — P.W. Marriott, GE, letter forwarding responses to Agenda Item 12 discussed during November 20 and 21, 1991, meeting with Reactor Systems Branch of NRC. Responses withheld.
Fiche: 60332:103-60332:106
acn: 9201160227

January 10, 1992 — P.W. Marriott, GE, letter forwarding response to Agenda Items 1, 5, 9, and 16 discussed at GE/NRC Reactor Systems Branch November 20 and 21, 1991, meetings. Items include stability performance in normal operating region loss of AC power and loss of feedwater hearing transient.
Fiche: 60332:065-60332:077
acn: 9201160018

January 15, 1992 — C. Poslusny, NRC, letter forwarding draft document on Defense-in-Depth and Diversity Assessment of GE advanced BWR protection system for review. Requests comments regarding accuracy of report treatment of Systems Reactions and Design Basis Events by February 10, 1992.
Fiche: 60341:081-60341:208
acn: 9201220274

January 16, 1992 — R.L. Nease, NRC, letter forwarding, "Component Failure Data Handbook," technical evaluation report. Handbook contains generic component failure data and error factors.
Fiche: 60515:004-60515:171
acn: 9201230259

January 16, 1992 — C. Poslusny, NRC, letter forwarding information omitted from January 16, 1992, submittal consisting of enclosure with review guidance and two enclosures with questions to support closure of severe accident issues for advanced BWR.
Fiche: 60356:312-60356:316
acn: 9201230245

January 17, 1992 — R.L. Nease, NRC, letter forwarding draft NUREG-1449, "NRC Staff Evaluation of Shutdown and Low Power Operation." Final version of NUREG-1449 scheduled to be issued to Commission by early February 1992.
Fiche: 60341:209-60342:297
acn: 9201220280

Junuary 17, 1992 — C. Poslusny, NRC, forwarding summary of January 14, 1992, meeting with UNTIL regarding draft of advanced BWR design reliability program dated December 19, 1991. Draft and list of meeting attendees enclosed.
Fiche: 60402:265-60402:297
acn: 9201290084

January 17, 1992 — General external technical reports, "Advanced BWR design certification generic ITAAC for Category 1 Structures Position Paper."
Fiche: 60378:324-60378:355
acn: 9201240141

January 17, 1992 — General external technical reports, "Tier 1 Design Certification Material Pilot ITAAC Examples for GE Advanced BWR Design."
Fiche: 60378:222-60378:323
acn: 9201240140

January 17, 1992 — P.W. Marriott, GE, letter forwarding, "Tier 1 Design Certification MATL Pilot ITAAC Examples for GE Advanced BWR Design" and "Advanced BWR Design Certification Generic ITAAC for Seismic Category 1 Structures Position Paper."
Fiche: 60378:220-60378:355

January 17, 1992 — C. Poslusny, NRC, letter forwarding NRR Advanced Reactor Division open item tracking system report dated January 8, 1992.
Fiche: 60356:329-60356:353
acn: 9201230253

January 20, 1992 — R.L. Nease, NRC, letter forwarding plan and agenda for January 28 through 30, 1992, audit of GE ODYNO and REDYA transient analysis codes.
Fiche: 60379:332-60379:335
acn: 9201280134

January 22, 1992 — S.S. Dua, letter forwarding response to open issue 3 of SECY-91-153 regarding main steamline seismic classification including static design procedure to be utilized in evaluation of seismic capability of condenser anchorage and turbine building.
Fiche: 60397:150-60397:161
acn: 9201270140

January 22, 1992 — D. Crutchfield, NRC, letter discussing responses to NRC open items on advanced BWR SSAR Chapter 14. Requests that until expedite responses to open items identified in November 5, 1991, DSER.
Fiche: 60403:238-60403:240

January 28, 1992 — C. Poslusny, NRC, letter providing comments on information included in SSAR regarding control rod design criteria and requests that information be provided to staff.
Fiche: 60481:049-60481:051
acn: 9202050431

January 31, 1992 — P.W. Marriott, GE, letter forwarding proprietary NEDC-30032, "Joint Study Final Report." Joint study with regard to study (ii) related to advanced BWR thermal margin during rapid coastdown 820401-830331. Report withheld.
Fiche: 60492:050-60492:053
acn: 9202040413

February 3, 1992 — R.C. Mitchell, letter forwarding 24 proprietary oversized drawings regarding advanced BWR piping and instrumentation and process flow. With 23 oversize drawings. Drawings withheld.
Fiche: 60688:293-60688:294
acn: 9202060278

February 3, 1992 — R.C. Mitchell, letter forwarding letter with updated advanced BWR piping and instrumentation and process flow drawings. W-116 oversized drawings.
Fiche: 60583:001-60583:002
acn: 9202110336

February 3, 1992 — R.C. Mitchell, letter forwarding letter responding to leak before break issue addressed in December 9 and 10, 1991, GE/NRC meeting. Advises that GE intends to amend SSAR with response in future amendment.
Fiche: 60574:178-60574:262
acn: 9202110324

February 3, 1992

R.C. Mitchell, letter forwarding nonproprietary responses to additional items of concern noted in draft SER for Chapter 7. Advises that GE will amend advanced BWR SSAR with responses in future amendments.
Fiche: 60574:133-60574:177
acn: 9202110316

February 3, 1992

R.C. Mitchell, letter forwarding proprietary responses to additional information noted in October 4, 1991, draft SER for Chapter 7. Responses are cross referenced with summary item number corresponding to review meeting in San Jose, California on August 7 and 8, 1991. Responses withheld.
Fiche: 60579:298-60579:298
acn: 9202110221

February 10, 1992

P.W. Marriott, GE, letter forwarding responses to January 10, 1992, 16 requests for additional information on advanced BWR design for severe accidents.
Fiche: 60627:101-60627:124
acn: 9202190376

February 11, 1992

P.W. Marriott, GE, letter forwarding response to performance and quality evaluation branch open items on advanced BWR standard SAR Chapter 14.
Fiche: 60677:256-60677:257
acn: 9202190379

February 13, 1992

P.W. Marriott, GE, letter forwarding proprietary Appendix 18f, "Emergency Operation Information and Controls," to Chapter 18, "Human Factors Engineers," of advanced BWR STD SAR covering control room inventory. Appendix 18f withheld.
Fiche: 60627:070-60627:070
acn: 9202190366

February 14, 1992

P.W. Marriott, GE, letter forwarding nonproprietary portion of GE responses to agenda items discussed during November 20 and 21, 1991, meeting with NRC Reactor Systems Branch regarding standby liquid control system instrumentation and controls.
Fiche: 60627:073-60627:100
acn: 9202190343

February 14, 1992

P.W. Marriott, GE, letter forwarding proprietary portion of GE response to agenda items discussed during November 20-21, 1991, meeting with NRC Reactor Systems Branch. Response withheld
Fiche: 60627:072-60627:072
acn: 9202190325

February 17, 1992

T.J. O'Neil, letter forwarding proprietary revised Appendix 18e, "Advanced BWR Man-Machine Interface System Design and Implementation Process," of advanced BWR SSAR, App. withheld.
Fiche: 60854:350-60854:350
acn: 9203030270

February 18, 1992

V.M. McCree, meeting summaries-internal (non-transcript) summary of November 20, 1991, meeting with GE in San Jose, California to discuss open items for staff review of advanced BWR Std SAR.
Fiche: 60710:066-60710:134
acn: 9202260310

February 19, 1992

R.L. Nease, letter forwarding internal flooding analysis. Metholodology used is combination of qualitative and quantitative analyses that looks for vulnerabilities to internal floods that could cause core damage.
Fiche: 60705:305-60706:122
acn: 9202260235

February 19, 1992

D. Crutchfield, NRC, letter requesting proposed advanced BWR TS significantly different from BWR-6 TS on computer disk in Wordperfect 5.1 format and electronic mark-up of NUREG-1434 parts which require only minor revisions to be tailored to advanced BWR design.
Fiche: 60705:286-60705:288
acn: 9202260214

February 19, 1992

G.W. Ehlert, letter forwarding external technical reports on, "Radwaste Building Seismic Analysis."
Fiche: 60827:141-60827:149
acn: 9203050230

February 20, 1992

R.L. Nease, NRC, meeting summaries-internal (non-transcript) summary of January 1, 1992, meeting with GE in Rockville, Maryland regarding status of PRA sensitivity and uncertainly analyses for advanced BWR. List of attendees and GE handouts enclosed.
Fiche: 60726:184-60726:232
acn: 9202280069

February 20, 1992

P.W. Marriott, GE, letter forwarding discussion of differences between US advanced BWR and K-6-7 project. Advanced BWR design under review for differences to K-6-7 and additional differences will be included in future SSAR Amendment.
Fiche: 60752:062-60752:070
acn: 9202270241

February 24, 1992

P.W. Marriott, GE, letter forwarding draft of Revision 0, "Advanced BWR SSAR Main Steam Feedwater and SRVDL Piping Design Criteria and Analysis Methods," and draft Revision 0 to, "Advanced BWR Feedwater Loop and Piping and Equipment Loads," per GE/NRC February 9 and 10, 1991, meeting.
Fiche: 60782:304-60783:029
acn: 9203030235

February 25, 1992

P.W. Marriott, GE, letter forwarding App 19P to Chapter 19 of "Evaluation of Potential Mods to Advanced BWR Design."
Fiche: 60751:289-60751:315
acn: 9202260157

February 25, 1992

R. Nease, NRC, letter forwarding proprietary Revision R-0 to "Advanced BWR Project Common Engineering Work Plan." Plan withheld.
Fiche: 60782:299-60782:299
acn: 9203020112

February 25, 1992

P.W. Marriott, letter requesting addition of listed individual to advanced BWR document distribution list.
Fiche: 60786:321-60786:321
acn: 9202280354

February 25, 1992 — C. Poslusny, NRC, meeting summaries-internal (non-transcript) summary of October 24, 1991, meeting with GE in Rockville, Maryland regarding open issues in several areas concerning review of advanced BWR SSAR.
Fiche: 60734:284-60734:288
acn: 9202280344

February 25, 1992 — R. Nease, NRC, letter forwarding proprietary summary of January 27, 1992, telcon with NRC and Brookhaven Laboratory to clarify aspects of human factors review of advanced BWR, specifically review of design implementation process. Summary withheld.
Fiche: 60854:348-60854:348
acn: 9203030287

February 25, 1992 — R. Nease, NRC, forwarding proprietary revised Appendix 18e, "Advanced BWR Man-Machine Interface System Design and Implementation Process," of advanced BWR SSAR. App withheld.
Fiche: 60854:349-60854:350
acn: 9203030268

February 26, 1992 — R.L. Nease, memorandum forwarding proprietary summary of NRC/GE January 7, 1992, meeting on advanced BWR SSAR Chapter 18. Meeting summary withheld.
Fiche: 60778:051-60778:054
acn: 9202270211

February 26, 1992 — V.M. McCree, NRC, letter forwarding corrected list of attendees for February 18, 1992, summary of meeting held on November 20 and 21, 1991.
Fiche: 60772:204-60772:206
acn: 9203030344

February 29, 1992 — M. Herzog, forwarding report draft Revision 0 to, "Advanced BWR Feedwater Loop a Piping and Equipment Loads."
Fiche: 60782:339-60783:029
acn: 9203030253

February 29, 1992 — M. Herzog, forwarding report draft Revision 0 to, "Advanced BWR SSAR Main Steam Feedwater and SRVDL Piping System Design Criteria and Analysis Methods."
Fiche: 60782:305-60782:338
acn: 9203030246

March 3, 1992 — A.E. Rogers, forwarding report, "Radwaste Building Seismic Analysis." Informs that GE intends to amend SSAR with subject analysis in future amendments.
Fiche: 60827:140-60827:149
acn: 9203050228

March 3, 1992 — R.C. Pierson, NRC, letter submitting near term actions to facilitate issue resolution regarding advanced BWR probabilistic risk assessment
Fiche: 60811:195-60811:197
acn: 9203050165

March 4, 1992 — R.C. Pierson, letter forwarding summary of NRC February 10 through 12, 1992, audit of advanced BWR RPV internals. Lists two GE commitments.
Fiche: 60839:113-60839:131
acn: 9203060154

March 5, 1992

A.E. Rogers, letter forwarding Revision B to 23(a)6100(aq) Section 17.3 regarding responses to request for resolution of issues related to reliability assurance program (RAP). Subject responses will be included as amendment to advanced BWR SSAR in future.
Fiche: 60898:283-60898:304
acn: 9203110132

March 5, 1992

A.E. Rogers, letter forwarding Revision B to 23a6100aq Section 17.3 regarding responses to request for resolution of issues related to reliability assurance program (RAP). Subject responses will be included as amendment to advanced BWR SSAR in future.
Fiche: 60898:283-60898:304
acn: 9203110132

March 9, 1992

R.C. Mitchell, letter summarizing staff position regarding NRC conference call on DSER comments to advanced BWR SSAR ISI requirements.
Fiche: 60930:048-60930:049
acn: 9203120371

March 10, 1992

Meeting summaries internal (non-transcript) summary of February 28, 1992, meeting with GE in Rockville, Maryland regarding open items in advanced BWR review concerning postulated trip of all reactor internal pumps and postulated command mode failure of pressure regulator to down scale position.
Fiche: 60963:309-60963:321
acn: 9203170131

March 11, 1992

R.C. Mitchell, letter forwarding draft Revision 0 to, "Advanced BWR SRVDL Wetwell Piping Stress Analysis Design Report," and draft Revision 0 to design report, "Main Steamline A & Safety Relief Valve Discharge Piping Stress Analysis," per December 9 and 10, 1991, GE/NRC meeting.
Fiche: 60992:037-60992:245
acn: 9203180162

March 11, 1992

R.C. Mitchell, letter forwarding responses to resolution of issues related to advanced BWR draft SER Chapters 1, 2, 3, 5, 6, 9, 10, 12, 13, 14 and 15 (SECY-91-355).
Fiche: 60991:162-60991:338
acn: 9203180156

March 11, 1992

R.C. Mitchell, letter forwarding proprietary responses to issues regarding Sections 9.3, 9.5, and 11.2 of advanced BWR SSAR. Responses reflect corrections and additions to earlier proprietary submitals. Responses withheld.
Fiche: 60991:161-60991:161
acn: 9203180147

March 11, 1992

P.W. Marriott, letter forwarding piping design inspections, tests, analyses, and acceptance criteria (ITAAC). Piping design ITAAC will be included as part of generic ITAAC.
Fiche: 60992:321-60992:327
acn: 9203180142

March 13, 1992

P.W. Marriott, GE, letter forwarding proprietary Amendment 20 to advanced BWR SSAR. Report withheld.
Fiche: 60998:347-60998:347
acn: 9203200342

March 13, 1992 — P.W. Marriott, GE, letter forwarding nonproprietary Amendment 20 to advanced BWR SSAR.
Fiche: 61061:001-61062:128
acn: 9203200337

March 13, 1992 — J.N. Wilson, Federal Register notices - notice of receipt of application for design certification.
Fiche: 60982:349-60982:349
acn: 9203190450

March 13, 1992 — D. Crutchfield, NRC, letter discussing December 20, 1991, request for application for approval of advanced BWR design be considered as application for Part 52 design approval and subsequent design certification. Notice of receipt of application for design certification enclosed.
Fiche: 60982:346-60982:349
acn: 9203190446

March 25, 1992 — P.W. Marriott, GE, letter forwarding revisions to Appendix 18a, 18b, and 18d to Chapter 18 of advanced BWR SSAR in reference to December 13, 1991, submittal of Amendment 19 to advanced BWR SSAR. Revisions withheld.
Fiche: 61211:072-61211:072
acn: 9204010120

March 30, 1992 — General external technical reports--advanced BWR design document Section 3.7, "Radiation Protection," Section 12.3, "Radiation Protection Design Features," and Section 12a.1, "Calculation of Airborne Radionuclides."
Fiche: 61791:097-61791:231
acn: 9205200194

March 31, 1992 — Text-safety report--"Tier 1 Design Certification Material for GE Advanced BWR Design - Stage 2 Submittal."
Fiche: 61273:181-61274:223
acn: 9204080070

March 31, 1992 — M.L. Scott, letter contract NRC-03-89-027 awarding Task Order 32, "Design Process Inspection - GE Advanced Boiling Water Reactor," to "Nuclear Power Reactor Operations Modifications and Maintenance Inspection Services."
Fiche: 61320:101-61320:106
acn: 9204130313

April 1, 1992 — P.W. Marriott, GE, letter forwarding modifications supporting main steamline seismic classification.
Fiche: 61298:269-61298:271
acn: 9204080007

April 1, 1992 — T.H. Boyce, NRC, meeting summary of February 27, 1992, meeting with GE Nuclear Energy in Rockville, Maryland. Topics discussed included interfaces and inspection analyses and acceptance criteria for advanced BWR.
Fiche: 61287:105-61287:124
acn: 9204090336

April 1, 1992 — G. Kelly, letter forwarding clarification of Confirmatory Item C-O1.
Fiche: 61463:069-61463:070
acn: 9204270112

April 2, 1992

P.W. Marriott, GE, letter forwarding proprietary GE responses to resolution of selected issues regarding advanced BWR DSER Chapter 19 (SECY-91-309). Report withheld.
Fiche: 61271:194-61271:194
acn: 9204060391

April 2, 1992

R.C. Pierson, NRC, letter requesting review of enclosed advanced BWR TS indicating changes necessary to properly reflect advanced BWR & design and safety analyses.
Fiche: 61293:092-61293:162
acn: 9204100376

April 2, 1992

B.J. DuBose, notification of contract execution awarding Task Order 32, "Design Process Inspection - GE Advanced Boiling Water Reactor," to, "Nuclear Power Reactor Operations Modifications and Maintenance Inspection Services."
Fiche: 61320:100-61320:106
acn: 9204130309

April 3, 1992

P.W. Marriott, GE, letter forwarding nonproprietary and proprietary responses to resolution of issues related to Chapter 8 of advanced BWR DSER (SECY-91-355). Proprietary responses withheld.
Fiche: 61364:100-61364:235
acn: 9204130074

April 3, 1992

P.W. Marriott, GE, letter forwarding proprietary responses to resolution of issues related to Chapter 8 of advanced BWR DSER (SECY-91-355). Enclosures withheld.
Fiche: 61330:344-61330:344
acn: 9204130069

April 6, 1992

P.W. Marriott, GE, letter forwarding, "Tier 1 Design Certification for GE Advanced BWR Design - Stage 2 Submittal," including descriptions and proposed inspections, tests, analyses, and acceptance criteria (ITAAC) for 40 advanced BWR systems. Lists information not covered by report.
Fiche: 61273:179-61274:223
acn: 9204080069

April 6, 1992

P.W. Marriott, GE, letter forwarding GE responses to resolution of issues related to Chapter 15 of advanced BWR Draft SER incorporating responses to NRC staff comments and to outstanding issues 136 and 139.
Fiche: 61329:292-61329:341
acn: 9204130227

April 7, 1992

G. Kelly, letter forwarding instructions on turning fragility curves into HCLPFs and Table of Seismic Boolean equations used by BNL and EQE to develop estimates of HCLPF for advanced BWR.
Fiche: 61463:071-61463:073
acn: 9204270119

April 8, 1992

P.W. Marriott, GE, letter forwarding Section 4 inadvertently omitted from April 6, 1992, letter forwarding, "Tier 1 Design Certification Material for the GE Advanced BWR Design Stage 2 Submittal." Section 4 covers interface Tier 1 material in reference to ultimate heat sink.
Fiche: 61331:057-61331:060
acn: 9204130208

April 8, 1992 — P.W. Marriott, GE, letter forwarding 34--11 x 17 foldout drawings identified for later delivery in March 13, 1992, submittal of Amendment 20 to advanced BWR SSAR. Updated page change instructions and page status sheets also enclosed. Enclosures withheld.
Fiche: 61506:354-61506:354
acn: 9204220093

April 8, 1992 — Text-safety report--Amendment 20 to advanced BWR SSAR 11 x 17 foldout drawings page change instructions and page status sheets.
Fiche: 61396:245-61397:148
acn: 9204160195

April 8, 1992 — P.W. Marriott, GE, letter forwarding 11 x 17 drawings as part of Amendment 20 to GE advanced BWR SSAR per March 13, 1992, submittal. Page change instructions and page status sheets also enclosed.
Fiche: 61396:244-61398:148
acn: 9204160184

April 9, 1992 — J. Fox, GE, letter forwarding comments on selected items from Table 1.8-22 experience information applicable to advanced BWR covering storage of low level radwastes at sites and clarification of surveillance requirements for diesel impurity tests.
Fiche: 61784:250-617@4:257
acn: 9205190285

April 9, 1992 — G. Kelly, letter discussing follow-up on open items from advanced BWR PRA draft SER and MAR meeting in San Jose, California.
Fiche: 61463:074-61463:075
acn: 9204270126

April 10, 1992 — G. Kelly, letter forwarding initial concerns raised by ACRS regarding credit for RWCU and FW system in high pressure sequences in advanced BWR PRA and evaluation of LOCAs outside of containment.
Fiche: 61463:076-61463:129
acn: 9204270130

April 10, 1992 — R.L. Palla, letter forwarding listed responses from GE regarding advanced BWR for review under Task Order 2 of FIN 1-2412. Advises that second document contains proprietary information. Without enclosure.
Fiche: 61415:322-61415:322
acn: 9204220130

April 11, 1992 — J. Fox, GE, letter forwarding Human Factors Engineering ITAAC-DAC Action Plan Item (4).
Fiche: 61884:246-61884:256
acn: 9205280226

April 14, 1992 — R.C. Mitchell, letter forwarding proprietary GE responses to resolution of selected issues regarding advanced BWR design SER Chapter 19 (SECY-91-309). Responses withheld.
Fiche: 61364:273-61364:273
acn: 9204160229

April 15, 1992

R.C. Mitchell, letter forwarding proprietary responses to resolution of SECY-91-309 Confirmatory Item 1 as related to advanced BWR draft SER Chapter 19. Responses withheld.
Fiche: 61360:347-61360:347
acn: 9204160279

April 20, 1992

P.W. Marriott, GE, letter forwarding response to SECY-91-309, Confirmatory Item 17, and Outstanding Item 18 (partial) for resolution of selected issues related to advanced BWR draft SER Chapter 19.
Fiche: 61464:228-61464:228
acn: 9204240162

April 22, 1992

P.W. Marriott, GE, letter forwarding responses to discussion items of October-November 1991, GE/NRC performance and quality evaluation branch conference. Responses withheld.
Fiche: 61495:328-61495:328
acn: 9204280363

April 24, 1992

R.C. Stirn, letter forwarding response to outstanding issues 140 and 144 in references to revision of Appendix 15e - ATWS analysis of ABWR DSER SECY-91-355.
Fiche: 61549:181-61549:305
acn: 9205010292

April 24, 1992

P.W. Marriott, GE, letter forwarding proprietary revision to Appendix 19f and 19e for containment ultimate strength and 100-percent metal-water reaction. Appendix 9e revised to formally document increased pressure capability resulting from thicker drywell head. Enclosure withheld.
Fiche: 61509:320-61509:320
acn: 9204300361

April 24, 1992

P.W. Marriott, GE, letter forwarding Section 2.15.10 Reactor Building of Stage 2 GE advanced BWR Tier 1 design certification material. Submittal supplement Tier 1 advanced BWR design certification material transmitted earlier by April 6, 1992, letter.
Fiche: 61505:145-61505:188
acn: 9204290217

April 27, 1992

P.D. Knecht, letter forwarding April 27, 1992, memorandum to BNL regarding LOCA outside containment in advanced BWRS.
Fiche: 61784:224-61784:229
acn: 9205200162

April 28, 1992

C. Poslusny, NRC, meeting summary of March 25 and 26, 1992, with GE in San Jose, California regarding status of open issues design interfaces and ITAAC in reference to NRC review of SSAR for ABWR. Draft interim human factors criteria and GE proprietary information enclosed. GE proprietary information withheld.
Fiche: 61713:001-61713:161
acn: 9205140241

April 28, 1992

J. Fox, GE, letter forwarding proposed draft advanced BWR TS Section 3.3.1.1-2 regarding RPS instrumentation-logic.
Fiche: 61784:258-61784:275
acn: 9205200188

April 29, 1992 — J. Fox, GE, letter forwarding nonproprietary and proprietary information on Section 3.11 and appendix of advanced BWR SSAR regarding environmental qualification of safety-related mechanical and electrical equipment. Enclosure withheld.
Fiche: 61815:001-61875:005
acn: 9205100241

April 29, 1992 — J. Fox, GE, letter forwarding information regarding reactor water makeup system, makeup water preparation system components, and HECWS system component description as background information for advanced BWR review.
Fiche: 61784:171-61784:205
acn: 9205200192

April 30, 1992 — R.C. Stirn, letter forwarding response to Agenda Item 11 discussed during GE/NRC Reactor Systems Branch November 20 and 21, 1991, meeting regarding credit for non-safety-grade equipment.
Fiche: 61589:346-61589:348
acn: 9205050247

April 30, 1992 — Record of telecon with GE on April 30, 1992, regarding development of Advanced BWR Inventory SSAR Appendix 18f.
Fiche: 61878:337-61878:339
acn: 9205280186

April 30, 1992 — R.C. Stirn, letter forwarding Section 3.7, "Radiation Protection of Stage 2 GE Advanced BWR Tier I Design Certification Material," containing figures designating radiation zones for reactor building, control building, and radwaste building.
Fiche: 61605:232-61605:267
acn: 9205050240

May 1, 1992 — J. Fox, GE, letter forwarding proprietary information regarding advanced BWR fuel design. Enclosure withheld.
Fiche: 61815:007-61815:008
acn: 9105100218

May 1, 1992 — J. Fox, GE, letter forwarding proprietary information regarding intersystem LOCA. Enclosure withheld.
Fiche: 61875:006-61815:006
acn: 9105100111

May 1, 1992 — G.E. Miller, letter forwarding draft of flooding analysis for potential piping leaks in reactor service water system.
Fiche: 61791:079-61791:082
acn: 9205190287

May 1, 1992 — G.E. Miller, letter forwarding information regarding advanced BWR HECW system to replace information sent on April 29, 1992.
Fiche: 61784:168-61784:170
acn: 9205200182

May 1, 1992 — J. Fox, GE, letter forwarding information regarding BWR containment steam bypass leakage capability. Sensitivity study results demonstrate that currently specified bypass leakage capability of 0.05 ft^2 is not at high point of cliff.
Fiche: 61784:206-61784:215
acn: 9205200150

May 3, 1992 — J. Fox, GE, letter forwarding comments on human factors engineering ITAAC-DAC.
Fiche: 61814:294-61814:362
acn: 9205280188

May 4, 1992 — C. Poslusny, NRC, letter requesting that licensee address enclosed questions regarding review of advanced BWR inservice testing.
Fiche: 61741:341-61741:352
acn: 9205200060

May 5, 1992 — J. Duncon, letter forwarding advanced BWR PRA punchout list.
Fiche: 61911:089-61911:111
acn: 9205290049

May 10, 1992 — C. Poslusny, NRC, summary of February 10 through 12, 1992, audit at GE San Jose, California office to review documentation and bases for establishment of ITAAC for ABWR RPV internals.
Fiche: 61785:034-61785:050
acn: 9205260196

May 11, 1992 — U. Saxena, letter forwarding viewgraphs of blowdown mass energy data used in advanced BWR subcompartment pressurization analyses.
Fiche: 61784:230-61784:249
acn: 9205190281

May 11, 1992 — D. Maxwell, letter forwarding response to NRC questions on Generic Letter 80-35 regarding dc power supplies.
Fiche: 61791:075-61791:078
acn: 9205190280

May 13, 1992 — J. Fox, GE, letter forwarding table of Chapter 14 open items including test procedures, pre-fuel load checks, preoperational test procedures and interfaces.
Fiche: 61791:041-61791:069
acn: 9205190282

May 14, 1992 — J. Fox, GE, letter forwarding writeup of loose parts monitoring system which will appear in SSAR via upcoming amendment.
Fiche: 61784:216-61784:223
acn: 9205200161

May 15, 1992 — R.C. Pierson, NRC, letter forwarding summary of advanced BWR Structural Design audit at GE.
Fiche: 61794:241-61794:263
acn: 9205280255

May 15, 1992 — R.C. Pierson, NRC, letter forwarding information and summarizes GE advanced BWR design process assessment.
Fiche: 61794:229-61794:240
acn: 9205280244

May 18, 1992 — C.B. Brinkman, letter responding to issue of diversity for digital instrumentation and control system for System 80 delineated in NRC April 30, 1992, letter. Best estimate analysis underway in order to make realistic assessment of plant performance given computer failure.
Fiche: 61884:189-61884:193
acn: 9205280060

May 20, 1992 — R.C. Pierson, NRC, letter forwarding March 23 through 26, 1992, audit report of GE advanced BWR piping design and ITAAC. Audit agenda and list of attendees enclosed.
Fiche: 61822:154-61822:212
acn: 9206010261

May 26, 1992 — D. Crutchfield, NRC, letter requesting that vendor reconsider submittal on USIs and GSIs. Revised submittal should be provided by June 30, 1992, to meet listed criteria.
Fiche: 61822:050-61822:056
acn: 9206010145

May 28, 1992 — Text-safety report, "Request for Additional Information Performance of Containment Structures Advanced BWR."
Fiche: 61822:284-61822:286
acn: 9205280183

May 28, 1992 — C. Poslusny, NRC, letter notification of June 8, 1992, meeting with GE in San Jose, California to discuss issues regarding staff review of ABWR.
Fiche: 61883:331-61883:335
acn: 9206030321

May 28, 1992 — J.M. Taylor, NRC, text-safety report informs Commission of status of development of design acceptance criteria (DAC) for ABWR.
Fiche: 61979:005-61980:186
acn: 9206040228

May 29, 1992 — D. Crutchfield, NRC, letter forwarding announcement and invitation for Fourth Annual NRC Regulatory Information Conference on July 21 and 22, 1992, with GE to discuss status of ABWR and SBWR licensing effort since November 1991, ALWR conference.
Fiche: 61883:266-61883:270
acn: 9206030340

May 29, 1992 — R.C. Pierson, NRC, letter advising that vendor must meet or exceed commitment dates for submittals required to complete evaluation of SSAR for GE advanced BWR. Requests firm submittal date for necessary changes by June 3, 1992.
Fiche: 61920:318-61920:320
acn: 9206020311

May 29, 1992 — J. Duncon, letter forwarding updated advanced BWR PRA punch-list reflecting results of March 23, 25, and 25, 1992, discussions.
Fiche: 61912:206-61912:227
acn: 9205290002

May 29, 1992 — D. Crutchfield, NRC, letter forwarding announcement and invitation for Fourth Annual NRC Regulatory Information Conference to discuss status of CE System 80 licensing effort since November 1991, ALWR conference.
Fiche: 61882:197-61882:201
acn: 9206030360

May 30, 1992 — P.W. Marriott, GE, letter forwarding, "Tier I Design Certification Material for GE ABWR Design," Stage 3 including design descriptions and proposed ITAAC for all ABWR systems for which design certification being sought.
Fiche: 61925:001-61926:308
acn: 9206020300

June 1, 1992 — General external technical reports, "Tier I Design Certification Material for GE ABWR Design."
Fiche: 61925:003-61926:308
acn: 9206020303

June 1, 1992 — H.A. Careway, GE, letter forwarding modification to uppder drywell shielding and figure showing radiation field prior to additional shielding.
Fiche: 62152:009-52152:012
acn: 9206260036

June 1, 1992 — J. Fox, GE, letter forwarding additional changes to Chapter 14 of ABWR SSAR, in response to various telecons regarding closeout of open items from staff draft SER. Changes necessary to close Chapter 14 draft SER open items complete, except for Items 118, 120, and 121.
Fiche: 62158:329-62158:356
acn: 9206260178

June 1, 1992 — J. Duncan, GE, letter forwarding sensitivity analysis of human error probabilities in advanced BWR PRA.
Fiche: 62199:301-62199:311
acn: 9206260275

June 1, 1992 — J. Fox, GE, letter forwarding nonproprietary and proprietary information regarding equipment qualification, in response to June 1, 1992, telecon and May 5 and 6, 1992, meeting. Proprietary information withheld.
Fiche: 62163:209-62163:210
acn: 9206290019

June 1, 1992 — J. Fox, GE, letter forwarding resonse to Questions 8 and 9 regarding ABWR drywell head buckling capability. Responses to other 11 questions will be provided soon.
Fiche: 62192:288-62912:294
acn: 9206290278

June 1, 1992 — J. Fox, GE, letter forwarding nonproprietary and proprietary information regarding containment hydrodynamic loads. Proprietary information withheld.
Fiche: 62230:249-62230:257
acn: 9207010268

June 3, 1992 — S.Q. Ninh, NRC, meeting summary of May 20, 1992, public meeting between NRC and ABB-CE in Rockville, Maryland to discuss staff comments on applicant pilot ITAAC submittal. Comments and list of attendees enclosed.
Fiche: 62036:001-62036:019
acn: 9206160251

June 3, 1992 — Legal transcripts and orders and pleadings; transcript of June 3, 1992, public meeting in Rockville, Maryland regarding status of GE advanced BWR application for design certification. With scheduling notes and viewgraphs.
Fiche: 61971:047-61971:133
acn: 9206100205

June 3, 1992 — L.G. Frederick, GE, letter forwarding Table 2, "Human Actions Below Top 300 Cutsets" and Table 4, "Human Action Acronyms Deleted from Model," in response to NRC request for sensitivity analysis on human errors.
Fiche: 62153:358-62153:360
acn: 9206250301

June 3, 1992 — J. Fox, GE, letter forwarding information regarding HVAC exhaust monitoring.
Fiche: 62145:011-62145:013
acn: 9206260033

June 4, 1992 — R.C. Berglund, letter responding to NRC May 29, 1992, letter raising concerns that Stage 2 ITAAC submittal contained several inconsistencies reflected in lack of internal QA. Urges continuation of face-to-face staff and management interactions.
Fiche: 61958:354-61958:356
acn: 9206080103

June 4, 1992 — C. Poslusny, NRC, meeting summaries-internal (non-transcript) summary of May 7, 1992, meeting with GE in Bethesda, Maryland regarding staff review of SSAR for advanced BWR.
Fiche: 62020:201-62020:315
acn: 9206120218

June 4, 1992 — J. Fox, GE, letter forwarding fax regarding response to Question 3 of ACRS letter and exemption requests from GDC 56.
Fiche: 62159:056-62159:085
acn: 9207060200

June 4, 1992 — J. Fox, GE, letter forwarding proprietary fax regarding response to PRA portion of Question 10 of April 13, 1992, letter pertaining to RWCU. Response withheld.
Fiche: 62251:060-62251:060
acn: 9207060110

June 4, 1992 — J. Fox, GE, letter forwarding material discussed on June 3, 1992, regarding ABWR suppression pool bypass. Material withheld.
Fiche: 62249:360-62249:360
acn: 9207060159

June 5, 1992 — J.N. Fox, letter notifying that licensee now designated as, 'GE Nuclear Energy,' and abbreviated, 'GE.'
Fiche: 61995:357-61995:358
acn: 9206110279

June 5, 1992 — S.J. Stark letter responding to May 29, 1992, letter expressing concern regarding impact of ABWR review by five day delay in providing information concerning tornado design features and submittal date for changes. Suggest issue be discussed at GE management meeting on June 8, 1992.
Fiche: 61997:260-61997:261
acn: 9206110168

June 5, 1992 — J. Fox, GE, letter forwarding intersystem LOCA evaluation.
Fiche: 62160:280-62160:310
acn: 9206250344

June 5, 1992 — J. Fox, GE, letter forwarding intersystem LOCA evaluation, including proprietary pages 19B.2-44 and 19B.2-45 to ABWR SSAR. Proprietary pages withheld.
Fiche: 62273:001-62273:029
acn: 9206250344

June 5, 1992

J. Duncan, GE, letter forwarding corrections to June 1, 1992, fax regarding human factors, consisting of Table 2 regarding human actions below top 300 cutsets and Table 4 regarding human action acronyms deleted from model.
Fiche: 62250:097-62250:099
acn: 9207060143

June 5, 1992

J. Duncan, GE, letter forwarding viewgraphs regarding status of key PRA activities and backend analyses and severe accident closure, in preparation for June 8, 1992, meeting.
Fiche: 62250:087-62250:096
acn: 9207060154

June 7, 1992

C. Buchholz, GE, letter forwarding proprietary fax regarding advanced BWR sensitivity and scoping studies. Enclosure withheld.
Fiche: 62251:059-62251:059
acn: 9207060120

June 8, 1992

S.Q. Ninh, NRC, meeting summaries-internal (non-transcript) summary of March 6, 1992, meeting with GE in Rockville, Maryland regarding advanced BWR Open Issues regarding Human Factors Engineering inspections, tests, analyses, and acceptance criteria and design acceptance criteria.
Fiche: 62020:178-62020:184
acn: 9206120199

June 9, 1992

J. Fox, GE, letter forwarding fax message regarding T&C TS for primary containment isolation instrumentation.
Fiche: 62160:007-62160:030
acn: 9206260206

June 9, 1992

J. Fox, GE, letter forwarding responses to NRC audit of GE on ABWR piping design criteria and sample analysis on March 23 through 27, 1992, and Revision 2 to Design Bases Spec 386HA931, "Event Combinations & Acceptance Criteria."
Fiche: 62190:182-62190:300
acn: 9206260247

June 10, 1992

U. Saxena, GE, letter forwarding information regarding wetwell-to-reactor building negative differential pressure.
Fiche: 62157:341-62157:345
acn: 9206260280

June 11, 1992

H.A. Careway, GE, letter forwarding proprietary drawing of Kashiwazaki Kariwa Nuclear Power Generation Station Units 5 and 7 shield wall penetrations, in reference to upper drywell access hatches. Drawing withheld.
Fiche: 62157:253-62157:253
acn: 9206260212

June 15, 1992

J. Chambers, GE, letter forwarding discussion of major issues in advanced BWR TS that need resolution quickly in order to keep review on schedule.
Fiche: 62157:338-62157:340
acn: 9206260278

June 16, 1992

S.J. Stark, GE, letter forwarding information regarding GE overall design process to complete and control US advanced BWR final design.
Fiche: 62110:282-62110:285
acn: 9206240021

June 16, 1992

J. Fox, GE, letter forwarding summary description of computer codes used in safety analysis, including ODYNA/REDYA models for advanced BWR transient analysis.
Fiche: 62154:328-62154:333
acn: 9206250342

June 17, 1992

S.J. Stark, GE, letter forwarding additional Stage 3 Tier 1 design certification material for GE ABWR design to supplement and replace material transmitted by May 30, 1992, letter.
Fiche: 62161:001-62161:112
acn: 9206250321

June 17, 1992

S.Q. Ninh, NRC, letter providing summary of 18 confirmatory items identified in final SER for Chapter 18, Human Factors Engineering, where staff and GE have reached tentative agreement.
Fiche: 62120:202-62120:214
acn: 9206250409

June 22, 1992

S.J. Stark, GE, letter forwarding advanced BWR SSAR, Section 18E.2, "Man-Machine Interface System" to support Design Acceptance Criteria 36. BNL will be providing information as designated in Table 18E.1.1.
Fiche: 62144:330-62144:357
acn: 9206290060

June 25, 1992

J. Duncan, GE, letter forwarding new PRA Section 19.7 regarding PRA as design tool, updating April 7, 1992, fax.
Fiche: 62567:203-62567:212
acn: 9207290092

June 26, 1992

J.N. Fox, GE, letter forwarding markup of NBS P&ID, markup of Table 3.2-1, pages 3.2-12.4 and 3.2-9 and Section 3 of NN Newmark paper regarding earthquake-resistant design G. Ehlert discussed. W/one oversize drawing.
Fiche: 62199:312-62199:345
acn: 9206260207

June 26, 1992

S.J. Stark, GE, letter discussing impact of changes in errors in ECCS evaluation methodology used by GE. Peak cladding temperature variations resulting from plant-specific system or fuel changes not addressed.
Fiche: 62227:213-62227:214
acn: 9206300260

June 26, 1992

T. Boyce, NRC, letter forwarding recommended addition to GE advanced BWR Tier 1 design descriptions and ITAAC and input to advanced BWR Tier 1 design documentation to incorporate radiation protection design acceptance criteria.
Fiche: 62152:028-62152:036
acn: 9206260054

June 27, 1992

J. Fox, GE, letter forwarding proprietary fax regarding containment ultimate strength evaluation. Enclosure withheld.
Fiche: 62611:342-62611:344
acn: 9207300174

June 27, 1992 — J. Duncan, GE, letter forwarding discussion of draft SER Open Item 21 regarding design and reliability assumptions and insights related to system outside advanced BWR design certification.
Fiche: 62567:173-62567:179
acn: 9207290083

June 29, 1992 — J. Duncan, GE, letter forwarding new Sections 19.11 through 19.13 of advanced BWR PRA regarding human action overview, PRA input to reliability assurance problem and summary of insights gained from PRA.
Fiche: 62567:165-62567:172
acn: 9207290080

June 29, 1992 — J. Duncan, GE, letter forwarding information on modification to advanced BWR Paragraph 2.2.2 regarding consequence analysis/site acceptability.
Fiche: 62567:213-62567:214
acn: 9207290095

June 29, 1992 — S.Q. Ninh, NRC, letter forwarding summary of confirmatory and open items identified in final SER for Chapter 12, "Radiation Protection," and Chapter 14, "Initial Plant Test Programs," for information.
Fiche: 62204:182-62204:195
acn: 9207060060

June 30, 1992 — J. Duncan, GE, letter forwarding PRA input to ITAAC Section 19.8 regarding Tier 1 treatment of design features identified as important by PRA.
Fiche: 62567:180-62567:191
acn: 9207290085

June 30, 1992 — J. Duncan, GE, letter forwarding information on Section 19.9 regarding COL license information, including specific procedure for unisolated RWCU line break, confirmation of RWCU operation beyond design basis and event-specific procedures for severe external flooding.
Fiche: 62567:192-62567:202
acn: 9207290089

June 30, 1992 — J. Duncan, GE, letter forwarding updated advanced BWR PRA consequence analysis, covering consequence analysis results and additional results.
Fiche: 62567:215-62567:222
acn: 9207290098

June 30, 1992 — R.C. Pierson, NRC, letter discussing GE Nuclear schedule for submittal of FSSAR for advanced BWR.
Fiche: 62241:347-62241:349
acn: 9207070258

July 2, 1992 — D.J. Robare, GE, letter forwarding proprietary responses to generic power uprate ACRS open items noted in NRC June 3, 1992, letter. Responses withheld.
Fiche: 62262:272-62262:276
acn: 9207070257

July 2, 1992 — J. Fox, GE, letter forwarding proprietary fax regarding advanced BWR SSAR information reassessment. Enclosure withheld.
Fiche: 62638:225-62638:225
acn: 9207300161

July 6, 1992 — S.J. Stark, GE, letter forwarding proprietary details of information submitting corrections or additions to submittal of Amendment 21 to GE's ABWR SSAR.
Fiche: 63139:224-63139:229
acn: 9209160126

July 6, 1992 — S.J. Stark, GE, letter forwarding Amendment 21 to advanced BWR SSAR.
Fiche: 62332:001-62334:026
acn: 9207100137

July 8, 1992 — J. Fox, GE, letter forwarding proprietary fax regarding minimum effort on responding to May 26, 1992, letter of GSI and USI guide for NRC advanced LWR review. Enclosure withheld.
Fiche: 62638:221-62638:224
acn: 9207300151

July 9, 1992 — H.A. Careway, GE, letter forwarding tables containing bin sorting used to produce Table 1-1 in June 30, 1992, fax sent to NRC as part of PRA consequence analysis, backup evaluations. Latest evaluation corrects weather input data error noted in original calculations.
Fiche: 62567:102-62567:105
acn: 9207290013

July 10, 1992 — J. Duncan, GE, letter forwarding updated advanced BWR punch list regarding tasks to wrapup PRA. Review requested.
Fiche: 62567:317-62567:348
acn: 9207290035

July 13, 1992 — R.C. Mitchell, GE, letter forwarding proprietary Amendment 21 drawings to ABWR SSAR. Drawings withheld.
Fiche: 62416:355-62416:356
acn: 9207160123

July 13, 1992 — R.C. Mitchell, GE, letter forwarding nonproprietary drawings to GE ABWR SSAR, Amendment 21.
Fiche: 62464:136-62464:304
acn: 9207200077

July 14, 1992 — J. Fox, GE, letter forwarding Item B to inservice test schedule, consisting of draft amendment to Table 3.9-8, "Inservice Testing, Safety-Related Pumps & Valves."
Fiche: 62568:001-62568:033
acn: 9207290010

July 15, 1992 — J. Fox, GE, letter forwarding update to Direct Containment Heating Report. Updated report withheld.
Fiche: 63945:021-63945:022
acn: 9211180251

July 15, 1992 — C. Poslusny, NRC, letter forwarding summary of interim evaluation concerning licensee May 21, 1992, submittal regarding justification for turbine building static seismic analysis.
Fiche: 62445:318-62445:322
acn: 9207220369

July 15, 1992 — C. Poslusny, NRC, letter forwarding listed documents regarding final SER review of advanced BWR SSAR and design certification material, consisting of agenda for July 27, 1992, management meeting, preliminary list of final SER open and confirmatory items and evaluation of structural ITAAC.
Fiche: 62568:034-62568:109
acn: 9207290012

July 16, 1992 — S.Q. Ninh, NRC, letter forwarding summary of confirmatory and open items identified in final SER for Chapters 2, 4, 5, 11, and 15 of advanced BWR.
Fiche: 62442:347-62442:354
acn: 9207220401

July 16, 1992 — S.Q. Ninh, NRC, letter forwarding summary of confirmatory and open items identified in final SER for Chapter 19, probabilistic risk assessment of advanced BWR.
Fiche: 62479:077-62479:088
acn: 9207240187

July 20, 1992 — J.F. Klapproth, GE, letter forwarding proprietary material presented at June 26, 1992, meeting regarding rotated bundle evaluation. Enclosure withheld.
Fiche: 62636:356-62636:360
acn: 9207310136

July 22, 1992 — J. Fox, GE, letter forwarding information regarding July 22 deferred response letter to P.W. Marriott from C. Poslusny dated May 4, 1992, for advanced BWR IST review.
Fiche: 63037:295-63037:332
acn: 9209090254

July 23, 1992 — J.N. Fox, GE, letter forwarding proprietary Toshiba test data of 10 reactor internal pump (RIP) and 9 RIP operations. Data withheld.
Fiche: 63164:189-63164:190
acn: 9209160281

July 24, 1992 — NRC, letter submitting comments regarding PGA of OBE issue in Chapters 2 and 3 of SSAR.
Fiche: 63005:358-63005:359
acn: 9209040145

July 27, 1992 — S.Q. Ninh, letter discussing identification of two preliminary confirmatory items and eight confirmatory open items identified in final SER for Chapter 10 regarding steam power conversion.
Fiche: 62609:332-62609:343
acn: 9208040214

July 29, 1992 — C. Poslusny, letter forwarding two sets of preliminary staff comments on GE's ABWR Phase III design certification material.
Fiche: 63003:097-63003:203
acn: 9209040085

July 30, 1992 — J. Fox, GE, letter forwarding information regarding additonal P&ID test connections for IST code pump and valve tests and current changes (marked) to IST Table 3.9-8 of July 22, 1992.
Fiche: 63040:311-63041:003
acn: 9209090248

July 31, 1992

W.T. Russell, NRC, letter forwarding SE regarding generic bouding analyses and equipment evaluations contained in topical report NEDC-31984P. GE commitment to establish standardized program fundamental to success of generic BWR power uprate program.
Fiche: 62748:191-62748:203
acn: 9208120007

August 3, 1992

C. Czajkowski, BNL, letter forwarding TER input for Chapters 5, 6, and 9 of ABWR SSAR regarding RCS ESF and auxiliary systems, respectively. Concludes that information in subject chapters acceptable. Report sent in fulfillment of Task Assignment 7 of FIN L-1892.
Fiche: 71418:307-71418:334
acn: 92078130010

August 6, 1992

J. Fox, GE, letter forwarding information on advanced BWR fuel storage and handling. Advises that proposed revision to Section 9.1 and that significant changes regarding Sections 9.1.2.1.3 and 9.1.2.1.4, recognizing fuel storage racks are purchase equipment.
Fiche: 63035:349-63035:361
acn: 9209090238

August 7, 1992

P.W. Marriott, GE, letter forwarding Invoices XT0477-92 and XT0553-92 for review charges inadvertently sent to licensee. GE has not yet filed formal application for NRC review of simplified BWR.
Fiche: 62792:039-62792:049
acn: 9208130172

August 7, 1992

J. Fox, GE, letter forwarding information regarding RPV surveillance - advanced BWR.
Fiche: 63037:339-63037:342
acn: 920909036

August 7, 1992

C.E. Buchholz, GE, letter forwarding details of conceptual design for corium shield. Sheild design to prevent flow of molten core debris into lower drywell sumps. Information also being provided to ACRS in preparation for August 19, 1992, meeting.
Fiche: 63948:004-63948:015
acn: 9211180277

August 10, 1992

G. Kelly, NRC, forwarding additional questions regarding GE ABWR PRA submittals made during June 1992.
Fiche: 71549:259-71549:262
acn: 9211180446

August 10, 1992

J.F. Quirk, GE, letter providing responses to technical issues identified in April 13, 1992, letter regarding review of draft SER on GE advanced BWR design.
Fiche: 63947:021-63947:190
acn: 9211180239

August 12, 1992

R.C. Pierson, NRC, letter forwarding detailed comments on Tier 1 design certification material submittal for ABWR. Additional detail consistent with SSAR to enable final evaluation for FDA requested.
Fiche: 62840:147-62841:018
acn: 9208200151

August 13, 1992

G. DeGrassi, BNL, letter forwarding trip report of July 28 through 31, 1992, visit to San Jose, California, to complete review of GE proposed piping design criteria and sample analyses for ABWR.
Fiche: 71464:302-71464:348
acn: 9208280216

August 13, 1992

R.C. Pierson, NRC, letter requesting review of enclosure, "ABWR Reactor Water Cleanup System Review," for proprietary information. Advises ACRS intent to discuss report at subcommittee meeting on August 19, 1992. Report withheld.
Fiche: 71420:185-71420:187
acn: 9208190232

August 17, 1992

R.C. Pierson, NRC, letter forwarding confirmatory and open items identified in FSER for Chapter 7 regarding instrumentation and control system of ABWR.
Fiche: 62864:350-62864:358
acn: 9208240353

August 18, 1992

R.C. Mitchell, GE, letter forwarding proprietary pages to SSAR for ABWR.
Fiche: 62922:279-62922:282
acn: 9208240159

August 19, 1992

R.C. Pierson, NRC, letter forwarding August 18, 1992, memo from W.T. Russell to D.M. Crutchfield regarding proposed changes to 10 CFR Part 100, Appendix A, and draft evaluation concerning use of single earthquake design for advanced BWR.
Fiche: 62896:126-62896:138
acn: 9208260207

August 26, 1992

J.F. Quirk, GE, letter forwarding GE evaluation of common mode failure of ditigal instrumentation and control, dated June 8, 1992. Evaluation identifies set of safety-grade control room displays and controls, independent of computer system to satisfy staff position.
Fiche: 63051:291-63051:337
acn: 9209090221

August 31, 1992

J. Fox, GE, letter forwarding page 5.3-4 of ABWR SSAR, Amendment 15 regarding RPV surveillance, reflecting weld specimen definition change, per B. Elliot suggestion.
Fiche: 63947:350-63947:353
acn: 9211180281

September 2, 1992

R.C. Pierson, NRC, letter requesting that schedule be provided consistent with resolving identified concerns regarding SSAR Appendix 19P, "Evaluation of Potential Design Mods to ABWR," by middle of October 1992.
Fiche: 63129:065-63129:069
acn: 9209140221

September 4, 1992

J.F. Klapproth, GE, letter submitting agenda items for GE fuel technology update meeting on September 22, 1992, in Rockville, Maryland. Items include GE 11 audit findings closure, stability update, new product development overview of GE 12 and 13 and upcoming license submittals.
Fiche: 63214:332-63214:332
acn: 9209210040

September 9, 1992 — P.D. Knecht, GE, letter providing preliminary draft responses to NRC request for information regarding pool bypass, per August 18, 1992, fax.
Fiche: 63929:106-63929:114
acn: 9211180322

September 11, 1992 — J.N. Fox, GE, letter forwarding responses to Piping Design Audit Open Items A-10, A-17, and A-28.
Fiche: 63396:217-63396:232
acn: 9210050222

September 11, 1992 — M. Ross, GE, letter forwarding update of HFE Tier 2 design acceptance criteria.
Fiche: 63960:023-63960:047
acn: 9211190025

September 11, 1992 — R.C. Pierson, NRC, letter requesting that GE provide staff with prioritized list of ABWR TS to be based on risk and reliability considerations, per July 27, 1992, ABWR open issues meeting.
Fiche: 63283:350-63283:354
acn: 9209240258

September 11, 1992 — R.C. Pierson, NRC, letter discussing guidance for use of single-earthquake design for systems, structures, and components in ABWR. Safety evaluation regarding use of single-earthquake design enclosed.
Fiche: 63283:271-63283:282
acn: 9209240282

September 16, 1992 — J. Fox, GE, letter forwarding presentation material from "Advanced Reactor Programs Advanced BWR Control Room Design," presented by M.A. Ross in Tokyo, Japan, on April 3 and 4, 1992.
Fiche: 63948:074-63948:143
acn: 9211180320

September 16, 1992 — C. Poslusny, NRC, letter forwarding summary of open items resulting from NRC review of SSAR Sections 3.7 and 3.8 and NRC audits conducted at San Jose office. Two followup audits will be conducted at Bechtel office in San Francisco in October and November.
Fiche: 63200:324-63200:332
acn: 9209180067

September 16, 1992 — R.C. Pierson, NRC, provides enclosed staff comments on Section 3.5, "Software Development," of Tier 1 design certification material for GE ABWR for review. Requests set of revised ITAAC for section in timely manner. ITAAC will be discussed at next management meeting.
Fiche: 63321:011-63321:129
acn: 9209290248

September 18, 1992 — P.W. Marriott, GE, letter forwarding Amendment 22 to "ABWR SSAR."
Fiche: 63349:001-63354:237
acn: 9210010116

September 21, 1992 — P.W. Marriott, GE, letter forwarding foldoout drawings of selected sections of Chapters 8, 9, 12, 15, and 18 of Amendment 22 to ABWR SSAR.
Fiche: 63380:187-63380:307
acn: 9210010066

September 22, 1992 — C. Poslusny, NRC, letter forwarding draft staff preliminary evluation of ABWR design performance under severe conditions to be used as basis for discussions in September 29 through October 1, 1992, public meeting in Rockville.
Fiche: 71492:127-71492:194
acn: 9209280237

September 24, 1992 — C.E. Buchholz, GE, letter submitting clarification/additional information needed for closure of Level 2 PRA issues.
Fiche: 63948:208-63948:244
acn: 9211180101

September 30, 1992 — J.F. Klapproth, GE, letter forwarding GE-NE-770-24-0892, "Generic Model for Probability of Operation w/Mis-Oriented Fuel Bundle," per June 26, 1992, meeting with NRC regarding rotated bundle event licensing basis change.
Fiche: 63466:220-63466:235
acn: 9210090175

September 30, 1992 — R.C. Pierson, NRC, letter providing clarification to September 2, 1992, request for additional information regarding advanced BWR SSAR Appendix 19P.
Fiche: 63452:350-63452:351
acn: 9210080267

October 1, 1992 — J. Duncan, GE, letter forwarding updated ABWR punch list for PRA, as discussed in September 22, 1992, meeting with NRC.
Fiche: 63942:099-63942:136
acn: 9211180246

October 2, 1992 — J. Fox, GE, letter forwarding proposed modification to Subsection 3.5.1.1.1.4 regarding internal missiles - fans.
Fiche: 63948:280-63948:282
acn: 9211180086

October 5, 1992 — G. Kelly, NRC, letter forwarding list of questions regarding reliability assurance program, ABWR seismic margins analysis, RWCU and requantification of ABWR PRA. NRC working on better description of staff expectations regarding seismic margins analysis for ABWR PRA.
Fiche: 71550:016-71550:022
acn: 9211180457

October 6, 1992 — J. Fox, GE, letter forwarding information regarding ablation of inner steel plate and fill concrete.
Fiche: 63956:303-63956:307
acn: 9211180102

October 8, 1992 — G.W. Ehlert, GE, letter forwarding detailed pedestal structural drawing of ABWR.
Fiche: 63952:355-63952:360
acn: 9211180108

October 8, 1992 — J. Fox, GE, letter forwarding IST responses to telecon questions on October 6, 1992, for discussion on October 9, 1992.
Fiche: 63956:283-63956:292
acn: 9211180113

October 8, 1992

J. Fox, GE, letter forwarding proposed resolution of ISLOCA for ABWR, including modified P&ID for affected system. GE will prepare corresponding modification to Subsection 19B.2.15 regarding high/low pressure interface design following NRC review and approval of proposed ISLOCA.
Fiche: 63943:338-63943:350
acn: 9211180288

October 9, 1992

A. McSherry, GE, letter forwarding proprietary Revision 1 to 23A1317, "Safety System Logic & Control System Design Spec."
Fiche: 63939:326-63939:327
acn: 9211180128

October 9, 1992

R.L. Nease, letter forwarding summary of each confirmatory and open item identified in draft FSER for GE ABWR, in support of upcoming meetings between GE and NRC to discuss closure of issues.
Fiche: 63519:001-63519:131
acn: 9210160301

October 12, 1992

J. Fox, GE, letter forwarding changes to Table 3.9-8 regarding IST safety-related pumps and valves.
Fiche: 63948:325-63948:328
acn: 9211180119

October 14, 1992

J.N. Fox, GE, letter forwarding modified responses to piping design audit Open Items A-6 and A-26, and calculational summary for SRV-quencher and pedestal weld stress analysis corresponding to Open Item A-4.
Fiche: 63942:289-63942:319
acn: 9211180238

October 16, 1992

J.N. Fox, GE, letter forwarding response to piping design audit Open Items A-12 and A-25 regarding combination of inertia and relative support motion effects and acceleration level for calculation of missing mass contributions, respectively. Calculation enclosed.
Fiche: 63942:190-63942:209
acn: 9211180230

October 20, 1992

D.M. Crutchfield, NRC, letter forwarding draft final safety evaluation report on ABWR. Report contained significant number of open and confirmatory items which must be resolved prior to completion of final report.
Fiche: 63670:001-63672:185
acn: 9210270334

October 27, 1992

J.Duncan, GE, letter forwarding reponse to questions regarding advanced BWR PRA.
Fiche: 71549:002-71549:009
acn: 9211180304

October 29, 1992

R.C. Pierson, NRC, letter forwarding list of questions regarding NRC reliability study and evaluation of internal floods and fires during modes other than full power. Questions not to be regarded as request for new information.
Fiche: 63780:250-63780:255
acn: 9211050341

November 3, 1992 — C.E. Buchholz, GE, letter submitting response to questions from September 29, 1992, meeting regarding type of concrete used in pedestal, mass of material used in core concrete interaction calculations, and time of Zr depletion for bounding sequence for core concrete interaction sequence.
Fiche: 63947:002-63947:020
acn: 9211180294

November 13, 1992 — J. Fox, GE, letter forwarding chart reflecting remaining ABWR certification process and ABWR FDA schedule.
Fiche: 63947:249-63947:252
acn: 9211180299

November 16, 1992 — J.N. Fox, GE, letter forwarding preliminary, "Sample Analysis for Effect of Postulated Pipe Break - ABWR Main Steam Piping." Report provides sample pipe break analysis and addresses remaining SSAR issues raised during audit regarding postulated pipe ruptures.
Fiche: 63948:144-63948:207
acn: 9211180338

November 17, 1992 — C. Poslusny, NRC, letter forwarding comments and questions from preliminary review of pilot TS for advanced BWR I&C system.
Fiche: 63950:270-63950:273
acn: 9211200016

November 20, 1992 — R.C. Mitchell, GE, letter forwarding modifications to Amendment 23 to ABWR SSAR. Mods includes partial resolution of COL license information, codes, and standards update, piping audit responses, expansion of inservice testing, 60-year vessel surveillance plan, and update of dose assessment.
Fiche: 64035:001-64038:126
acn: 9211300015

November 20, 1992 — R.C. Mitchell, GE, letter forwarding proprietary modifications to Amendment 23 to ABWR SSAR.
Fiche: 64044:176-64044:176
acn: 9211300021

November 20, 1992 — R.C. Mitchell, GE, letter forwarding changes to proprietary 11x17 foldout drawings from Chapter 7 of ABWR SSAR, Amendment 23.
Fiche: 64015:316-64015:316
acn: 9211300034

November 20, 1992 — R.C. Mitchell, GE, letter forwarding changes to nonproprietary 11x17 foldout drawings from Chapter 8 of ABWR SSAR, Amendment 23.
Fiche: 64059:183-64059:206
acn: 9211300041

December 1, 1992 — G. Galletti, NRC, letter forwarding items identified as result of staff review of GE advanced BWR shutdown panel instrumentation inventory w/o enclosure.
Fiche: 63950:270-63950:273
acn: 9301150099

December 2, 1992 — C. Poslusny, NRC, letter forwarding SE accepting GE proposal for implementing ISLOCA issue resolution for advanced BWR.
Fiche: 64157:099-64157:107
acn: 9212070153

December 8, 1992 — R. Louison, GE, letter forwarding marked-up advanced BWR design document, Section 2.10.1, "Turbine Main Steam System," Section 2.10.2, "Condensate Feedwater & Condensate Air Extraction System" and Section 2.10.4, "Condensate Purification System."
Fiche: 64270:253-64270:284
acn: 9212170035

December 8, 1992 — R. Louison, GE, letter forwarding listed ABWR ITAAC sections and response to NRC questions and comments on system.
Fiche: 64281:001-64281:107
acn: 9212210192

December 10, 1992 — C.E. Buchholz, GE, letter responding to remaining currently open items raised regarding ABWR SSAR.
Fiche: 64807:247-64807:251
acn: 9302100083

December 15, 1992 — C. Poslusny, NRC, letter forwarding preliminary evaluation of ABWR design for instrumentation & control diversity per open item noted in NRC draft final SER. Most of items satisfactorily resolved. Expects discussion of diversity issue at January 21, 1993, management meeting.
Fiche: 64261:080-64261:093
acn: 9212180127

December 21, 1992 — C. Poslusny, NRC, letter forwarding preliminary safety evaluation for information provided by GE regarding capacity of reinforced concrete containment vessel in Appendix 19F of SSAR. Advises that additional information necessary.
Fiche: 64440:328-64440:339
acn: 9301040056

December 21, 1992 — C. Poslusny, NRC, letter forwarding proposed scope of operating experience review regarding resolution of open item in draft final SER for human factors engineering design for advanced BWRs.
Fiche: 64602:197-64602:200
acn: 9301150311

December 22, 1992 — G. Kelly, NRC, letter forwarding list of clarifications needed to complete NRC review of LOCA outside containment for advanced BWR PRA.
Fiche: 64600:349-64600:350
acn: 9301150320

December 23, 1992 — C. Poslusny, NRC, letter discussing status of GE advanced BWR shutdown risk draft FSER.
Fiche: 64432:303-64432:305
acn: 9212310122

December 28, 1992 — G. Kelly, NRC, letter forwarding requested clarification that deals with areas of GE Chapter 19, Appendix K submittal (PRA input to reliability assurance program).
Fiche: 64572:027-64572:028
acn: 9301150086

January 7, 1993

D.J. Robare, GE, letter forwarding selected section of Chapter 6, "ESF" of SSAR for advanced BWR, consisting of nonproprietary 11x17 foldout drawings of standby gas treatment system.
Fiche: 64554:336-64554:343
acn: 9201130182

January 7, 1993

D.J. Robare, GE, letter forwarding proprietary selected sections of Chapter 7, "Instrumentation and Control System of SSAR for Advanced BWR," consisting of Amendment 24 11x17 foldout drawings to GE.
Fiche: 64554:333-64554:333
acn: 9301130194

January 7, 1993

D.J. Robare, GE, letter forwarding selected sections of Chapter 1, "Introduction and General Description of Plant," Chapter 3, "Design of Structures, Components and System," consisting of Amendment 24 to GE advanced BWR SSAR.
Fiche: 64555:001-64555:296
acn: 9301130218

January 12, 1993

I. Fox, GE, letter forwarding list of recent submittals related to resolution of open items identified in draft final SER for ABWR.
Fiche: 64710:001-64712:035
acn: 9301270253

January 12, 1993

G. Kelly, NRC, letter forwarding updated punch list for ABWR PRA issues. Overlap of issues assocaited with CA-1, CA-2 and CA-3, in that issues also covered in "belonging to other branches" eliminated.
Fiche: 74348:231-74348:241
acn: 9303220102

January 13, 1993

J.N. Fox, GE, letter forwarding responses to questions transmitted via NRC December 23, 1992, letter on ABWR shutdown risk study (App 19Q).
Fiche: 64681:350-64681:354
acn: 9301260237

January 14, 1993

P.P. Stancavage, GE, letter responding to NRC December 21, 1992, request for additional information regarding preliminary input to final SER on containment performance. Analysis of axisymmetric structures, taking into account nonlinear behavior, will be submitted by January 20, 1993.
Fiche: 64600:360-64600:361
acn: 9301150233

January 14, 1993

J. Fox, GE, letter forwarding resubmittal of responses to four NRC questions on most recent draft PRA input to RAP, Appendix 19K, and draft SSAR, Appendix 19K, with respect to ABWR review schedule. Responses originally submitted via facsimile on January 8, 1993.
Fiche: 64681:355-64681:358
acn: 9301260230

January 14, 1992

G. Kelly, NRC, letter forwarding further updated punch list for ABWR issues. Informs that NRC has not received submittal from GE on internal flooding (from hot high pressure fluids) subcompartment analysis.
Fiche: 74348:189-74348:200
acn: 9303220069

January 15, 1993 — J. Fox, GE, letter forwarding resubmittal of GE comments on NRC ABWR PRA issue status punch list, dated January 14, 1993. Comments originally submitted via facsimile on January 14, 1993, with respect to accelerated ABWR review schedule.
Fiche: 64688:327-64688:339
acn: 9301260264

January 18, 1993 — J. Fox, GE, letter forwarding responses to December 22, 1992, memo regarding clarification on LOCAs outside of containment, with respect to accelerated ABWR review schedule.
Fiche: 64685:272-64685:303
acn: 9301260268

January 19, 1993 — J. Fox, GE, letter forwarding revised proposed closure of ABWR DFSER Open Item 17.3.5-1 in support of accelerated ABWR review schedule.
Fiche: 64699:263-64699:282
acn: 9301280210

January 20, 1993 — J. Fox, GE, letter forwarding Bechtel Rept RPRT-STRU-008, Revision O, "Containment Structrural Evaluation for Pressure Capacity Summary Report," in reference to GE plan for resolving Appendix 19F open items, dated January 14, 1993.
Fiche: 64699:283-64699:295
acn: 9301280204

January 22, 1993 — J. Fox, GE, letter forwarding ABWR SSAR markups addressing Open Items 6.2.1.6-1, 6.2 1.6-2, 6.2.4.1-1, 6.2.4.1-2, 6.2.4.1-3, and 6.5.1-2, and Confirmatory Items 6.5.1-2, including additional change in Subsection 6.2.1.2-2.
Fiche: 64700:334-64700:347
acn: 9301280197

January 25, 1993 — J. Fox, GE, letter forwarding drafts of ABWR design document, MOV design description, and modified Subsection 3.9.6, IST of pumps and valves, in support of acelerated ABWR review schedule.
Fiche: 64761:347-64761:354
acn: 9302030256

January 25, 1993 — J. Fox, GE, letter forwarding ABWR SSAR markups of proprietary pages addressing Confirmatory Items 4.2-2 and 5.1-1, reflecting corrections or additions to earlier submittals and proprietary affidavits under which pages originally issued.
Fiche: 71618:087-71618:087
acn: 9302030264

January 25, 1993 — S.Q. Ninh, NRC, letter discussing preliminary staff evaluation of ABWR severe accident performance.
Fiche: 64697:319-64697:321
acn: 9301280269

January 25, 1993 — S.Q. Ninh, NRC, letter advising of summary of open items listed in Section 1.6 of ABWR draft final SER. Changes listed.
Fiche: 71611:145-71611:154
acn: 9301280273

January 26, 1993

S.Q. Ninh, NRC, letter discussing audit of ABWR structural design to be held February 22 through 25, 1993, regarding review of design calculations to close out open items identified in draft final safety evaluation report.
Fiche: 64724:355-64724:357
acn: 9302010293

January 28, 1993

J. Fox, GE, letter forwarding responses to NRC questions on RHR alarms and modification to SSAR Subsection 9.3.2.3.2 regarding feedwater corrosion product monitor per accelerated advanced BWR review schedule.
Fiche: 64760:285-64760:288
acn: 9302030027

January 28, 1993

J. Fox, GE, letter forwarding markups of advanced BWR SSAR Sections 3.6 and 3.9 for OBE elimination and elimination of AP & SSE load combination to support accelerated advanced BWR review schedule.
Fiche: 64760:257-64760:270
acn: 9302030040

January 28, 1993

G. Kelly, NRC, letter forwarding questions previously sent (by fax or letter) regarding ABWR PRA, as discussed in San Jose, January 1993, management meeting. Thoughts on PRA-based ITAAC also enclosed.
Fiche: 74348:207-74348:229
acn: 9303220092

January 29, 1993

P.W. Marriott, GE, letter forwarding Amendment 25 to GE advanced BWR SSAR, Chapter 13, conduct of operations.
Fiche: 64706:281-64706:281
acn: 9301290129

January 29, 1993

P.W. Marriott, GE, letter forwarding Amendment 25 to "ABWR SSAR."
Fiche: 64764:117-64764:234
acn: 9302030035

January 29, 1993

J. Fox, GE, letter forwarding draft of Section 19E.2, deterministic analyses of plant performance for "ABWR SSAR," Chapter 19, in support of accelerated ABWR review schedule.
Fiche: 64770:092-64771:071
acn: 9302030293

January 29, 1993

J. Fox, GE, letter forwarding draft responses to advanced BWR SSAR Chapter 8 non-ITAAC draft FSER items. Listed items will be addressed by February 8, 1993.
Fiche: 64771:181-64771:268
acn: 9302030307

January 29, 1993

P.W. Marriott, GE, letter forwarding nonproprietary 11x17 foldout drawings to Amendment 25 to "ABWR SSAR."
Fiche: 64762:317-64762:347
acn: 9302030355

January 29, 1993

P.W. Marriott, GE, letter forwarding proprietary pages 4C-1 and 4C-1.1 to Amendment 25 to "ABWR SSAR."
Fiche: 64760:236-64760:236
acn: 9302030380

January 29, 1993 — J. Fox, GE, letter forwarding proposal to characterize man-made site design parameters regarding missiles and gases, in support of accelerated ABWR review schedule.
Fiche: 64809:186-64809:189
acn: 9302100150

January 29, 1993 — J. Fox, GE, letter forwarding response to request for additional information on ABWR pedestal anchorage.
Fiche: 64808:351-64808:352
acn: 9302100225

January 30, 1993 — J. Fox, GE, letter forwarding markups of proposed changes to Chapters 2 and 3 open issue resolution and Appendix 3H, supporting accelerated advanced BWR review schedule.
Fiche: 64765:001-64766:040
acn: 9302030262

February 1, 1993 — J. Fox, GE, letter forwarding markup of ABWR SSAR Chapter 16 in accordance with STS (NUREG-1433 and NUREG-1434).
Fiche: 64803:066-64804:297
acn: 9302100456

February 2, 1993 — J. Fox, GE, letter forwarding "Submittal Supporting Accelerated ABWR Review Schedule."
Fiche: 64777:296-64777:303
acn: 9302040095

February 2, 1993 — J. Fox, GE, letter forwarding first five pages of C. Buchholz December 10, 1992, fax containing response to currently open items, in support of accelerated ABWR review schedule. Last 19 pages successfully transmitted on December 10, 1992.
Fiche: 64807:246-64807:251
acn: 9302100076

February 2, 1993 — C. Poslusny, NRC, letter forwarding preliminary revision of DFSER pages 4-2 through 4-4 for information and to facilitate further discussions of resolution of outstanding items for Chapter 4.
Fiche: 64788:317-64788:324
acn: 9302110345

February 3, 1993 — J. Fox, GE, letter forwarding markup of Section 2.3 regarding COL information, addressing all draft FSER Chapter 2 COL action items to support accelerated ABWR schedule.
Fiche: 64828:314-64828:322
acn: 9302110362

February 4, 1993 — J. Fox, GE, letter forwarding comparison of SSAR and industry initiatives on piping design and analyses to support accelerated ABWR review schedule.
Fiche: 64851:271-64851:275
acn: 9302110358

February 9, 1993 — J. Fox, GE, letter forwarding submittal supporting accelerated advanced BWR review schedule. Submittal for resolution of open and confirmatory piping DFSER items listed in Attachment 1, including previously closed items for information.
Fiche: 64834:077-64834:170
acn: 9302160193

February 9, 1993

J. Fox, GE, letter forwarding complete set of draft responses to advanced BWR SSAR, Chapter 8 non-ITAAC draft FSER open items, including Open Item 8.3.5-1 regarding roadmap. Transmittal replaces January 29, 1993, transmittal, and incorporates information discussed in telecons.
Fiche: 64854:194-64854:302
acn: 9302170004

February 9, 1993

J. Fox, GE, letter forwarding responses to open issues documented in Sections 2.1 and 2.3 of Enclosure 2 to NRC November 13, 1992, summary of October 12 through 15, 1993, meeting, to support accelerated advanced BWR review schedule.
Fiche: 64854:001-64854:125
acn: 9302170007

February 10, 1993

J. Fox, GE, letter forwarding proposed replacement of ABWR Appendix 3A, "Seismic Soil-Structure Interaction Analysis Report," as followup to January 30, 1993, transmittal supporting accelerated ABWR review schedule.
Fiche: 64845:001-64845:348
acn: 9302170090

February 11, 1993

T.H. Boyce, NRC, letter forwarding summary of January 11 through 27, 1993, meeting with licensee regarding ITAAC.
Fiche: 64915:147-64915:302
acn: 9302230271

February 12, 1993

J. Fox, GE, letter forwarding proposed changes to Section 3.2 of Revision A to 23A6100AE, addressing issue of main steam line leakage path and seismic classification.
Fiche: 64957:269-64957:282
acn: 9302220094

February 12, 1993

J. Fox, GE, letter forwarding proprietary markups of Sections 11.2, 11.3, and 11.4 addressing Open Items 20.2-2 and COL Action Items 9.3.8-2, 11.0-1, 11.2.1-1, 11.2.1.2, 11.2.2-1, 11.2.2-3, 11.3.2-1, 11.4.1-1, 11.4.1-2, 11.4.1-3 and 11.4.2-1. Withheld.
Fiche: 98472:013-98472:025
acn: 9302240247

February 12, 1993

J. Fox, GE, letter forwarding markup of advanced BWR SSAR Section 14.2 regarding preoperational testing, addressing Open Items 14.2.12.3-1 and 14.2.12.3-2, to support accelerated advanced BWR review.
Fiche: 74133:002-74133:214
acn: 9303040061

February 12, 1993

C. Poslusny, NRC, letter forwarding guidance documents regarding Tier 2 information considered in preparation of SSAR revisions to complement ITAAC items discussed in recent meetings with MEM staff.
Fiche: 64846:357-64846:361
acn: 9302160142

February 16, 1993

J. Fox, GE, letter forwarding proposed draft as severe accident input into Tier 2. Only few items suitable for inclusion in ITAAC. Cross-tie for firewater system and containment overpressure protection system should be identified in ITAAC.
Fiche: 64966:355-64966:361
acn: 9302190359

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February 16, 1993 — J. Fox, GE, letter forwarding vendor followup action to February 11, 1993, telecon with NRC regarding SSAR Chapter 14, "Initial Test Program," to support accelerated advanced BWR review schedule.
Fiche: 74122:327-74122:333
acn: 9303040051

February 16, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Open Items 5.3.2-1 and 15.3-1, and Confirmatory Items 4.2-3 and 4.4-1 regarding Reactor Systems and Mechanical Engineering Branches outstanding items to support accelerated advanced BWR review schedule.
Fiche: 74136:290-74136:310
acn: 9303040057

February 16, 1993 — J. Fox, GE, letter forwarding draft of Chapter 8 that incorporates markup provided under February 9, 1993, letter and more recent markups resulting from telecons since February 9, 1993, to submittal supporting accelerated advanced BWR review schedule.
Fiche: 74137:217-74137:303
acn: 9303040100

February 16, 1993 — S. Ninh, NRC, letter forwarding proposed agenda for February 22 through 26 audit. Suggests that licensee provide copy of enclosure to NRC and Bechtel to facilitate understanding of scope of audit.
Fiche: 64968:324-64968:325
acn: 9302190352

February 17, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing COL Action Items 17.1.1-1, 17.2, 17.3.1-1, 17.3.5-1, and 17.3.9-1. Advises that change reflected in markups in addition to changes proposed in January 19, 1993, letter addressing Open Item 17.3.5-1.
Fiche: 74025:260-74025:265
acn: 9302250197

February 18, 1993 — M. Janus, NRC, letter forwarding changes to DFSER Chapter 9 Section 9.3.5 regarding reliability of suction valves for SLCS, per February 17, 1993, discussion.
Fiche: 64969:139-64969:140
acn: 9302190355

February 22, 1993 — J. Fox, GE, letter forwarding report entitled, "Advanced BWR ATWS Stability Study," to address Open Item 4.4-1 and Confirmatory Item 15.5.2-1 to support accelerated advanced BWR review schedule.
Fiche: 74260:265-74260:303
acn: 9303150200

February 23, 1993 — J. Fox, GE, letter forwarding SSAR markups revising responses to Open Item 15.3-1 and COL Action Items 17.1.1-1 and 17.2-1 originally transmitted in letters dated February 16 and 17, 1993, supporting accelerated advanced BWR review schedule.
Fiche: 74258:293-74258:297
acn: 9303150316

February 23, 1993 — M. Janus, NRC, letter forwarding draft statement of NRC and GE discussions involving valve ITAACs discussed during February 22, 1993, telecon.
Fiche: 71631:331-71631:332
acn: 9302250116

February 24, 1993 — J. Fox, GE, letter forwarding proposed SSAR markup of Subsection 3.9.6, "Testing of Pumps & Valves," and Subsection 3.9.7, "COL License Information."
Fiche: 74029:278-74029:288
acn: 9303010116

February 24, 1993 — J. Fox, GE, letter forwarding SSAR markup responding to COL Action Item 6.3.4.2-1 and revised Nuclear Boiler System IBD Drawing 137C9464 (SSAR Figure 7.3-2) showing revised ADS logic responding to Confirmatory Item 6.3.3-1 with 38 drawings. Drawings withheld.
Fiche: 74069:045-74069:048
acn: 9303010362

February 24, 1993 — T.H. Boyce, NRC, letter forwarding summary of February 3 and 4, 1993, meeting with GE to discuss lessons learned from January 11 through 21, 1993, meeting on ABWR ITAAC.
Fiche: 74067:001-74067:143
acn: 9303030256

February 25, 1993 — J. Fox, GE, letter forwarding draft of new Appendix 3L, "Procedure for Evaluation of Postulated Ruptures in High Energy Lines," and SSAR markups for Subsections 3.6-1 and 3.6-2, to support accelerated advanced BWR review schedule.
Fiche: 74119:341-74119:357
acn: 9303040018

February 25, 1993 — J. Fox, GE, letter forwarding SSAR markups of selected portions of Section 3.11 regarding environ qualification of mechanical and electrical equipment and radiation dose for gamma and beta data, to support advanced BWR accelerated review schedule.
Fiche: 74133:334-74133:348
acn: 9303040028

February 26, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing advanced BWR draft FSER COL Action Items 3.3.2-1, 3.5.1.2-1, 3.4.3-1, 3.10-1, and 9.3.5-1, to support accelerated advanced BWR review schedule.
Fiche: 74099:351-74099:360
acn: 9303040020

February 26, 1993 — J. Fox, GE, letter forwarding amplification of January 25, 1993, response to Confirmatory Item 15.1-1 regarding verification of ODYNA and REDYA code changes, to support accelerated advanced BWR review schedule
Fiche: 74136:311-74136:312
acn: 9303040024

February 26, 1993 — J. Fox, GE, letter forwarding results of analyses of defined set of Chapter 15 events that would bound consequences of postulated common mode failure of microprocessor-based instrumentation and control safety system. Results of six events listed.
Fiche: 74133:215-74133:245
acn: 9303040065

March 1, 1993 — J. Fox, GE, letter forwarding responses to G. Kelly December 22, 1992, memo to J. Duncan requesting clarification of information contained in SSAR Subsection 19E.2.3.3 regarding suppression pool bypass paths, to support accelerated advanced BWR review schedule.
Fiche: 74113:320-74113:351
acn: 9303040054

March 2, 1993 — J. Fox, GE, letter forwarding SSAR markups for Subsections 3.6-2, 3.6-3, 3.6-4, and 3.6-5, in support of accelerated ABWR review schedule for SSAR Section 3.6.
Fiche: 74236:316-74236:333
acn: 9303110053

March 3, 1993 — J. Fox, GE, letter forwarding SSAR markups for listed sections covering evalution of control building flooding events, evaluation of turbine building flooding events, and protection of UHS, to support accelerated advanced BWR review schedule.
Fiche: 74228:309-74228:324
acn: 9303100202

March 4, 1993 — J. Fox, GE, letter forwarding responses to questions on advanced BWR probabilistic flooding analysis discussed with G. Kelly on February 22, 1993, and documented in NRC February 25, 1993, letter.
Fiche: 74207:075-74207:086
acn: 9303100254

March 4, 1993 — B. Huffman, NRC, letter forwarding markups from Human Factors Branch on advanced BWR ITAAC and Chapter 18, Appendix E of SSAR. Vendor should be prepared to discuss items during March 5, 1993, telecon.
Fiche: 74200:246-74200:291
acn: 9303090111

March 4, 1993 — M. Janus, NRC, letter forwarding summary of Chapter 3 issues, "Design of SSC."
Fiche: 74145:344-74145:360
acn: 9303090606

March 5, 1993 — J. Fox, GE, letter forwarding detailed presentation of justification and benefits for eliminating annulus pressurization and SSE as design load combination for advanced BWR, to support accelerated advanced BWR review schedule.
Fiche: 74207:218-74207:222
acn: 9303100237

March 5, 1993 — J. Fox, GE, letter forwarding replacement pages for text provided in February 26, 1993, letter regarding feedwater line break inside containment and shutdown cooling line break inside containment, to support accelerated advanced BWR review schedule.
Fiche: 74207:223-74207:235
acn: 9303100247

March 5, 1993 — J. Fox, GE, letter forwarding markup of SSAR Chapter 6 addressing Open Items 6.2.5-3 regarding containment purging and venting and 6.2.6-6 regarding combustible gas control in containment and COL Action Item 6.2.5-1 regarding alternate hydrogen control.
Fiche: 74207:062-74207:066
acn: 9303100259

March 5, 1993 — J. Fox, GE, letter forwarding SSAR markups in support of accelerated ABWR review schedule for resolution of outstanding items of Section 3.11. Markups withheld.
Fiche: 71643:033-71643:033
acn: 9303110070

March 8, 1993 — R.C. Mitchell, GE, letter providing key schedule dates for completion of all information required for staff to complete review of ABWR, as follow-up to February 25, 1993, meeting. Licensee will submit final SSAR by July 31, 1993.
Fiche: 74313:293-74313:294
acn: 9303170239

March 8, 1993 — J. Fox, GE, letter discussing Confirmatory Item 6.1.1-1 which directs vendor to commit to follow EPRI NP-3589-SL-LD, "BWR Water Chemistry Guidelines." Vendor committed to follow 1987 revision to guidelines, and confirmatory item should be closed.
Fiche: 74336:354-74336:354
acn: 9303220033

March 8, 1993 — J. Fox, GE, letter forwarding J. Duncan March 8, 1993, memo to NRC responding to NRC questions regarding ECCS pumps taking suction from suppression pool, which during Class II sequences, could exceed pump design basis temperature.
Fiche: 74340:185-74340:187
acn: 9303220039

March 8, 1993 — J. Duncan, GE, letter responding to NRC questions regarding advanced BWR ECCS pumps taking suction from suppression pool, which during Class II sequences, could exceed pump design basis temperature. Listed material will be placed in SSAR.
Fiche: 74340:186-74340:187
acn: 93032200040

March 8, 1993 — J. Fox, GE, letter forwarding J. Duncan March 8, 1993, memo to NRC providing partial response to NRC request that advanced BWR PRA be used to identify important feature of seismic margins, flooding and fire.
Fiche: 74340:135-74340:144
acn: 9303220044

March 8, 1993 — J. Duncan, GE, letter forwarding partial response to NRC request that advanced BWR PRA be used to identify important features regarding seismic margins, flooding and fire, including important insights from advaned BWR seismic margins analysis.
Fiche: 74340:136-74340:144
acn: 9303220050

March 8, 1993 — J. Fox, GE, letter forwarding replacement of proposed SSAR markup of Subsection 3.9.6, "Testing of Pumps & Valves," and Subsection 3.9.7, "COL License Info," provided in vendor February 24, 1993, letter. Enclosure incorporates GE understanding of GE/NRC March 5, 1993, telecon.
Fiche: 74336:325-74336:335
acn: 9303220055

March 8, 1993 — J. Fox, GE, letter forwarding memo responding to NRC question regarding ECCS pumps taking suction from suppression pool.
Fiche: 71724:161-71724:162
acn: 9306090491

March 9, 1993 — J.N. Wilson, NRC, letter discussing review of August 18, 1992, request for withholding information in ABWR SSAR from public disclosure. Informs that only material designated in affidavit for listed subjects is appropriately classified as proprietary.
Fiche: 71641:211-71641:215
acn: 9303120129

March 9, 1993

G. Kelly, NRC, retransmits additional ABWR PRA questions, previously sent on January 23, 1993.
Fiche: 74348:176-74348:176
acn: 9303220042

March 11, 1993

J. Fox, GE, letter forwarding draft SSAR Section 19H.5, "COL License Information," to support accelerated advanced BWR review schedule.
Fiche: 74348:334-74348:339
acn: 9303220062

March 12, 1993

R.W. Borchardt, NRC, letter forwarding assessment of ex-vessel fuel-coolant-interaction energetics for ABWR w/o report.
Fiche: 74319:197-74319:197
acn: 9303190186

March 12, 1993

G. Kelly, NRC, documents conference call on March 11, 1993, with licensees regarding ECCS pump qualifications and Class II sequences.
Fiche: 74418:338-74418:340
acn: 9303290164

March 12, 1993

G. Kelly, NRC, confirms telecon on March 11, 1993, regarding qualification temp for ECCS pumps.
Fiche: 71724:163-71724:266
acn: 9306090510

March 16, 1993

J. Fox, GE, letter forwarding proposed changes to SSAR Sections 1.8, 3.8, and 3.9 which address Open Item 14.1.3.8-1 pertaining to welding. Changes reviewed by D. Terao during ITAAC review meeting in San Jose, California, from January 11 through 20, 1993.
Fiche: 74376:202-74376:229
acn: 9303250085

March 16, 1993

J. Fox, GE, letter forwarding correction to Subsection 3.9.6 and mods to RHR valves F0-14, 015, and 016 discussed during March 16, 1993, telecon. Proposed ITAAC for check valves also enclosed. Information submitted to support accelerated ABWR review schedule.
Fiche: 74376:354-74376:359
acn: 9303250088

March 16, 1993

J. Fox, GE, letter forwarding GE February 26, 1993, internal memo addressing resolution of Chapter 18 draft FSER outstanding items, initially faxed to NRC on March 12, 1993. Items include validation of detailed design, standard features, and prototype evaluation, and operator workload.
Fiche: 74379:228-74379:234
acn: 9303250119

March 17, 1993

J. Fox, GE, letter forwarding SSAR markups addressing listed DFSER outstanding items. GE recommends that first two sentences of fifth paragraph of DFSER Page 14-18 regarding effect of pipe support stiffness on piping response be replaced, as listed.
Fiche: 74377:318-74377:356
acn: 9303250149

March 18, 1993 — J. Fox, GE, letter forwarding T. O'Neil's responses to G. Galletti note to M. Ross regarding NRC review of GE ABWR remote shutdown panel inventory of displays, controls, and alarms.
Fiche: 74376:192-74376:193
acn: 9303250060

March 23, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing DFSER TMI regarding outstanding Open Items 20.3-6 and 20.3-9 and COL Action Items 20.3-1, 20.3.1-2, 20.3.1-3, 20.3.1-4, 20.3.1-5, and 20.3-2.
Fiche: 74448:340-74448:353
acn: 9304010178

March 23, 1993 — J. Fox, GE, letter forwarding proposed wording for Chapter 18 issues based on GE/NRC March 22, 1993, conference call.
Fiche: 74437:356-74437:358
acn: 9304010187

March 24, 1993 — P.W. Marriott, GE, letter forwarding Amendment 26 of selected sections of Chapters 1 through 20 of advanced BWR SSAR.
Fiche: 74398:025-74398:237
acn: 9303250117

March 24, 1993 — P.W. Marriott, GE, letter forwarding proprietary Amendment 26 to selected sections of Chapters 1 and 11 of SSAR for advanced BWR.
Fiche: 74385:304-74385:304
acn: 9303260143

March 24, 1993 — G. Kelly, NRC, letter providing comments on draft "Important Features from PRA - Advanced BWR."
Fiche: 74418:330-74418:336
acn: 9303290174

March 25, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing DFSER Open Items 3.2.1-1, 3.2.1-2, 3.7.2-6, 3.7.2-7, and 3.8.4-1.
Fiche: 74435:354-74435:357
acn: 9304010196

March 25, 1993 — G. Kelly, NRC, letter forwarding comments on response to questions on advanced BWR probabilistic flooding analysis faxed on March 4, 1993.
Fiche: 74418:342-74418:344
acn: 9303290150

March 26, 1993 — J. Fox, GE, letter forwarding preliminary version of proposed design certification material covering advanced BWR instrumentation and control (I&C) issues.
Fiche: 74425:260-74425:292
acn: 9303300234

March 26, 1993 — J. Fox, GE, letter forwarding information pertaining to advanced BWR SSAR Section 19E consequence analysis and vent release points.
Fiche: 74435:358-74435:360
acn: 9304010203

March 26, 1993 — J. Fox, GE, letter forwarding SSAR markups for Subsection 3.4 on flooding, mentioned to NRC staff at Bethesda ITAAC meetings. Changes address utility request to eliminate curbs andf sills where not required.
Fiche: 74453:313-74453:325
acn: 9304010207

March 29, 1993 — J. Fox, GE, letter forwarding SSAR markups providing listed information regarding piping design, to support accelerated ABWR review schedule.
Fiche: 74472:303-74472:313
acn: 9304060108

March 31, 1993 — J. Fox, GE, letter forwarding final draft of Section 191, responding to several NRC questions regarding advanced BWR seismic margin analysis.
Fiche: 74471:155-74471:233
acn: 9304050301

March 31, 1993 — J. Fox, GE, letter forwarding listed information that address DFSER Chapter 8 outstanding items, to support accelerated ABWR review schedule.
Fiche: 74489:001-74489:226
acn: 9304060310

March 31, 1993 — J. Fox, GE, letter forwarding markup of advanced BWR SSAR Chapter 16, Section 3.3, "Instrumentation," and Section 38, "Electrical Power System," per STS (NUREG-1433 and NUREG-1434).
Fiche: 74604:001-74605:083
acn: 9304140235

March 31, 1993 — J.N. Wilson, NRC, letter forwarding PRA and severe accident ITAAC insights guidance document that formalizes process for identifying safety significant insights from ABWR PRA and severe accident evaluations.
Fiche: 71663:252-71663:255
acn: 9304050192

April 1, 1993 — J. Fox, GE, letter forwarding proposed SSAR markup addressing currently evolving BWROG turbine inservice test and inspection surveillance program, to support accelerated ABWR review schedule.
Fiche: 74474:355-74474:357
acn: 9304060111

April 2, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing DFSER Confirmatory Items 6.2.5-1, 5.2.5-2, and Open Item 20.3-10. Requests that copy of transmittal be provided to G. Gou.
Fiche: 74489:269-74489:274
acn: 9304060426

April 2, 1993 — J. Fox, GE, letter forwarding SSAR markups that address Open Item 7.1.3.1-1, Confirmatory Item 7.5.2-1 and COL Action Items 7.3.1.11-1, 7.7.1.15-1, and 7.8-1. Requests that copy of transmittal be provided to J. Stewart.
Fiche: 74484:212-74484:221
acn: 9304060427

April 2, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing DFFSER COL Action Item 14.1.3.3.7.3-1. Requests that copy of transmittal be provided to S. Hou and J. Brammer.
Fiche: 74489:265-74489:268
acn: 9304060429

April 2, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing DFFSER Confirmatory Item 9.5.1.2.2-1 and COL Action Items 9.5.1.4.6-1 and 20.3.1-1. Requests that copy of transmittal provided to B. Burton.
Fiche: 74486:325-74486:351
acn: 9304060431

April 2, 1993 — J. Fox, GE, letter forwarding information addressing Chapters 3 and 5 DFSER Confirmatory Item 3.9.2.3-2 on Page 3-64 of DFSER regarding May 10, 1992, audit commitments, COL Item 3.9.2.3-1 regarding vibration assessment test report and Item 5.2.4-1 regarding PSI and 89 code.
Fiche: 74504:282-74504:289
acn: 9304070068

April 5, 1993 — J. Fox, GE, letter forwarding Revision 15 to Engineering Operating Procedure (EOP) 40-300, "Engineering Computer Programs," to be used in conjunction with resolution of Confirmatory Item 15.1-1, "Verification of ODYN & REDY Code Changes."
Fiche: 74568:319-74568:331
acn: 9304120010

April 6, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Section 4.2 COL action items regarding testing and summary of test programs and objectives. COL Action Item 14.2.12.3-1 no longer required since corresponding information now included as design requirement.
Fiche: 74668:254-74668:261
acn: 9304200163

April 6, 1993 — J. Fox, GE, letter forwarding proprietary SSAR markups addressing DFSER Confirmatory Items 7.2.1-1 and 7.2.2.1-3.
Fiche: 74621:309-74681:317
acn: 9304200183

April 6, 1993 — J. Fox, GE, letter forwarding GE engineering operating procedures (EOPs), referenced in EOP 40.300 and provided in author April 5, 1993, letter in conjunction with resolution of Confirmatory Item 15.1-1.
Fiche: 74675:280-74675:335
acn: 9304210050

April 7, 1993 — J. Fox, GE, letter forwarding markups of HFE Tier 1 information and SSAR Appendix 18E, advanced BWR human-machine interface design implementation process.
Fiche: 75555:167-74555:221
acn: 9304090313

April 7, 1993 — J. Fox, GE, letter forwarding marked-up TS 3.3.5.1 regarding ECCS instrumentation, initially provided in March 31, 1993, letter to support accelerated advaned BWR review schedule.
Fiche: 74559:350-74559:358
acn: 9304120014

April 8, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft FSER Open Item 7.7.1.15-1 regarding design of plant security system and design basis for sound-powered telephone system, to support accelerated advanced BWR review schedule.
Fiche: 74603:258-74603:262
acn: 9304140224

April 8, 1993 — J. Fox, GE, letter forwarding markups addressing draft FSER Chapter 18 outstanding items regarding design goals and design basis planning, development and design, control room standard design features and remote shutdown system.
Fiche: 74606:346-74606:357
acn: 9304140289

April 9, 1993 — P.W. Marriott, GE, letter correcting discrepancy in proprietary classification for interlock block diagrams, radwaste bldg arrangements and P&IDs of advanced BWR SSAR Chapters 1, 11, and 12, and SAFER/GESTAR LOCA analysis results, per NRC March 9, 1993, request.
Fiche: 74577:357-74577:359
acn: 9304130329

April 9, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft FSER Open Item 8.3.5-1 regarding dc emergency lighting (Class 1E dc power supply) per April 7, 1993, telecon, to support accelerated advanced BWR review schedule.
Fiche: 74608:346-74608:347
acn: 9304140227

April 9, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing draft FSER Open Item 9.4.6-1 w/three oversize figures. Fiche:74620:357-74620:359
acn: 9304140357

April 12, 1993 — J. Fox, GE, letter forwarding markup of draft FSER Confirmatory Item 7.2.1-2, consisting of Table 1.8-22, "Experience Applicable to ABWR," to support accelerated ABWR review schedule.
Fiche: 74677:330-74677:331
acn: 9304190058

April 13, 1993 — J. Fox, GE, letter forwarding markup showing proposed mods to February 12, 1993, submittal of Section 14.2 which responded to Open Items 14.2.12.3-1 and 14.2.12.3-2, to support accelerated advanced BWR review schedule.
Fiche: 74620:143-74620:211
acn: 9304160033

April 14, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft final SER, Confirmatory Item 7.6.1.3-1 regarding instrumentation and controls for process radiation monitoring system and high pressure/low pressure system interlock protection functions.
Fiche: 74744:354-74744:355
acn: 9304260199

April 16, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing DFSER Open Item 2.6-1, including consideration of issues identified in Section 1.4 of EPRI Evolutionary Plant SER. Enclosure markup Table 2.0-1 submitted in support of accelerated ABWR review schedule.
Fiche: 74743:356-74743:357
acn: 9304260135

April 16, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing draft FSER Chapter 12 outstanding items regarding radiation sources, radiation protection features, health physics program, and compliance with RG 8.8.
Fiche: 74746:262-74746:277
acn: 9304260215

April 16, 1993 — J. Fox, GE, letter forwarding responses to draft final SER TS items, in support of accelerated ABWR review schedule.
Fiche: 74744:358-74744:361
acn: 9304260232

April 16, 1993 — J. Fox, GE, letter forwarding SSAR markup of Chapter 14 regarding startup testing.
Fiche: 74762:107-74762:259
acn: 9304270056

April 19, 1993 — J. Fox, GE, letter forwarding information to support accelerated ABWR review schedule for Chapter 3 of draft FSER Open Items 3.9.3.1-2 and 14.1.3.3.5.10-1 regarding thermal striping.
Fiche: 74820:012-74820:022
acn: 9305030001

April 19, 1993 — G. Kelly, NRC, letter forwarding thoughts put together from comments received from contractor on advanced BWR shutdown analysis.
Fiche: 74707:333-74707:337
acn: 9304220194

April 20, 1993 — J. Fox, GE, letter forwarding Level 2 design review reports from independent design verification packets for ODYNA and REDYA computer codes, per request during April 19, 1993, telecon supporting closure of draft FSER Confirmatory Item 15.1-1.
Fiche: 74820:001-74820:011
acn: 9305030016

April 20, 1993 — J. Fox, GE, letter forwarding SSAR markup of TS LCO 3.3.2.2 regarding operability of feedwater and main turbine trip instrumentation necessary to close draft final SER TS Item 15.1-1.
Fiche: 71693:294-71693:304
acn: 9305030132

April 21, 1993 — J. Fox, GE, letter forwarding mods to selected pages from Attachment 3 to March 31, 1993, letter, consisting of Table 1.8-21, "Industrial Codes & Standards Applicable to Advanced BWR," agreed upon in April 21, 1993, telecon.
Fiche: 74741:201-74741:205
acn: 9304230042

April 21, 1993 — J. Fox, GE, letter forwarding SSAR Figures 7.2-7, revised Figures 7.2-9 and 7.2-10 in response to DFSER Confirmatory Item 7.2.1-4 regarding incomplete drawing and electrical connections.
Fiche: 98503:001-98503:085
acn: 9304260124

April 21, 1993 — G. Kelly, NRC, letter forwarding information gathered from comments received from NRC contractor on ABWR internal flooding analysis.
Fiche: 74739:338-74739:341
acn: 9304260026

April 22, 1993 — J. Fox, GE, letter forwarding draft of revised Appendix 18F addressing DFSER Confirmatory Item 18.4.3-1.
Fiche: 74743:292-74743:310
acn: 9304260137

April 22, 1993 — J. Fox, GE, letter forwarding information which compares insights examples provided by C. Buchholz (GE) to NRC February 16, 1993, examples sent by B. Palla to GE on March 24, 1993. Information may be useful to NRC in preparation for GE NRC April 26, 1993, meeting.
Fiche: 74744:332-74744:341
acn: 9304260142

April 22, 1993 — J. Fox, GE, letter forwarding justification of three independent ECCS subsystems which addresses DFSER Open Item 16-3.
Fiche: 74744:356-74744:357
acn: 9304260147

April 22, 1993 — C. Tang, GE, letter forwarding revised LCO and bases for TS 3.1.5 operability for each control rod scram accumulator.
Fiche: 74819:100-74819:110
acn: 9305030291

April 23, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft FSER Open Item 3.10.3-1.
Fiche: 74807:339-74807:347
acn: 9304300362

April 23, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft Confirmatory Items 7.2.5-1 and 7.2.5-2.
Fiche: 74806:350-74806:353
acn: 9304300363

April 23, 1993 — J. Fox, GE, letter forwarding updated version of Sections 16.0 and 16.1 addressing COL Action Item 16-1.
Fiche: 74806:344-74806:346
acn: 9304300365

April 23, 1993 — J. Fox, GE, letter forwarding replacement pages 18F-14 and Table 18F-23 of April 22, 1993, submittal supporting accelerated advanced BWR review schedule on draft SER Confirmatory Item 18.4.3-1.
Fiche: 74806:347-74806:349
acn: 9304300367

April 23, 1993 — J. Fox, GE, letter forwarding composite of advanced BWR containment event tree material, replacing information currently contained in Section 19D.5 of SSAR.
Fiche: 74807:258-74807:327
acn: 9304300373

April 23, 1993 — R.C. Mitchell, GE, letter forwarding Central Files version of Amendment 27 to GE ABWR SSAR, proprietary information for sections of Chapter 1, 6, and 11 regarding plant description, safety features, and waste management, respectively.
Fiche: 74853:097-74853:097
acn: 9305060069

April 23, 1993 — R.C. Mitchell, GE, letter forwarding public version of Amendment 27 to ABWR SSAR as result of first phase of SSAR verification activity. Charges primarily clarifications, w/o new information.
Fiche: 74850:142-74852L:217
acn: 9305060184

April 26, 1993 — J. Fox, GE, letter forwarding revised versions of advanced BWR Tier 1 ITAAC material reviewed during January 11 through 21, and March 8 through 12, 1993, GE/NRC meetings. Written dispositions of punch list items from January and March meetings also enclosed.
Fiche: 74776:001-74776:243
acn: 9304300245

April 26, 1993 — J. Fox, GE, letter forwarding replacement markups to April 23, 1993, letter addressing draft final SER Confirmatory Items 7.2.5-1 and 7.2.5-2.
Fiche: 74774:335-74774:339
acn: 9304300259

April 26, 1993 — J. Fox, GE, letter forwarding modification to page 15 of Attachment 4 to March 31, 1993, letter regarding draft final SER Chapter 8.
Fiche: 74774:340-74774:341
acn: 9304300261

April 26, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Open Items 3.8.4-2 and 6.2.6-8 and COL Action Item 3.8.4-1 regarding other seismic Category I structures, structural integrity pressure resut and potential bypass leakage paths.
Fiche: 74818:001-74818:123
acn: 9305030014

April 26, 1993 — J. Fox, GE, letter forwarding revision to January 18, 1993, markup addressing draft FSER Open Item 9.3.3.2-1 regarding samples of radiation levels, to support accelerated ABWR review.
Fiche: 74820:023-74820:024
acn: 9305030018

April 27, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft final SER Confirmatory Item 7.4.1.1-2.
Fiche: 74774:351-74774:352
acn: 9304300233

April 27, 1993 — J. Fox, GE, letter forwarding modified Subsection 6.1.1.1.3.4, reflecting references to RGs 1.36 and 1.82, with regard to ABWR thermal insulation.
Fiche: 74779:210-74779:352
acn: 9304300254

April 28, 1993 — C. Tang, GE, letter forwarding revised TS 3.1.5, "Control Rod Scram Accumulators," reflecting results of NRC discussion with Rose.
Fiche: 74832:272-74832:282
acn: 9305040323

April 28, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft FSER Open Item 1.2.6-1 regarding standard plant scope and site plan.
Fiche: 74864:316-74864:319
acn: 9305070354

April 28, 1993 — J. Fox, GE, letter forwarding replacement pages for Attachment 1 to March 31, 1993, letter for draft final SER Confirmatory Item 8.3.2.8-1 and Open Item 8.3.3.5-1. Corresponding SSAR markups also enclosed.
Fiche: 74862:220-74862:228
acn: 9305100032

April 28, 1993 — J. Fox, GE, letter forwarding SSAR markup adding Revision 2 to NUREG-0313. Revision inadvertently removed on Amendment 15.
Fiche: 74862:357-74862:358
acn: 9305100038

April 29, 1993 — R.C Mitchell, GE, letter forwarding Amendment 27, page change instruction for Chapter 1, "Introduction & General Description of Plant," Chapter 5, "Reactor Coolant Systems...," Chapter 6, "Engineered Safety Features," Chapter 8, "Electric Power," and Chapter 9.
Fiche: 74854:001-74854:106
acn: 9305050169

April 29, 1993 — R.C. Mitchell, GE, letter forwarding proprietary Amendment 27 to ABWR SSAR, consisting of 11x17 foldout drawings.
Fiche: 74848246-74848:247
acn: 9305050177

April 29, 1993 — J. Fox, GE, letter discusses draft final SER Open Item 1.1-1, with respect to December 15, 1992, SRM regarding SECY-89-334, "Recommended Priorities for Review of Std Plant Designs." GE believes ABWR SSAR satisfies objectives of policy guidance provided by subject SRM.
Fiche: 74862:218-74862:219
acn: 9305100044

April 29, 1993 — I. Selin, NRC, letter responding to licensee April 6, 1993, letter commenting on importance of completing reviews of both ABWR and System 80+ designs as quickly as possible.
Fiche: 74835:084-74835:086
acn: 9305060342

April 30, 1993 — C. Tang, GE, letter forwarding SLC system revised TS SR 3.1.7.7 on pages 3.1-23 and B 3.1-42.
Fiche: 74835:318-74835:321
acn: 9305050115

April 30, 1993 — J. Fox, GE, letter forwarding SSAR marrkups addressing Open Item 7.2.6-1, 7.2.6-2, 7.2.6.4, 7.2-8-1, 7.7.1.15-2, and Confirmatory Items 7.2.1-3, 7.2.2.2-1, 7.2.2.5-1, 7.2.8-2, 7.2.8-3, 7.2.8-5, 7.3.2-1 and 7.4.1.4-1.
Fiche: 74866:188-74866:243
acn: 9305070263

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing draft FSER Open Item 3.8.3-1 and COL Action Item 9.4.8-1 regarding drywell equipment and pipe support structure and reactor shield wall stabilizer.
Fiche: 74870:096-74870:105
acn: 9305070344

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Confirmatory Items 3.6.1-2, 6.2.1.7-1 and response to Open Item 6.2.1.6-3. Response to question on Subsection 6.2.1.2.2 regarding design features also enclosed.
Fiche: 74870:046-74870:094
acn: 9305070351

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing draft FSER Action Item 1.1.2.1-1, Open Items 1.2.2-1 and 1.2.2-2 regarding common engineering design control process.
Fiche: 74870:043-74870:045
acn: 9305070353

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markup and Appendix 1C, "Advanced BWR Station Blackout Considerations," addressing draft FSER Confirmatory Item 9.2.13-1.
Fiche: 74865:001-74865:021
acn: 9305070355

April 30, 1993 — J. Fox, GE, letter forwarding draft replacement for Appendix 19B, "Assessment of Applicable USIs & GSIs," addressing Open Items 20.1-1 and 20.2-1.
Fiche: 74870:158-74870:243
acn: 9305100002

April 30, 1993 — J. Fox, GE, letter forwarding updated Table 1.9-1, "Summary of ABWR Std Plant COL License Info," addressing draft final SER Open Item 1.9-1.
Fiche: 74862:205-74862:217
acn: 9305100004

April 30, 1993 — J.N. Fox, GE, letter forwarding SSAR markups for minor revisions to January 28, 1993, OBE elimination submittal, consisting of draft final SER Open Items 3.1-1 and 14.1.3.3.5.15-1, and SSAR markup to expand definition of pipe supports identified as "Limit Stops."
Fiche: 74866:311-74866:316
acn: 9305100015

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markup and replacements for Tables 3I.3-9 through 3I.3-13 and Tables 3I.3-19 through 3I.3-22 addressing draft final SER Open Item 3.11.3-1.
Fiche: 74862:193-74862:204
acn: 9305100019

April 30, 1993 — J. Fox, GE, letter submits summary of results of GE review of issues identified in GE HFE Program Review Model, addressing Open Item 18.9.2.2.1-1, provided to NRC in transmittal dated August 13, 1992.
Fiche: 74862:191-74862:192
acn: 9305100021

April 30, 1993 — J. Fox, GE, letter forwarding SSAR markup and new Appendix 1B, "Comparison of US ABWR & K-6/7 Difference," addressing draft final SER Confirmatory Item 1.2-1.
Fiche: 74862:178-74862:190
acn: 9305100022

April 30, 1993 — J. Fox, GE, letter forwarding "Resolution ISLOCA for ABWR," addressing DFSER Open Items 5.4.7-2 and 20.2-3.
Fiche: 74902:083-74902:146
acn: 9305130045

May 3, 1993 — J. Fox, GE, letter forwarding replacement page for Table 6.2-4, originally included in April 30, 1993, transmittal addressing draft final SER Confirmatory Item 6.2.1.7-1.
Fiche: 74870:041-74870:042
acn: 9305070254

May 3, 1993 — J. Fox, GE, letter forwarding drawings regarding containment overpressure protection.
Fiche: 74875:338-74875:343
acn: 9305110095

May 3, 1993 — J. Fox, GE, letter forwarding correction to April 27, 1993, letter, correcting marked up Subsection 6.1.1.1.3.4 regarding ABWR thermal insutation to reflect "not" in third sentence.
Fiche: 74954:236-74954:237
acn: 9305170216

May 4, 1993 — J. Fox, GE, letter forwarding omitted issues from April 30, 1993, transmittal, including second page of GSI 142 in support of accelerated ABWR review schedule regarding USIs and GSIs.
Fiche: 74875:324-74875:337
acn: 9305110105

May 5, 1993 — J. Fox, GE, letter forwarding GE understanding of April 26, 1993, telecon between GE and NRC on SSAR Chapter 4 and Tier 1 for review regarding acceptability.
Fiche: 74898:323-74898:324
acn: 9305130022

May 5, 1993 — J. Fox, GE, letter forwarding SSAR markup for draft final SER Open Item 19.1.6.4-1, supplementing April 16, 1993, telecon.
Fiche: 74898:353-74898:354
acn: 9305130029

May 5, 1993 — R.W. Borchardt, NRC, letter discussing review of April 9, 1993, letter providing response to preliminary evaluation of information in advanced BWR SSAR classified as proprietary information by GE Nuclear Energy.
Fiche: 74870:268-74870:269
acn: 9305110274

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft final SER Open Items 3.7.2-8 and 3.7.2-9, per markup dated January 30, 1993.
Fiche: 74901:069-74901:075
acn: 9305130008

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing draft final SSAR Section 14.2 outstanding items to clarify role of start-up administrative manual and scoping documents, per April 6, 1993, letter.
Fiche: 74901:080-74901:091
acn: 9305130014

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markup showing alternate path to discharge excess water to main condenser rather than to suppressing pool, per discussions w/ B. Burton and J. Lyons at April 13 through 15, 1993, meeting with NRC in San Jose, California.
Fiche: 74900:348-74900:355
acn: 9305130016

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing draft final SER Confirmatory Item 6.2.5-3, supplementing March 3, 1993, letter.
Fiche: 74898:355-74898:359
acn: 9305130017

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markups proposed for overpressure protection system.
Fiche: 74901:044-74901:057
acn: 9305130020

May 7, 1993 — J. Fox, GE, letter forwarding responses to Audit Items 3 and 11 of February 22, 1993 and November 13, 1993, audit reports, respectively.
Fiche: 74898:325-74898:352
acn: 9305130032

May 7, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing Section 3.7 issues of February 22, 1993, audit report. Markup includes Audit Items 3 and 11 responses, November 11, 1993, and February 22, audit reports, respectively.
Fiche: 74930:334-74931:078
acn: 9305130132

May 11, 1993 — J. Fox, GE, letter forwarding SSAR markups regarding valve operability assurance, reflecting reflecting resolution obtained in May 3, 1993, telecon.
Fiche: 74951:333-74951:340
acn: 9305180188

May 11, 1993 — J. Fox, GE, letter forwarding SSAR markups to improve/clarify Section 3.10, "Seismic Qualification of Seismic Category I Instrumentation & Electrical Equipment (Including Other Dynamic Loads)."
Fiche: 74951:061-74951:065
acn: 9305180193

May 11, 1993 — J. Fox, GE, letter forwarding SSAR markups to Chapter 8 material that resulted from GE/NRC May 7, 1993, telecon.
Fiche: 74957:141-74957:160
acn: 9305180296

May 11, 1993 — J. Fox, GE, letter forwarding replacement page (page 3 of 13) for overpressure protection system SSAR markup of May 7, 1993, letter.
Fiche: 74957:081-74957:082
acn: 9305180300

May 11, 1993 — J. Fox, GE, letter forwarding drafts of TS 3.3.8.1, "Loss of Power Instrumentation," and 3..3.8.2, "Vital AC Electric Power Monitoring."
Fiche: 74952:001-74952:023
acn: 9305180306

May 11, 1993 — J. Fox, GE, letter forwarding report entitled, "Condensation-Induces Water Hammer Evaluation for ABWR ECCS Piping," which will be referenced in GE resolution of USI A-1, "Water Hammer."
Fiche: 74950:001-74950:035
acn: 9305180314

May 11, 1993 — J. Fox, GE, letter forwarding SSAR markups for draft FSER outstanding issues in Chapter 7 regarding main steamline high flow monitoring (for leaks downstream of flow elements and fuel zone water level range).
Fiche: 74951:341-74951:361
acn: 9305180365

May 12, 1993 — J. Fox, GE letter forwarding SSAR markups addressing Open Issues 3.7.2-2 and 3.8.4-3 and COL Action Item 3.8.3-1, previously addressed as part of GE April 26, 1993, letter.
Fiche: 74951:066-74951:071
acn: 9305180187

May 12, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing COL Action Item 9.5.1.5-1 regarding fire-related administrative controls.
Fiche: 74963:349-74963:352
acn: 9305190272

May 13, 1993 — J. Fox, GE, letter forwarding responses to NRC questions on flooding PRA transmitted by GE by letters dated March 25 and April 12, 1993.
Fiche: 74970:182-74970:197
acn: 9305190275

May 13, 1993 — GE, letter forwarding SSAR markup modifying response given in April 16, 1993, letter regarding draft FSER COL Action Item 12.5.1-1 regarding operational considerations.
Fiche: 74982:236-74982:237
acn: 9305190279

May 13, 1993 — J. Fox, GE, letter forwarding marked-up SSAR Section 14.2, per NRC comments made during April 20, 1993, telecon. Comments cover feedwater control system preoperational test, standby gas treatment system preoperational test and containment isolation valve leakage rate tests.
Fiche: 74987:329-74989:358
acn: 9305200121

May 13, 1993 — D. Crutchfield, NRC, letter discussing results of work between NRC and GE to establish an acceptable minimum inventory of fixed-position controls, displays and alarms over two-year period.
Fiche: 75021:268-75021:271
acn: 9305250238

May 14, 1993 — P.W. Marriott, GE, letter forwarding documents regarding radiation protection. Documents provided by GE March 9, 1992, letter in support of ABWR SSAR Chapter 12 at NRC request. Documents originally considered proprietary. Documents being reissued as Class 1.
Fiche: 74940:001-74942:005
acn: 9305180107

May 14, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing questions raised at May 11, 1993, GE/NRC conference call regarding Subsection 3..5.1.1, "Internally Generated Missiles (Outside Containment)."
Fiche: 74970:163-74970:167
acn: 9305200028

May 14, 1993 — J. Fox, GE, letter forwarding modification to GE response to draft FSER Open Item 3.7.2-2 regarding support of deadweight of equipment and piping transmitted via author May 12, 1993, letter.
Fiche: 74970:170-74970:171
acn: 9305200029

May 14, 1993 — J. Fox, GE, letter forwarding SSAR markup regarding qualification by experience, per May 14, 1993, telecon with D. Terao.
Fiche: 74987:317-74987:320
acn: 9305200113

May 14, 1993 — P.W. Marriott, GE, letter forwarding proprietary Appendix 19F, Sections 19F.1 through 19FA.2 of SSAR for ABWR. Proprietary enclosure withheld.
Fiche: 74987:189-74987:190
acn: 9305200136

May 14, 1993 — P.W. Marriott, GE, letter forwarding Amendment 28 to nonproprietary sections of Chapter 19, "Response to Severe Accident Policy Statement," of ABWR SSAR.
Fiche: 74968:001-74970:119
acn: 9305200149

May 17, 1993 — C. Tang, GE, letter forwarding revised Section 19.1.9.1, CUW line break procedure, per May 10, 1993, telecon.
Fiche: 74976:301-74976:304
acn: 9305200122

May 18, 1993 — J. Fox, GE, letter forwarding listed information to support accelerated advanced BWR review schedule for USIs and GSIs, including GI A-1, A-10, and A-17, based on May 6, 1993, telecon.
Fiche: 74988:038-74988:059
acn: 9305200211

May 18, 1993 — J. Fox, GE, letter forwarding SSAR markups of new Appendix 3L and Report GE-NE-123-E070-0493, "Sample Analysis for Effect of Postulated Pipe Break ABWR Main Steam Piping," App 3L markups address NRC comments.
Fiche: 74999:056-74999:116
acn: 9305210053

May 19, 1993 — J. Fox, GE, letter forwarding submittal supporting accelerated ABWR review schedule regarding effect of changing concrete tensile strength from 100 psi to 10 psi.
Fiche: 75011:311-75011:312
acn: 9305250156

May 19, 1993 — J. Fox, GE, letter forwarding submittal supporting accelerated ABWR review schedule regarding audit item 2 associated with wind loading.
Fiche: 75011:327-75011:331
acn: 9305250168

May 19, 1993 — J. Fox, GE, letter forwarding SSAR markup of revised LCO 3.7.5, "Main Bypass System," supporting accelerated ABWR review schedule.
Fiche: 75011:313-75011:322
acn: 9305250177

May 19, 1993 — J. Fox, GE, letter forwarding draft composite of Revision B to 23A6100AE, "Advanced BWR Standard Plant SSAR."
Fiche: 75011:280-75011:291
acn: 9305250182

May 19, 1993 — J. Fox, GE, letter forwarding revised pages to App 3A, "Seismic Soil Structure Interaction Analysis."
Fiche: 75015:206-75015:238
acn: 9305250204

May 20, 1993 — J. Fox, GE, letter forwarding Sections 1, 2, 4, and 5 and pages B3.3-75 and B3.3-91 to advanced BWR TS previously omitted.
Fiche: 75063:243-75063:309
acn: 9305280187

May 21, 1993 — R.C. Mitchell, GE, letter forwarding revised versions of selected advanced BWR Tier 1/ITAAC material for advanced BWR system and proposed Tier 1 entries for design reliability assurance program and initial test program.
Fiche: 75034:001-75034:210
acn: 9305260197

May 21, 1993 — J. Fox, GE, letter forwarding SSAR markups providing clarifications requested in May 19, 1993, telecon regarding feedwater piping classification and use of special engineered pipe supports, to support accelerated ABWR review schedule for Chapter 3.
Fiche: 75077:267-75077:272
acn: 9306010134

May 21, 1993 — J. Fox, GE, letter forwarding info regarding COL Open Item 7.2.6-3 on shared use of EMS and provision of operator info and time to manually mitigate accident, inadvertently omitted from April 30, 1993, letter.
Fiche: 75077:273-75077:274
acn: 9306010141

May 21, 1993 — J. Fox, GE, letter forwarding draft version of SSAR addressing COL Action Items 9.3.3-1 and 9.3.8-1 regarding safety design bases and sate design bases (interface requirements), respectively.
Fiche: 75083:190-75083:193
acn: 9306020223

May 21, 1993 — J. Fox, GE, letter forwarding SSAR markups providing Chapter 14 clarifications regarding initial test program, per May 21, 1993, discussions with NRC.
Fiche: 75083:201-75083:204
acn: 9306020232

May 21, 1993 — J. Fox, GE, letter forwarding SSAR markups for May 17, 1993, conference call regarding clarification of Chapter 1 and 9, consisting of Table 3.4-1, "Structures, Penetrations & Access Openings Designed for Flood Protection."
Fiche: 75083:214-75083:224
acn: 9306020278

May 21, 1993 — J. Fox, GE, letter forwarding response to inquiries regarding Amend 27 covering suppression pool cooling.
Fiche: 75082:333-75082:336
acn: 9306020279

May 24, 1993 — J. Fox, GE, letter forwarding submittal supporting accelerated advanced BWR review schedule - LCO 3.10.11.
Fiche: 75077:341-75077:348
acn: 9306010207

May 24, 1993 — J. Fox, GE, letter forwarding SSAR markup of TS Section B3.0 regarding LCOs.
Fiche: 75091:211-75091:225
acn: 9306020344

May 25, 1993 — J. Fox, GE, letter forwarding C.E. Buchholz May 21, 1993, memo closing all issues discussed at April 25, 1993, meeting except insights/Tier 2/Tier 1.
Fiche: 75122:310-75122L:332
acn: 9306030196

May 26, 1993 — J. Fox, GE, letter forwarding replacements to SSAR markups of Appendix 3L and to report GE-NE-123-E070-0493, "Sample Analysis for Effect of Postulated Pipe Break Advanced BWR Main Steam Piping," provided in May 18, 1993, letter.
Fiche: 75091:001-75091:062
acn: 9306020259

May 26, 1993 — J. Fox, GE, letter forwarding markup of composite changes to Table 3.9-8 regarding inservice testing, safety-related pumps and valves. No changes made to table since Amendment 27.
Fiche: 75117:318-75117:324
acn: 9306030076

May 26, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing Item 9.4.1(1) of May 25, 1993, telecon regarding control building HVAC.
Fiche: 75117:045-75117:056
acn: 9306030079

May 26, 1993 — K. Gregoire, GE, letter lists documents used as representative set of inputs for characterizing lessons learned from operating experience in previous nuclear plant designs.
Fiche: 75117:356-75117:356
acn: 9306030208

May 26, 1993 — G.E. Miller, GE, letter forwarding answers to queries in telecons on May 25 and 26, 1993, regarding ABWR SSAR.
Fiche: 75952:248-74952:249
acn: 9307220098

May 26, 1993 — D. Crutchfield, NRC, letter discussing GE March 5, 1993, request for deviation regarding ABWR design basis loading combinations. NRC has not endorsed use of probabilistic approach as basis for decoupling SSE & LOCA loading combination. Response requested.
Fiche: 75143:278-75143:280
acn: 9306070141

May 27, 1993 — J. Fox, GE, letter forwarding SSAR markups to Chapter 8 material, resulting from GE/NRC May 24, 1993, telecon covering motor control centers, 120-v/240-v distribution system, 120-v ac Class 1E instrument power system and operating configuration.
Fiche: 75147:313-75147:328
acn: 9306040271

May 28, 1993 — J. Fox, GE, letter forwarding markups to Chapter 8 material resulting from May 27, 1993, GE/NRC telecon.
Fiche: 75137:330-75137:336
acn: 9306040231

May 28, 1993 — B. Simon, GE, letter forwarding proposed identification scheme regarding channel definitions for TS.
Fiche: 75278:342-75278:346
acn: 9306080004

May 28, 1993 — D.J. Robare, GE, letter forwarding Amendment 29 to ABWR SSAR. Changes in listed chapters primarily resolution of draft final SER outstanding items.
Fiche: 75282:001-75285:083
acn: 9306080396

May 28, 1993 — C. Tang, GE, letter forwarding revised TS for LLO 3.10.11 regarding low power physics test.
Fiche: 75300:304-75300:307
acn: 9306090177

May 28, 1993 — C. Tang, GE, letter forwarding revised TS page 3.10-32 clarifying what low power physics test LCO is intended to address. Phrase "partial SDM test required by RG 1.68," added per telecon.
Fiche: 75300:305-75300:305
acn: 9306090204

May 28, 1993 — D.J. Robare, GE, letter forwarding proprietary sections of Chapters 3, 4, and 6 of ABWR SSAR, Amendment 29. Proprietary sections withheld.
Fiche: 75427:345-75427:347
acn: 9306180143

May 28, 1993 — D.J. Robare, GE, letter forwarding proprietary drawings of Amendment 29 to ABWR SSAR. Drawings withheld.
Fiche: 75450:024-75450:025
acn: 9306180156

May 28, 1993 — D. Crutchfield, NRC, letter forwarding staff comments and questions regarding ABWR TS issues.
Fiche: 75261:336-75261:340
acn: 9306070374

June 1, 1993 — C. Tang, GE, letter forwarding revised 18F introduction for discussion.
Fiche: 75148:141-75148:142
acn: 9306040237

June 1, 1993 — J. Fox, GE, letter forwarding markups for Chapters 2 and 3 of ABWR SSAR regarding envelope of ABWR standard plant site design parameters and wind and tornado loadings.
Fiche: 75139:014-75139:090
acn: 9306040240

June 1, 1993 — J. Fox, GE, letter forwarding SSAR markups to Chapter 8 material, resulting from May 28, 1993, GE/NRC telecon covering description of offsite power system, periodic testing of electrical system and equipment and Class 1E battery installation and maintenanace requirements.
Fiche: 75137:317-75137:329
acn: 9306040265

June 1, 1993 — J. Fox, GE, letter forwarding information for Appendix F of ABWR SSAR regarding containment liner plate evaluation for severe accident conditions. Supplement 1 to Bechtel Report RPT STRI-008, "Containment Structural Evaluation for Ultimate Pressure Capacity Rept," also enclosed.
Fiche: 75139:161-75139:257
acn: 9306040275

June 1, 1993 — C. Oza, GE, letter requesting response on acceptability of attached resolution for Open Item 19.1.6.4-3, with regard to personnel access and egress routes for fire suppression activities.
Fiche: 75794:346-75794:347
acn: 9307230173

June 2, 1993 — J. Fox, GE, letter forwarding information regarding important features identified by ABWR PRA, covering RCIC, combustion turbine generator, high pressure core flooder logic and control, ac independent water addition system and reactor building cooling water/reactor service water system.
Fiche: 75147:275-75147:312
acn: 9306040236

June 2, 1993 — J. Fox, GE, letter forwarding markup of Chapter 9 of ABWR SSAR, per telecons with NRC. Subjects covered include tests and inspections (interface requirements), SE of equipment, and Table 9.2-41 regarding reactor building cooling water Division A.
Fiche: 75278:351-75278:361
acn: 9306080230

June 2, 1993 — J. Fox, GE, letter forwarding proprietary markup of Chapter 11 of ABWR SSAR, as result of telecons with NRC. Enclosure withheld.
Fiche: 75281:353-75281:353
acn: 9306080231

June 2, 1993 — J. Fox, GE, letter forwarding draft composite of Subsection 3.9.6 regarding design and qualification requirement for addition to page 3.9-22.
Fiche: 75304:294-75304:299
acn: 9306090264

June 3, 1993 — J. Baechler, GE, letter forwarding responses to questions raised by S. Ninit regarding radioactive drain transfer, DG combustion air intake and exhaust system and condensate and feedwater.
Fiche: 75279:333-75279:346
acn: 9306090135

June 4, 1993 — D.J. Robare, GE, letter forwarding revised versions of third phase of ABWR Tier 1/ITAAC material supporting accelerated ABWR design certification review.
Fiche: 75288:204-75288:324
acn: 9306090135

June 4, 1993

J. Fox, GE, letter forwarding Attachments A, B, and C. Attachment A represents important insights from ABWR severe accident analysis. Information will be used to develop Tier 2 documentation.
Fiche: 75305:242-75305:258
acn: 9306100160

June 4, 1993

R.W. Borchardt, NRC, letter discussing resolution of two Open Items 4.4-1 and 20.3-8. GE should provide schedule for inputs for issues by June 9, 1993. Prompt response would allow staff opportunity to resolve open items in expeditious manner.
Fiche: 75315:346-75315:355
acn: 9306090142

June 7, 1993

J. Fox, GE, letter forwarding draft amendment of ABWR SSAR Chapter 14, covering summary of test programs and objectives, const test objectives, preoperational test objectives and startup test objectives.
Fiche: 75324:001-75324:203
acn: 9306110073

June 9, 1993

J. Fox, GE, letter forwarding draft, revised Appendix 18F consisting of results of analysis of information and control needs of main CR operators, to address draft FSER Confirmatory Item 18.4.3-1.
Fiche: 75384:003-75385:005
acn: 9306160050

June 10, 1993

J. Fox, GE, letter forwarding set of draft I&C TS, incorporating latest SSLC definitions into LCO 23.3.1.1. New LCO 3.3.1.4 regarding ECCS actuation will be developed by June 21, 1993, meeting.
Fiche: 75383:012-75383:012
acn: 9306160060

June 11, 1993

D.J. Robare, GE, letter providing licensee closure plan and status for resolution of questions on proprietary nature of certain portions of ABWR.
Fiche: 75368:298-75368:301
acn: 9306150425

June 11, 1993

J. Fox, GE, letter forwarding revised responses to draft FSER Open Items 1.2.2-1 and 1.2.2-2. Vendor will submit final, verified SSAR, consisting of Tier 1 design description and complementary integrated set of ITAAC by July 31, 1993.
Fiche: 75384:001-75384:002
acn: 9306160047

June 11, 1993

J. Fox, GE, letter forwarding revised TS LCO 3.6.4.3, "Standby Gas Treatment System." TS revised to address inoperability of both divisions of system.
Fiche: 75383:001-75383:260
acn: 9306160056

June 14, 1993

J. Fox, GE, letter forwarding markup of SSAR Section 38 aligning with Appendix 3H.
Fiche: 75478:028-75478:035
acn: 9306240449

June 14, 1993

J. Fox, GE, letter forwarding revised SSAR markup for DFSER COL Action Item 1.2.1-1, replacing licensee letter dated April 30, 1993, for item.
Fiche: 765478:036-75478:038
acn: 9306240453

June 14, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing DFSER Open Item 2.6-1, providing supplemental information to April 16, 1993, letter.
Fiche: 75506:343-75506:345
acn: 9306240459

June 14, 1993 — J. Fox, GE, letter forwarding proprietary markups of SSAR Appendix 3C, reflecting FINEL code and Appendix 19F, mainly incorporates liner tearing.
Fiche: 75493:269-75493:274
acn: 9306280311

June 14, 1993 — J. Fox, GE, letter forwarding SSAR markup, replacing markup in April 28, 1993, letter addressing draft FSER Open Item 1.2.6-1.
Fiche: 75514:175-75514:183
acn: 9306280311

June 15, 1993 — J. Fox, GE, letter forwarding SSAR markup of Figure 1.2-1, replacing figure provided in June 14, 1993, letter, addressing DFSER Open Item 1.2.6-1.
Fiche: 75512:350-75512:351
acn: 9306280224

June 15, 1993 — J. Fox, GE, letter forwarding SSAR markup of Appendix 18E plus attachment to Table 18E.2.1, GE believes provides satisfactory resolution of DFSER Open Item 18.9.2.2.1-1.
Fiche: 75514:163-75514:174
acn: 9306280228

June 16, 1993 — C.I. Grimes, NRC, letter forwarding preliminary drafts of low power and shutdown TS proposed for BWR current designs.
Fiche: 76075:001-76076:156
acn: 9308110177

June 16, 1993 — C.I. Grimes, NRC, letter forwarding preliminary draft BWR STS for lower power and shutdown conditions.
Fiche: 76063:356-76063:360
acn: 9308110259

June 17, 1993 — C.L. Larson, GE, letter forwarding revised sections of 19K.5 anf 19K.11.7 for ABWR SSAR. Sections reflect changes in PRA input to RAP regarding seismic analysis.
Fiche: 75794:348-75794:351
acn: 9307230190

June 18, 1993 — J. Fox, GE, letter forwarding markup of draft SSAR Subsection 18.8 on GE/NRC May 27, 1993, telecon.
Fiche: 75501:329-75501:331
acn: 9306240359

June 18, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing suppression pool strainer Issue 42. Information will be included in Amendment 30 scheduled for transmittal to NRC on July 8, 1993.
Fiche: 75506:350-75506:358.
acn: 9306240426

June 18, 1993 — D.J. Robare, GE, letter forwarding revised "ABWR Design Document." Material represents fourth and last of ABWR Tier 1/ITAAC submittal scheduled. Transmittal, together with transmittals of April 26, May 21, and June 4, 1993, provides material for total of 79 ABWR systems.
Fiche: 75504:242-75504:359
acn: 9306240454

June 18, 1993 — J. Fox, GE, letter forwarding responses to NRC comments on startup test material dated June 7, 1993, and pre-operational test material dated June 14, 1993.
Fiche: 75501:338-75501:342
acn: 9306240456

June 18, 1993 — J. Fox, GE, letter forwarding results of analyses assuming postulated common mode failure of SSLC and analyses assuming coincident failure of feedwater control system.
Fiche: 75511:150-75511:202
acn: 9306280337

June 21, 1993 — N. Hackford, GE, letter forwarding revision to June 18, 1993, submitta regarding fourth phase of revised ABWR Tier 1/ITAAC material.
Fiche: 75509:339-75509:341
acn: 9306280197

June 22, 1993 — J. Fox, GE, letter forwarding SSAR markups to Chapter 8 materials resulting from GE/NRC June 21, 1993, conference addressing listed confirmatory items. With exception of Appendix 1C (station blackout), responses should close out all remaining Chapter 8 outstanding items.
Fiche: 75512:330-75512:344
acn: 9306280235

June 22, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing Items 20, 27, and 31 of June 7 through 10, 1993, meeting in San Jose regarding containment overpressure protection system.
Fiche: 75509:178-75509:208
acn: 9306280244

June 23, 1993 — J. Fox, GE, letter forwarding modification to paper entitled, "Important Features Identified by ABWR PRA," submitted on June 2, 1993.
Fiche: 75521:259-75521:297
acn: 9306290049

June 23, 1993 — J. Fox, GE, letter forwarding SSAR markups resulting from GE/NRC June 23, 1993, Plant Systems Branch telecon, including Chapters 6, 9, and 11.
Fiche: 75527:348-75527:360
acn: 9306290078

June 23, 1993 — B. Raftery, GE, letter responding to NRC questions regarding generation of minimal cut sets in performing ABWR fire risk analysis and justification for why GE did not use important measures to analyze features from standpoint of fire risk.
Fiche: 75794:345-75794:345
acn: 9307230135

June 24, 1993 — J Fox, GE, letter forwarding markups reflecting minor mods resulting from NRC review and internal verification of SSAR Sections 19.7 through 19.13. Material will be reflected in Amendment 31.
Fiche: 75522:212-75522:243
acn: 9306300044

June 24, 1993 — J. Fox, GE, letter forwarding SSAR markup os Subsection 9.4.6 regarding radwaste building ac system, omitted from June 23, 1993, letter.
Fiche: 75522:343-75522:345
acn: 9306300046

June 24, 1993 — J. Fox, GE, letter forwarding markups addressing RPV water level instrumentation, Issue No. 15. Material will be included in Amendment 30 scheduled for transmittal to NRC on July 8, 1993.
Fiche: 75543:230-75543:244
acn: 9306300163

June 24, 1993 — A. McSherry, GE, letter forwarding final control building flooding event tree, noting that anti-siphon capability part of design of RSW system on both supply and return lines.
Fiche: 75794:343-74794:344
acn: 9307230120

June 25, 1993 — D. Crutchfield, NRC, letter forwarding chart of milestones to develop ABWR TS as discussed during management meeting on June 10, 1993.
Fiche: 75525:078-75525:084
acn: 9306300236

June 28, 1993 — J. Fox, GE, letter forwarding revised response to structural audit Item 11 of May 7, 1993, letter and markups of associated SSAR Sections 3.7 and 3A.
Fiche: 75683:183-75683:233
acn: 9307150133

June 28, 1993 — J. Fox, GE, letter forwarding SSAR markups responding to NRC request to provide oscillation power range monitor (OPRM) for ABWR. Design is BWROG LPRM based OPRM (Option III applicable to ABWR).
Fiche: 75684:281-75684:316
acn: 9307150170

June 28, 1993 — J. Fox, GE, letter forwarding final draft Section 19D.10, data uncertainty analysis for ABWR. Section will be included in Amendment 30 scheduled for issuance on July 8, 1993.
Fiche: 75684:258-75684:278
acn: 9307150173

June 28, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Suppressing Bypass Issue 24, including Section 6.2.1, containment functional design, Appendix 18A, emergency procedure guidelines and Appendix 18B, difference between BWROG EPG Revision 4 and ABWR EPG.
Fiche: 74582:088-75682:114

June 29, 1993 — R.C. Mitchell, GE, letter forwarding ABWR Tier 1/ITAAC material that was not included in submittals dated April 26, May 21, June 14 and 18, 1993. Material preliminary in that material has not been fully verified using GE procedures governing compliance with QA requirements.
Fiche: 75596:216-75596:278
acn: 9307060125

June 29, 1993 — J. Fox, GE, letter forwarding revisions to Section 5.0 of TS, previously submitted per discussions with NRC regarding main control room staffing.
Fiche: 75683:325-75683:327
acn: 9307150114

June 29, 1993 — D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and bases for sections listed.
Fiche: 75564:312-75564:346
acn: 9307020288

June 29, 1993 — R.W. Borchardt, NRC, letter forwarding comments regarding NRC review of ITAAC and NRC responses to GE June 4 and 22, 1993, letters. GE should revise ITAAC to resolve comments.
Fiche: 75564:347-75564:354
acn: 9307020326

June 30, 1993 — J. Fox, GE, letter forwarding proposed TS regarding shutdown, addressing Issue 16 for ABWR.
Fiche: 75686:266-75686:283
acn: 9307160082

July 2, 1993 — J. Fox, GE, letter forwarding writeups for GSI 73, 113, 120, and 151 regarding detached thermal sleeve, dynamic qualification testing of large bore hydraulic snubbers, online testability of protectionsystem and reliability of ATWS recirculation pump trips, respectively.
Fiche: 75683:281-75683:285
acn: 9307150083

July 2, 1993 — J. Fox, GE, letter forwarding SSAR markups of emergency procedures guidelines, incorporating ATWS stability strateg (Issue 12), per NRC request during June 10, 1993, meeting.
Fiche: 75683:286-75683:294
acn: 9307150092

July 2, 1993 — J. Fox, GE, letter forwarding responses to NRC June 28, 1993, comments on Chapter 14. Responses, where applicable, will be included in Amendment 30 scheduled for transmittal on July 8, 1993.
Fiche: 75683:295-75683:298
acn: 9307150167

July 2, 1993 — J. Fox, GE, letter forwarding final version of Appendix 1C ABWR station blackout considerations, replacing draft version of appendix provided in letter dated April 30, 1993, and addressing DFSER Confirmatory Item 9.2.13-1.
Fiche: 75700:155-75700:226
acn: 9307160297

July 2, 1993 — D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and bases for listed sections.
Fiche: 75650:262-75650:339
acn: 9307140187

July 2, 1993 — D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and their bases for Sections 3.1, "Reactivity Control," and 3.2, "Power Distribution."
Fiche: 75674:227-75674:304
acn: 9307150054

July 7, 1993 — J. Fox, GE, letter forwarding documentation of special LOCA core cooling analysis, performed to support TS extended AOTs.
Fiche: 75683:343-75683:354
acn: 9307150076

July 7, 1993 — J. Fox, GE, letter forwarding information regarding ABWR reactor water level system capabilities and indications of inadequate RPV water level, independent of RPV water level instrumentation.
Fiche: 75685:096-75685:103
acn: 9307150127

July 7, 1993 — C. Poslusny, NRC, letter informing that NRC voted to exempt ABB-CE System 80+ design certification from NRC policy on metrication and requests that licensee state whether or not to be relieved of responsibility for performing conversions.
Fiche: 75611:148-75611:149
acn: 9307090238

July 8, 1993 — D.J. Robare, GE, letter forwarding Amendment 30 to Revision C to "Advanced BWR SSAR." Changes are resolution DFSER outstanding items.
Fiche: 75663:001-75670:052
acn: 9307130190

July 8, 1993 — D.J. Robare, GE, letter forwarding proprietary Amendment 30, Revision B to GE ABWR SSAR.
Fiche: 75661:345-75661:346
acn: 9307130196

July 8, 1993 — J. Fox, GE, letter forwarding updated safety issues index incorporating NRC June 24, 1993, comments.
Fiche: 75795:342-75795:347
acn: 93072230220

July 8, 1993 — D.J. Robare, GE, letter forwarding Amendment 30 to proprietary foldout drawings to GE ABWR SSAR Chapter 7, "Instrumentation & Control Systems," revising Section 7.2, 7.3, and 7.7.
Fiche: 75985:343-75985:343
acn: 9307270041

July 8, 1993 — D.J. Robare, GE, letter forwarding Amendment 30, non-proprietary foldout drawings to GE ABWR SSAR, for Sections 3H, 4.6, 5.1, 5.4, 6.2, 6.7, 9.1, 9.3, 9.5, and 20.3.
Fiche: 75941:001-75941:134
acn: 9307270096

July 9, 1993

J. Fox, GE, letter forwarding electrical shutdown TS LCOs 3.8.2, 3.8.Y,, 3.8.5, 3.8.8, and 3.8.10. Bases for listed LCOs, accordingly. TS cover ac sources - shutdown and dc sources - shutdown and refueling.
Fiche: 75676:267-75676:283
acn: 9307140244

July 9, 1993

J. Fox, GE, letter forwarding SSAR markup resolving ISLOCA Issue 42 regarding intersystem LOCA for ABWR, replacing text in author April 30, 1993, letter.
Fiche: 75684:169-75684:236
acn: 9307150079

July 9, 1993

R.W. Borchardt, NRC, letter forwarding staff comments on GE ABWR Tier 1 submittals dated April 26, May 21, June 4, 18, 21, and 29, 1993. Advises that GE should revise Tier 1 design certification material to resolve comments and provide markup immediately.
Fiche: 75680:001-75680:169
acn: 9307160282

July 12, 1993

J. Fox, GE, letter forwarding SSAR markups providing design portion of resolution of I&C Diversity Issue 46, including Appendices 7C and 7B. Analysis portion of issue provided in June 18, 1993, letter.
Fiche: 75685:131-75685:184
acn: 9307160046

July 12, 1993

J. Fox, GE, letter forwarding proprietary data of 10 and 9 RIP operations. Data withheld.
Fiche: 75728:358-75728:358
acn: 9307200231

July 15, 1993

J. Fox, GE, letter forwarding bases for shutdown TS LCOs 3.7.2 regarding reactor building cooling water system, reactor service water system & UHS - shutdown and 3.73 regarding reactor building cooling water system, reactor service water system & UHS - refueling.
Fiche: 75723:169-75723:194
acn: 9307200286

July 15, 1993

J. Fox, GE, letter forwarding responses to NRC comments on USIs/GSIs, including July 9, 1993, telecon and addition of Issue C-8 to issue group resolved with no new requirements.
Fiche: 75726:301-75726:315
acn: 9307210122

July 15, 1993

J. Fox, GE, letter forwarding SSAR markup, clarifying in/out scope portion of potable and sanitary water system, requested in ITAAC questions and during July 14, 1993, telecon. Change will be included in Amendment 32, scheduled for submittal on August 31, 1993.
Fiche: 75726:334-75726:340
acn: 9307210125

July 15, 1993

D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and bases for listed sections.
Fiche: 76038:215-76038:313
acn: 9308100219

July 16, 1993 — J. Fox, GE, letter forwarding SSAR markup, clarifying boundaries of nonradioactive drain system, radioactive drain transfer system and liquid radwaste system.
Fiche: 75795:335-75795:341
acn: 9307230215

July 20, 1993 — J. Fox, GE, letter forwarding SSAR markups for listed changes made as result of consistency check between PRA and EPGs (Issue 9).
Fiche: 75930:271-75930:296
acn: 9307290049

July 21, 1993 — J. Fox, GE, letter informing that operator action histories for three different postulated LOCAS, previously evaluated in GE June 18, 1993, letter, requiring operator action within twenty minutes developed to close out operator time line aspect.
Fiche: 76022:155-76022:159
acn: 9308050197

July 21, 1993 — J. Fox, GE, letter forwarding shutdown electrical TS 3.8.2, 3.8.5, 3.8.8, and 3.8.10 and associated bases.
Fiche: 76022:304-76022:334
acn: 9308050199

July 21, 1993 — J.N. Wilson, NRC, letter forwarding draft safety issues index, generic issue review assignments, status of ABWR USI-GSI review and staff comments provided during conference calls.
Fiche: 76075:164-76075:184
acn: 9308120019

July 23, 1993 — D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and bases for Sections 3.4, RCS, 3.5, ECCS and 5.0 Administrative Controls (No Bases).
Fiche: 76104:057-76104:208
acn: 9308160300

July 26, 1993 — J. Fox, GE, letter forwarding listed items addressing M. Malloy July 2, 1993, fax regarding USIs and GSIs, with regard to accelerated ABWR review.
Fiche: 75997:027-75997:055
acn: 9308040120

July 26, 1993 — C. Poslusny, NRC, letter forwarding comments identifying items which need to be addressed in August SSAR amendment and documents generated by PRA task force.
Fiche: 75907:310-75907:334
acn: 9307280196

July 27, 1993 — J. Fox, GE, letter forwarding tabulation documents results of sensitivity analyses performed to determine impace of removal of ESF equipment from service.
Fiche: 75979:355-75979:358
acn: 9308030191

July 28, 1993 — R.C. Mitchell, GE, letter forwarding Revision 1 to 23A6100, "ABWR SSAR," Chapters 1 through 21. Listed sections contain proprietary information and will be submitted under separate cover.
Fiche: 76040:001-76056:011
acn: 9308040020

July 28, 1993 — R.C. Mitchell, GE, letter forwarding proprietary Revision 1 to 23A6100, "ABWR SSAR," Chapters 19 and 20 w/600 oversize drawings.
Fiche: 75998:001-75998:001
acn: 9308040057

July 28, 1993 — J. Fox, GE, letter forwarding revised shutdown TS LCO 3.8.Y and associated bases.
Fiche: 76037:216-76037:228
acn: 9308090329

July 30, 1993 — J. Fox, GE, letter responding to July 28, 1993, letter regarding staff review of licensee July 9, 1993, ISLOCA letter.
Fiche: 76011:005-76011:008
acn: 9308040327

July 30, 1993 — D. Crutchfield, NRC, letter forwarding proof and review ABWR TS for listed sections. Information in preparation for August 19 and 20, 1993, meeting also enclosed.
Fiche: 76286:001-76286:246
acn: 9309010196

August 3, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing Generic Fuel Licensing Item 17 and proprietary Appendix 4D, demonstrating that Chapters 4 and 15 meet proprietary acceptance criteria of Appendix 4B. Vendor plan to include information in Amendment 32 due by August 31, 1993. Appendix 4D withheld.
Fiche: 76080:234-76080:235
acn: 9308110367

August 4, 1993 — J. Fox, GE, letter forwarding SSAR markup addressing fuel bundle mis-orientation Item 4. Informs that GE plan to include information in Amendment 32 scheduled to be transmitted to NRC on August 31, 1993.
Fiche: 76075:343-76075:352
acn: 9308110247

August 4, 1993 — J. Fox, GE, letter forwarding updated TS sensitivity runs, as result of error discovered in modeling made to assess impact on CDF resulting from removal of ESF equipment from service, per July 27, 1993, transmittal.
Fiche: 76077:326-76077:327
acn: 9308110252

August 6, 1993 — J. Fox, GE, letter forwarding background and GE respones to Equipment/Instrumentation Survivability Issue 29. Concludes that SSAR adequately addresses issue and no further consideration of issue required.
Fiche: 76082:325-76082:326
acn: 9308110376

August 6, 1993 — J. Fox, GE, letter forwarding new SSAR Section 3H.5, structural analysis reports. Section will be included in Amendment 32 scheduled for transmittal on August 31, 1993
Fiche: 76077:264-76077:268
acn: 9308110380

August 6, 1993 — J. Fox, GE, letter forwarding draft analysis demonstrating that containment pressure can be controlled by venting early in sequence preventing pressure increasing to high drywell pressure containment isolation setpoint.
Fiche: 76076:310-76076:322
acn: 9308110388

August 6, 1993 — C.K. Tang, GE, letter forwarding revised TS 3.5.1, ECCS-operating. TS is LCO 3.5.1 for previously transmitted bases for TS 3.5.1.
Fiche: 76082:316-76082:324
acn: 9308110394

August 6, 1993 — C.K. Tang, GE, letter forwarding revised LCO 3.5.1 and bases, based on LOCA analyses requested by G. Thomas and PRA analyses requested by M. Wohl and BNL.
Fiche: 76076:287-76076:309
acn: 9308110397

August 10, 1993 — D. Crutchfield, NRC, letter forwarding proof and review of ABWR TS and bases for Sections 3.6, "Containment Systems," and 3.7, "Plant Systems."
Fiche: 76248:006-76248:189
acn: 9308270317

August 10, 1993 — D. Crutchfield, NRC, letter forwarding proof and review of ABWR TS and bases for Sections 3.6, "Containment Systems," and 3.7, "Plant Systems." Informs that sections as provided acceptable.
Fiche: 76411:001-76411:185
acn: 9309090466

August 12, 1993 — R.W. Borchardt, NRC, letter providing staff review comments on GIs regarding ABWR design. Advises that GE has not sufficiently addressed, in revised SSAR markups, all comments and concerns previously provided by staff.
Fiche: 76220:241-76220:255
acn: 9308270195

August 17, 1993 — G. Kelly, NRC, letter forwarding comparative markup of insights list showing differences between July 23, 1993, version and August 10, 1993, version.
Fiche: 76247:317-76247:335
acn: 9308260325

August 17, 1993 — D. Crutchfield, NRC, letter forwarding proof and review advanced BWR TS for low power and shutdown. Anticipates that formal comments to proof and review advanced BWR TS will be made by September 20, 1993.
Fiche: 76306:144-76305:283
acn: 9309020176

August 18, 1993 — J. Fox, GE, letter forwarding drafts of revised Sections 11.2, 11.3, 11.4, and associated drawings that will be incorporated in Amendment 32 as non-proprietary. Proprietary versions of 11.2, 11.3, and 11.4 will be retained in GE design record files w/16 figures.
Fiche: 76183:299-76183:345
acn: 9308190180

August 18, 1993 — J. Fox, GE, letter forwarding final SSAR markup of changes to Appendix 18E. Changes will be included in Amendment 32 to ABWR.
Fiche: 76236:273-76236:288
acn: 9308260305

August 18, 1993 — J. Fox, GE, letter forwarding Subsection 13.5, "Plant Procedures." Section will be included in Amendment 32 to ABWR.
Fiche: 76258:355-76258:360
acn: 9308260312

August 18, 1993 — R.W. Borchardt, NRC, letter requesting that corrected pages enclosed be used to replace pages inadvertently included in staff review comments on generic issues regarding ABWR.
Fiche: 76285:307-76285:310
acn: 9309010226

August 19, 1993 — J. Fox, GE, letter forwarding proposed SSAR markup adopting NRC position on Appendix B to ACI349.
Fiche: 76237:239-76237:244
acn: 9308260352

August 20, 1993 — M.J. La Rue, GE, letter providing advance notice of export shipment of SNM of low strategic significance (Category III).
Fiche: 71837:289-71827:290
acn: 9309080103

August 23, 1993 — J. Fox, GE, letter forwarding SSAR markup providing resolution of several severe accident issues raised by NRC. Markup will be included in next amendment for corresponding chapters of ABWR.
Fiche: 76236:289-76236:320
acn: 9308260296

August 23, 1993 — J. Duncan, GE, letter forwarding ABWR PRA/SA/DBA punch list, per August 12, 1993, telecon.
Fiche: 76283:223-76283:237
acn: 9308260341

August 25, 1993 — J.N. Fox, GE, letter forwarding proposed addition to SSAR Chapter 19 addressing issue of design certification material report contents, reflecting GE understanding of disposition of road map issues discussed during GE/NRC meetings July 27 through 29, 1993, in San Jose.
Fiche: 76304:209-76304:264
acn: 9308310085

August 26, 1993 — J.F. Quirk, GE, letter forwarding GENE-A0003649-01 "Technical Support Document for Amends to 10 CFR 51 Considering Severe Accidents Under NEPA for Plants of ABWR Design," per SRM dated October 25, 1991, regarding SECY-91-229, "Severe Accident Mitigation Design....".
Fiche: 76316:247-76316:278
acn: 9309010088

August 26, 1993 — D. Crutchfield, NRC, letter responding to several informal inquiries from design certification applicants regarding form and content of design control document. Forwarding current staff views regarding document.
Fiche: 76396:143-76396:151
acn: 9309100237

August 27, 1993 — J.F. Quirk, GE, letter requests that NRC exempt ABWR design certification from compliance with requirements of metrication policy adopted last year by NRC and published in FR (57FR46202), dated October 7, 1992, in reference to NRC July 7, 1993, letter.
Fiche: 76344:314-76344:315
acn: 9309020374

August 30, 1993	J. Fox, GE, letter forwarding TS Section 3.3, "Instrumentation," for proof and review. Fiche: 76342:001-76342:293 acn: 9309020032
August 30, 1993	R.W. Borchardt, NRC, letter requesting staff support to complete scope of inspection to be conducted at facility in San Jose, California on September 7 through 10, 1993. Inspection to review QA programs. Fiche: 76396:140-76396:142 acn: 9309100256
August 31, 1993	J.F. Quirk, GE, letter forwarding Volumes 1 and 2 of "ABWR Certified Design Material." GE believes that submittal represents complete set of Tier 1 ABWR material necessary to support design certification of ABWR, per 10 CFR Part 52. Fiche: 76343:001-76344:286 acn: 9309020393
August 31, 1993	D. Crutchfield, NRC, letter forwarding proof and review ABWR TS and bases for Sections 3.3, "Instrumentations" and 3.8, "Electric Power (includes Low Power & Shutdown)." Fiche: 76432:001-76433:121 acn: 9309140171
September 1, 1993	J. Fox, GE, letter forwarding new SSAR Subsection 3H.5.5, "Structural Analysis Report for Turbine Building." Fiche: 76369:335-76369:336 acn: 9309030344
September 1, 1993	J. Fox, GE, letter forwarding revised markups for Issues A10, A17, A47, B5, C8, C17, 25, 51, 82, 89, 113, 143, 153, and revised index (Table 19B.1-1) in response to NRC August 4, 1993, comments for review and resolution. Fiche: 76372:312-76372:339 acn: 9309070196
September 2, 1993	J. Fox, GE, letter forwarding August 31, 1993, letter from Bechtel, documenting that civil/structural calculations for licensing support of ABWR project performed, per Bechtel QA project procedures manual. Fiche: 76409:357-76409:358 acn: 9309080222
September 2, 1993	J. Fox, GE, letter forwarding missing pages from ABWR TS Section 3.3 proof and review version sent on August 30, 1993. Fiche: 76397:231-76397:245 acn: 9309080237
September 2, 1993	J. Fox, GE, letter forwarding Chandra September 2, 1993, note on Subsection 9.4. Fiche: 71850:146-71850:147 acn: 9309080358
September 10, 1993	C.K. Tang, GE, letter forwarding advanced page of Amendment 32 on Revision 1A.2.34. List of system expanded to include system that perform containment atmosphere and reactor coolant sampling functions, per September 9, 1993, telecon request. Fiche: 76449:351-76449:352 acn: 9309150192

September 10, 1993 — J. Fox, GE, letter forwarding Bechtel September 10 and August 31, 1993, letters regarding QA program plan and ABWR licensing support, civil/structural calculations, respectively.
Fiche: 76449:353-76449:355
acn: 9309150199

September 13, 1993 — J. Fox, GE, letter forwarding markups of P&R version of TS Section 1.1, "Definitions."
Fiche: 76512:037-76512:048
acn: 9309210164

September 13, 1993 — J. Fox, GE, letter forwarding P&R version of TS Sections 2.0, 3.0, and 3.1 supporting accelerated ABWR review schedule.
Fiche: 76511:324-76511:338
acn: 9309210182

September 13, 1993 — J. Fox, GE, letter forwarding marked up TS on LCO 3.5.2 regarding ECCS shutdown.
Fiche: 76511:334-76511:352
acn: 9309210207

September 13, 1993 — J. Fox, GE, letter forwarding TS supporting accelerated ABWR schedule regarding containment electrical penetration assemblies.
Fiche: 76511:339-76511:341
acn: 9309210211

September 15, 1993 — J. Fox, GE, letter forwarding two letters from Bechtel documenting application of QA project procedures manual to advanced BWR certification program.
Fiche: 76590:358-76590:360
acn: 9309280277

September 15, 1993 — J. Fox, GE, letter forwarding revised P&R version of TS LCOs 3.5.1 and 3.7.1 and associated bases to replace LCOs 3.5.1 and 3.7.1 issued for P&R dated July 22, and 30, 1993, respectively.
Fiche: 76511:170-76511:206
acn: 9309210202

September 17, 1993 — J.F. Quirk, GE, letter forwarding Amendment 32 to nonproprietary portions of "ABWR SSAR," transmitting final information required for NRC to complete review of ABWR and information resulting from GE internal SSAR verification process w/nonproprietary oversize drawings Books 1 and 2.
Fiche: 76530:001-76543:152
acn: 9309210131

September 17, 1993 — J.F. Quirk, GE, letter forwarding Amendment 32 to proprietary Sections 1.3 and 6.3, Appendices 3B, 4B, 4C, 4D, and 20A of "ABWR SSAR" w/proprietary oversize drawings. Proprietary section, appendices, and drawings withheld.
Fiche: 76515:337-76515:338
acn: 9309210147

September 17, 1993 — J. Fox, GE, letter forwarding P&R markups of TS Section 3., "Containment Systems," with exception of LCO 3.6.2.4, "Wetwell Spray," and associated bases. Markups of LCO 3.6.2.4 and bases will be provided on September 21, 1993.
Fiche: 76589:001-76589:128
acn: 9309280003

September 17, 1993 — J. Fox, GE, letter forwarding P&R markups of TS Section 3.7, "Plant Systems," supporting accelerated advanced BWR schedule.
Fiche: 76591:208-76591:311
acn: 9309280005

September 17, 1993 — J. Fox, GE, letter forwarding report of September 10, 1993, telecon regarding assumption of no superheat in SSAR corium shield analysis.
Fiche: 76590:306-76590:310
acn: 9309280275

September 17, 1993 — J. Fox, GE, letter forwarding Amendment 32 to advanced BWR SSAR Subsections 6.2.5.2.6.1(6) and 19E.2.1.2.3 which close out punch list Items 31 and 29, respectively.
Fiche: 76591:315-76591:322
acn: 9309280279

September 20, 1993 — J. Fox, GE, letter forwarding marked up TS Section 5.0, "Administrative Controls." Subsection 5.7.2.13, "Explosive Gas and Storage Radioactivity Monitoring Program," should be deleted due to inapplicability to advanced BWRs.
Fiche: 76582:252-76582:261
acn: 9309280001

September 21, 1993 — J. Fox, GE, letter forwarding markups of TS LCO 3.6.2.4, "RHR Wetwell Spray" and associated bases.
Fiche: 76588:333-76588:340
acn: 9309280009

September 21, 1993 — J. Fox, GE, letter forwarding markup of TS Section 1.1, "Definitions," supporting accelerated advanced BWR schedule.
Fiche: 76588:307-76588:312
acn: 9309280011

September 21, 1993 — J. Fox, GE, letter forwarding marked up TS Section 3.3, "Instrumentation," in support of accelerated advanced BWR review schedule.
Fiche: 76592:001-76592:308
acn: 9309280282

September 23, 1993 — J. Fox, GE, letter forwarding markups on TS Section 3.8, "Electrical Systems," supporting accelerated advanced BWR review schedule.
Fiche: 76588:271-76588:306
acn: 9309280007

September 27, 1993 — T.H. Boyce, NRC, letter submitting initial staff comments on GE ABWR Tier 1 Ausut 31, 1993, submittal regarding ABWR certified design material. Submittal adequately reflects agreements reached for Tier 1 material.
Fiche: 76673:202-76673:225
acn: 9310060058

September 28, 1993 — W.H. Rasin, NUMARC, letter providing comments on draft guidance on form and content of design control document.
Fiche: 71886:002-71886:026
acn: 9310070374

September 29, 1993 — J. Fox, GE, letter forwarding markups for Table 3.9-8, "IST" of ABWR SSAR.
Fiche: 76709:302-76709:316
acn: 9310050359

September 30, 1993 — J. Fox, GE, letter forwarding SSAR markup that removes deviation from Section B.3.a of Appendix A to Section 6.2.1.1.C of SRP regarding position indicators and alarms for vacuum breakers and amplifies vacuum valve operability tests, as follow-up to September 28, 1993, telecon.
Fiche: 76726:161-76726:166
acn: 9310070150

September 30, 1993 — J.F. Quirk, GE, letter forwarding "ABWR SSAR/Tier 1 Cross Reference Material," consisting of tables which identify relationship between SSAR safety analysis assumptions and ITAAC defined in ABWR design certification material submitted in August 31, 1993, letter.
Fiche: 76728:271-76728:329
acn: 9310080166

October 1, 1993 — J. Fox, GE, letter forwarding markup on TS LCO 3.5.1, "ECCS-Operating," incorporating review comments discussed between GE and NRC on September 30, 1993, in San Jose. Condition H also broken into new Conditions E and F, as agreed during reference meeting.
Fiche: 76700:311-76700:336
acn: 9310060289

October 4, 1993 — J. Fox, GE, letter forwarding SSAR markup of Section 11.5, providing COL license information and extended range effluent monitors for post accident monitoring, per TMI Item II.F.1.
Fiche: 76725:339-76725:344
acn: 9310080066

October 4, 1993 — J. Fox, GE, letter forwarding TS LCO 3.8.1, "AC Sources-Operating," incorporating review comments discussed between GE and NRC on September 30, 1993, in San Jose and new condition to address inoperability of one unit auxiliary transformer.
Fiche: 76717:210-76717:272
acn: 9310080072

October 5, 1993 — J. Fox, GE, letter forwarding SSAR markups covering classification of spent fuel pool line, appropriate figure for crack leak rate and inlet temperature protection for fuel pool cooling system filter demineralizers.
Fiche: 76765:271-76765:274
acn: 9310130279

October 5, 1993 — J. Fox, GE, letter forwarding TS LCO 3.3.4 ATWS and EOC-RPT Figure 3.3.4-1 for bases to be included in Revision O of TS.
Fiche: 76802:222-75802:223
acn: 9310150119

October 8, 1993 — J. Fox, GE, letter forwarding ABWR schedule regarding fuel and core designs.
Fiche: 76802:173-76802:174
acn: 9310150283

October 8, 1993 — J. Fox, GE, letter forwarding ABWR schedule regarding EPG changes incorporating ATWS stability issues.
Fiche: 76802:275-76802:280
acn: 9310150285

October 13, 1993 — J. Fox, GE, letter forwarding ABWR SSAR Appendix 19A markups.
Fiche: 76837:299-76837:308
acn: 9310190108

October 13, 1993 — J. Fox, GE, letter forwarding SSAR markup of selected portions of Section 6.5 which addresses discussion items of GE/NRC Plant Systems Branch October 13, 1993, telecon.
Fiche: 76837:311-76837:319
acn: 9310190111

October 13, 1993 — J. Fox, GE, letter forwarding description of basis for drywell spray initiation limit for ABWR, in response to M. Snodderly request in connection with review of containment EPGs.
Fiche: 76892:190-76892:196
acn: 9310210300

October 13, 1993 — J. Fox, GE, letter forwarding SSAR markup of selected portions of Section 6.5, addressing discussion items of GE/NRC Plant Systems Branch conference call on October 13, 1993.
Fiche: 76892:197-76892:203
acn: 9310210302

October 18, 1993 — J. Fox, GE, letter forwarding LCO 3.6.1.6 and associated bases for review and comment.
Fiche: 76917:334-76917:343
acn: 9310260257

October 20, 1993 — J. Fox, GE, letter forwarding SSAR markup of GSI 82 that responds to issues raised by Plant Systems Branch during October 8, 1993, telecon.
Fiche: 76914:321-76914:326
acn: 9310250293

October 20, 1993 — J. Fox, GE, letter forwarding Section 5.0 of TS incorporating agreements reached between NRC and GE on Paragraph 5.7.2.4, primary coolant sources outside containment and Paragraph 5.7.2.13, explosive gas and storage tank radioactivity monitoring program.
Fiche: 76913:183-76913:188
acn: 9310260131

October 20, 1993 — J. Fox, GE, letter forwarding responses to NRC questions on ABWR certified design material Document 25A5447. Changes will be incorporated in next revision of document currently scheduled for mid-November 1993.
Fiche: 76959:155-76959:229
acn: 9310270056

October 22, 1993 — J. Fox, GE, letter forwarding justification of number of cycles/events specified in Table 3.9-1 supporting accelerated ABWR review schedule.
Fiche: 76924:322-76924:326
acn: 9310260352

October 22, 1993 — J. Fox, GE, letter forwarding SSAR markups of Section 6.5 and Appendix 6A supporting accelerated ABWR schedule.
Fiche: 76986:354-76986:356
acn: 9310270008

October 22, 1993 — J. Fox, GE, letter forwarding SSAR markups responding to Open Items 1.2.6-1 and 2.6-1 regarding accelerated ABWR schedule.
Fiche: 76985:302-76985:305
acn: 9310270011

October 22, 1993 — J. Fox, GE, letter forwarding TS LCO 3.5.1, "ECCS Operating," and associated bases, incorporating P&R review comments and agreements between NRC and GE on use of CTG or ACIWA in LCO.
Fiche: 76985:276-76985:301
acn: 9310270040

October 22, 1993 — J. Fox, GE, letter forwarding LCOs 3.8.1, 3.8.4, and 3.8.7 and associated bases, incorporating agreements recently reached between NRC and GE. Notifies that in LCO 3.8.7, Conditions A & B from P&R version dated August 31, 1993, combined into one condition.
Fiche: 76995:126-76995:205
acn: 9310290032

October 25, 1993 — J. Fox, GE, letter forwarding LCO 3.6.1.6 regarding wetwell-to-drywell vacuum breakers and associated bases, incorporating agreements reached between NRC and GE.
Fiche: 77016:255-77016:263
acn: 9310290034

October 26, 1993 — J. Fox, GE, letter forwarding LCO 3.8.9 and associated bases, incorporating P&R review comments and recent agreements reached by NRC staff and GE. Requests markup comments as soon as possible.
Fiche: 76981:199-76981:216
acn: 9310280180

October 26, 1993 — J. Fox, GE, letter forwarding paper entitled, "ABWR Reactor Water Level System Capabilities," provided to D. Tang via fax on July 7, 1993, as basis of July 9, 1993, conference call.
Fiche: 76995:089-76995:095
acn: 9310280259

October 27, 1993 — J. Fox, GE, letter forwarding SSAR markup revising structural acceptance criteria of Subsection 3.8.1.5.
Fiche: 77056:239-77056:241
acn: 9311030264

October 27, 1993 — J. Fox, GE, letter forwarding SSAR markups addressing recent GE/NRC discussions pertaining to 8h RCIC capability.
Fiche: 77056:236-77056:238
acn: 9311030273

October 28, 1993 — J. Fox, GE, letter forwarding proprietary SSAR markups of Section 11.0 and Appendix 18F supporting accelerated ABWR schedule. Enclosure withheld.
Fiche: 77203:347-77203:357
acn: 9311120037

October 29, 1993 — J. Fox, GE, letter forwarding Figure 5.1-3 sheet 2, reflecting addition of dc to SRV solenoids to indicate that solenoids dc powered.
Fiche: 77108:238-77108:239
acn: 9311040376

October 29, 1993 — J. Fox, GE, letter forwarding SSAR markup that indicates dc powered SRV solenoids on Figure 5.1-3, "Nuclear Boiler System P&ID."
Fiche: 77166:224-77166:225
acn: 9311090202

November 1, 1993 — C. Poslusny, NRC, letter forwarding independent quality review group initial comments on GE Nuclear Energy ABWR certified design material and SSAR.
Fiche: 77167:284-77167:330
acn: 9311120026

November 2, 1993 — J. Fox, GE, letter forwarding sample page of TS format that reflects need for GE document control and NRC staff requirement for maintaining STS format in WordPerfect.
Fiche: 77166:034-77166:035
acn: 9311090157

November 2, 1993 — C.B. Brinkman, ABB-CE, letter requests counsel on System 80+ design certification project be placed on service list to receive documents regarding GE ABWR design certification application and rulemaking.
Fiche: 77232:001-77232:001
acn: 9311120204

November 3, 1993 — J.F. Quirk, GE, letter forwarding draft of ABWR SSAR Tables 19.8-1 through 19.8-7 that hae been annotated with cross references to ITAAC. GE intends to include final version of enclosed draft material in ABWR SSAR amendment currently scheduled for submittal in mid-November 1993.
Fiche: 77101:344-77101:358
acn: 9311040238

November 3, 1993 — J. Fox, GE, letter forwarding discussion paper on ABWR schedule regarding primary containment pressure control EPG-low pressure venting for NRC/GE conference call scheduled for November 4, 1993.
Fiche: 77148:282-77148:290
acn: 9311090208

November 3, 1993 — J. Fox, GE, letter forwarding ABWR schedule regarding TS 3.6.1.6 bases addition, indicated by redlined text.
Fiche: 77145:355-77145:356
acn: 9311090225

November 5, 1993 — J.F. Quirk, GE, letter forwarding proprietary ABWR SSAR information. Advises that balance of previously designated proprietary pages reclassified as nonproprietary and will be revised in Amendment 33 with proprietary designation removed. Proprietary information withheld.
Fiche: 77208:299-77208:304
acn: 9311150296

November 9, 1993 — J. Fox, GE, letter forwarding ABWR adaptation of new Section 5.0 of standard TS regarding administrative controls.
Fiche: 77264:088-77264:112
acn: 9311180150

November 9, 1993 — R.W. Borchardt, NRC, letter discussing GE relief from NRC metrication policy for both ABWR and SBWR designs.
Fiche: 77191:248-77191:253
acn: 9311150329

November 9, 1993 — T.H. Boyce, NRC, letter forwarding comments on GE ABWR Tier 1 certified design material.
Fiche: 77238:311-77238:336
acn: 9311180038

November 15, 1993 — C. Poslusny, NRC, letter forwarding replacement copy of independent quality review group initial comments on GE ABWR certified design material and SSAR, provided during November 10 and 11, 1993, meetings in San Jose, including missing pages due to xerographic error.
Fiche: 77293:001-77293:060
acn: 9312010388

November 16, 1993 — B. Strong, GE, letter requesting that John or Dale review rewritten sections, per licensee telecon.
Fiche: 77282:340-77282:346
acn: 9311190192

November 22, 1993 — R.W. Borchardt, NRC, letter forwarding advance copy of draft Commission paper, "Diversity in Method of Measuring Reactor Pressure Vessel Level in ABWR & Simplified BWR," for distribution to appropriate GE staff.
Fiche: 77355-349-77355:358
acn: 9312030287

November 22, 1993 — L. Slegers, Siemens Power Corp., letter responding to inquiry regarding diverse system for continuous water level measurement in BWR reactors.
Fiche: 77523:208-77523:208
acn: 9312160186

November 23, 1993 — J. Fox, GE, letter forwarding markup changes to tangential spear stress regarding stresses in concrete and reinforcing steel.
Fiche: 77374:120-77374:124
acn: 9312030060

November 30, 1993 — J.F. Quirk, GE, letter discusses Final Design Approval (FDA) regarding design certification (DC) rulemaking. Informs that industry does not agree with preliminary secondary reference couse proposed by NRC staff and will submit forthcoming position paper.
Fiche: 71991:211-71991:213
acn: 9401310064

November 30, 1993 — R.W. Borchardt, NRC, letter correcting November 22, 1993, letter transmitting draft Commission paper, by changing date of ACRS meeting and due date for GE comments from December 15 to December 9, 1993. Forwarding Commission paper for distribution to GE staff.
Fiche: 77395:072-77395:081
acn: 9312100030

December 2, 1993 — J. Fox, GE, letter transmitting draft Amendment 33 to ABWR SSAR, Section 3.8.1.5, "Structural Acceptance Criteria."
Fiche: 77394:355-77394:359
acn: 9312080140

December 7, 1993 — J.F. Quirk, GE, letter forwarding proprietary portions of Appendix 3B of SSAR for advanced BWR. Report withheld.
Fiche: 77427:359-77427:360
acn: 9312100021

December 7, 1993 — J.F. Quirk, GE, letter forwarding nonproprietary Amendment 33 to "Advanced BWR SSAR," w/200 oeversize drawings.
Fiche: 77451:001-77464:034
acn: 9312100053

December 7, 1993 — J.F. Quirk, GE, letter forwarding Revision 2 to Volumes 1 and 2 to 25A5447, "Advanced BWR Certified Design Material."
Fiche: 77483:001-77484:297
acn: 9312140341

December 8, 1993 — J. Fox, GE, letter forwarding Owners Group changes incorporated in ABWR TS Chapter 16, Amendment 33, supporting accelerated ABWR schedule.
Fiche: 77529:212-77529:301
acn: 9312200063

December 9, 1993 — J.F. Quirk, GE, letter requesting that all ABWR certification program correspondence be addressed to the undersigned, effective immediately.
Fiche: 77602:306-77602:306
acn: 9312170144

December 13, 1993 — J.F. Quirk, GE, letter forwarding Amendment 33 to advanced BWR SSAR.
Fiche: 77633:156-77633:341
acn: 9312270058

December 14, 1993 — C. Poslusny, NRC, letter forwarding documents including information on vessel level instrumentation experience at European reactors.
Fiche: 77523:207-77523:230
acn: 9312160184

December 29, 1993 — R.W. Borchardt, NRC, letter forwarding detailed discussion of remaining issues and final position for resolution regarding ABWR containment system and severe accident review issues.
Fiche: 77674:325-77674:333
acn: 9401050084

December 30, 1993 — D. Crutchfield, NRC, letter forwarding advance copy of FSER on ABWR design regarding review of application for certification of ABWR design to inform of staff current findings and remaining open and confirmatory issues.
Fiche: 77749:002-77752:326
acn: 9401110210

January 13, 1994 — J. Fox, GE, letter responding to low-pressure venting Items 1, 3, 4, and 5 of GE ABWR containment system and severe accident review issues transmitted by December 29, 1993, letter with regard to containment EPGs.
Fiche: 77937:328-77937:332
acn: 9401260126

January 14, 1994 — J. Fox, GE, letter forwarding SSAR markups addressing Open Items F19.3.3.2.1-1 and F19.3.3.2.1-2. Markups justify that RIP impeller and shaft replacement can take place with fuel in vessel and removal of blade and drive of same assembly can be conducted.
Fiche: 77937:333-77937:340
acn: 9401260123

January 14, 1994 — J.E. Wilkins, ACRS, summarizing 405th meeting of ACRS on January 6 and 7, 1994, regarding final report on design acceptance criteria process in certification of GE ABWR design.
Fiche: 78101:005-78101:009
acn: 9402070033

January 20, 1994 — J. Fox, GE, letter responding to containment emergency procedure guidelines issue on heat capacity temp limit portion of Open Issue F18.1-1, transmitted by December 29, 1993, letter.
Fiche: 77991:349-77991:357
acn: 9401310392

January 25, 1994 — J. Fox, GE, letter forwarding SSAR markups addressing Confirmatory Item F14.3.3-1 pertaining to ACRS comments on piping design acceptance criteria.
Fiche: 78086:349-78086:354
acn: 9402070239

January 25, 1994 — J. Fox, GE, letter forwarding SSAR markups addressing modeling uncertainty in PRA success criteria.
Fiche: 78086:341-78086:344
acn: 9402070250

January 26, 1994 — Transcript of January 26, 1994, briefing by GE in Rockville, Maryland regarding status of ABWR application for design certification.
Fiche: 78025:195-78025:260
acn: 9402030276

January 27, 1994 — C. Poslusny, NRC, letter forwarding staff feedback on ABWR Amendment 33 to SSAR and set of SSAR pages with marked up changes proposed by staff.
Fiche: 78091:001-78095:226
acn: 9402090184

February 1, 1994	R. Ng, NUMARC, letter forwarding information from design PRA for ABWR appropriate for inclusion as Chapter 19 of design control document. Information based on Section 19.8 of ABWR SSAR, "Important Features Identified by ABWR PRA" (Amendment 33). Fiche: 78111:203-78111:240 acn: 9402080319
February 1, 1994	T.H. Boyce, NRC, summarizing December 14, 1993, meeting with DOE in Rockville, Maryland to discuss progress of reviews for design certification of next-generation reactor designs. List of meeting attendees and viewgraphs presented by industry representatives enclosed. Fiche: 78106:292-78106:326 acn: 9402140161
February 2, 1994	C. Poslusny, NRC, letter providing round two of staff feedback on ABWR Amendment 33 to SSAR, certified design material and TS. Fiche: 78137:177-78137:216 acn: 9402140019
February 3, 1994	R.W. Borchardt, NRC, letter forwarding comments on GE ABWR certified design material and SSAR. Comments requested within 2 weeks to allow prompt review and resolution by ITAAC review team. Fiche: 78117:179-78117:308 acn: 9402140327
February 4, 1994	J. Fox, GE, letter forwarding SSAR markup addressing response to Open Item F6.2.1.9-1, pertaining to suppression pool strainers. Fiche: 78144:332-78144:334 acn: 9402140251
February 4, 1994	J. Fox, GE, letter forwarding SSAR markup addressing response to Open Item F4.2-1, pertaining to fuel burnup limit. Fiche: 72013:355-72013:356 acn: 9402140255
February 4, 1994	J. Fox, GE, letter forwarding CDM markups addressing response to Open Item F8.3.3.6-1, pertaining to addition of non-Class 1E loads to Class 1E system. Fiche: 78137:336-78137:340 acn: 9402140263
February 7, 1994	J. Fox, GE, letter forwarding SSAR markups addressing Open Item F1.9-1 regarding venting procedures, testing of RCIC bypass, turbine trip reliability, materials selection and increased capability for ACIWA system. Fiche: 78139:301-78139:333 acn: 9402140207
February 7, 1994	J. Fox, GE, letter forwarding SSAR markups addressing Open Item F19.2.3.3.8.3-1 regarding containment sump design. Fiche: 78139:246-78139:300 acn: 9402140211

February 7, 1994 — J. Fox, GE, letter responding to low-pressure venting Item 2 transmitted by NRC December 29, 1993, letter regarding containment system and severe accident review issues, including containment emergency procedure guidelines issues.
Fiche: 78137:299-78137:305
acn: 9402140212

February 7, 1994 — J. Fox, GE, letter forwarding proprietary SSAR markup addressing response to Open Item F4.2-1 regarding fuel burnup limit. Enclosure withheld.
Fiche: 78150:311-78150:311
acn: 9402140312

February 7, 1994 — J. Fox, GE, letter forwarding SSAR markup addressing response to Open Item F19.2.3.2.1-1 regarding ACRS concern with equipment tunnel protection.
Fiche: 78129:354-78129:360
acn: 9402140316

February 7, 1994 — J. Fox, GE, letter forwarding SSAR markup addressing response to Open Item F19.2.3.3.7-1 regarding equipment survivability.
Fiche: 78129:310-78129:342
acn: 9402140325

February 7, 1994 — H.J. Yang, NRC, letter concluding that control rod withdrawal block function of MRBM subsystem should not be included in SSAR Subsection 14.2.12.2.6, per review of reference NRC comments on adding MRBM testing information to SSAR Subsection 145.2.12.2.6.
Fiche: 78267:303-78267:304
acn: 9402240235

February 9, 1994 — J. Fox, GE, letter forwarding H.Y. Yang February 7, 1994, letter, concluding that control rod withdrawal block function of MRBM subsystem should not be included in Subsection 14.2.12.2.6 of SSAR.
Fiche: 78267:302-78267:304
acn: 9402240228

February 9, 1994 — J. Fox, GE, letter documenting plans to submit additional proprietary information on Chapters 11 and 18 as part of Amendment 34.
Fiche: 78233:324-78233:324
acn: 9402240240

February 10, 1994 — C. Tang, GE, letter forwarding markup of LCO 3.6.2.4 and bases to support 14-day AOT, with regard to ABWR SSAR Amendment 33, Item 9.6.5.2 concerning containment spray system for review.
Fiche: 72020:309-72020:320
acn: 9402240218

February 10, 1994 — J. Fox, GE, letter forwarding proposed modification to Subsection 1A.2.16 regarding identification of and recovery from conditions leading to inadequate core cooling (TMI II.F.2).
Fiche: 78267:310-78267:312
acn: 9402240365

February 10, 1994 — C. Poslusny, NRC, letter providing third round of staff comments regarding GE SSAR Amendment 33, including additional Plant Systems Branch, Standardization Project Branch, and markup of one TS page generated by staff audit.
Fiche: 78143:347-78143:359
acn: 9402160159

February 11, 1994 — A.A. James, GE, letter forwarding CDM and SSAR markups addressing Open Item F14.3.2-1 regarding ACRS concerns on fires and floods, including Michelson tunnel-related issues.
Fiche: 78267:067-78267:116
acn: 9402240369

February 14, 1994 — J. Fox, GE, letter forwarding revised SSAR markup addressing Open Item F6.2.1.9-1 regarding suppression pool strainers.
Fiche: 78316:189-78316:191
acn: 9402280121

February 14, 1994 — J. Fox, GE, letter forwarding write-up on consequences of simultaneous withdrawal of control rod and CR FMCRD requested.
Fiche: 78316:234-78316:235
acn: 9402280122

February 14, 1994 — C. Poslusny, NRC, letter providing fourth round of staff feedback on ABWR Amendment 33 to SSAR and TS. Markup of two TS pages generated by staff audit included.
Fiche: 78278:344-78278:347
acn: 9402250024

February 16, 1994 — C. Poslusny, NRC, letter providing fifth round of feedback on ABWR regarding Amendment 33 to standard safety analysis and TS.
Fiche: 78300:349-78300:353
acn: 9403010218

February 24, 1994 — J. Fox, GE, letter forwarding revised write-up on consequences of simultaneous withdrawal of control rod and FMCRD.
Fiche: 78367:355-78367:357
acn: 9403070334

February 25, 1994 — J. Fox, GE, letter responding to DBA suppression pool bypass open item of February 29, 1993, letter regarding containment systems and severe accident issues.
Fiche: 78446:346-78446:347
acn: 9403100272

March 3, 1994 — J. Fox, GE, letter updating J.F. Quirk November 5, 1993, letter regarding final reclassification of ABWR SSAR proprietary information on Chapters 11 and 18.
Fiche: 78500:277-78500:278
acn: 9403110288

March 4, 1994 — C. Tang, Westinghouse, letter forwarding markups for LCO 3.3.1.4, incorporating Amendment 34 of SSAR.
Fiche: 78423:338-78423:345
acn: 9403090337

March 4, 1994 — J. Fox, GE, letter forwarding SSAR markup addressing EPG issue on HTCL.
Fiche: 78513:316-78513:324
acn: 9403140277

March 8, 1994 — A. Beard, GE, letter forwarding SSAR markups regarding manual fire fighting in control building for J. Holmes.
Fiche: 78503:268-78503:272
acn: 9403150235

March 8, 1994 — J. Fox, GE, letter forwarding CRD/RIP information.
Fiche: 78531:358-78531:359
acn: 9403150470

March 10, 1994 — J. Fox, GE, letter forwarding revised response to materials selection portion of Open Item F1.9-1.
Fiche: 78538:325-78538:329
acn: 9403160151

March 18, 1994 — J. Fox, GE, letter forwarding revised response to DSER (SECY-91-235) Outstanding Issue 31.
Fiche: 78612:334-78612:340
acn: 9403220179

March 18, 1994 — C. Poslusny, NRC, letter documenting recent discussions held between NRC and GE staff regarding effort to resolve remaining open item identified in staff advance SE for ABWR.
Fiche: 78680:272-78680:273
acn: 9403290129

March 23, 1994 — M.A. Rowden, Fried, Frank, Harris, Shriver & Jacobson, letter forwarding draft proposed rulemaking and draft rule form and content for ABWR design certification proceeding for review and conderation.
Fiche: 78738:298-78738:352
acn: 9403300122

March 24, 1994 — R.W. Borchardt, NRC, letter discussing development of certified design material for evolutionary reactor designs.
Fiche: 78710:001-78710:048
acn: 9403310223

March 30, 1994 — D.A. Dreyfus, DOE, letter forwarding draft, "Advanced Reactor Research & Development Programs 5-Year Plan for Advanced Reactor Activities Under Energy Policy Act of 1992."
Fiche: 79015:001-79015:053
acn: 9404250187

March 30, 1994 — R.W. Borchardt, NRC, letter responding to March 9, 1994, letter regarding remaining issues on ABWR on Open Item F6.2.1.9-1.
Fiche: 78755:239-78755:241
acn: 9404050284

March 31, 1994 — J.F. Quirk, GE, letter forwarding revised "ABWR SSAR/Certified Design Material Cross Reference Material" for GE ABWR.
Fiche: 78751:250-78751:309
acn: 9404040096

March 31, 1994 — J.F. Quirk, GE, letter forwarding nonproprietary Amendment 34 to "Advanced BWR SSAR," for final design approval and design certification.
Fiche: 78880:001-78899:183
acn: 404110226

March 31, 1994 — J.F. Quirk, GE, letter forwarding proprietary portion of Amendment 34 to "ABWR SSAR." Proprietary portion withheld.
Fiche: 78861:232-78861:264
acn: 9404130156

April 5, 1994 — R.W. Borchardt, NRC, letter discussing preliminary findings from Vendor Inspection Branch inspection regarding ABWR design.
Fiche: 78926:175-78926:177
acn: 9404190118

April 11, 1994 — S.L. Kirberg, GE, letter forwarding Chapter 21 engineering drawing indexes to be inserted into Amendment 34 to SSAR.
Fiche: 78879:259-78879:260
acn: 9404130367

April 11, 1994 — J. Fox, GE, letter informing of submittal of supporting accelerated ABWR schedule regarding suppression pool strainers, which will incorporate agreed upon requirements and includng sample calculation.
Fiche: 78873:358-78873:359
acn: 9404150141

April 11, 1994 — J.N. Fox, GE, letter forwarding proprietary modification pages of SSAR, Amendment 34 to replace pages mailed in March 31, 1994, submittal. Notifies that four additional Figures 6.3-76 through 6.3-79 in modification package withheld.
Fiche: 98695:111-98695:111
acn: 9404180312

April 11, 1994 — J.N. Fox, GE, letter forwarding nonproprietary and proprietary modification pages to SSAR Amendment 34 and certified design material, Revision 3 to replace March 31, 1994, submittal.
Fiche: 78953:201-78953:276
acn: 9404180294

April 13, 1994 — J.F. Quirk, GE, letter forwarding "Advanced BWR Certified Design Material/ITAAC Review Guidance."
Fiche: 78878:002-78878:187
acn: 9404150146

April 14, 1994 — J. Fox, GE, letter forwarding submittal supporting accelerated ABWR schedule regarding suppression pool strainers.
Fiche: 78928:328-78928:334
acn: 9404180385

April 14, 1994 — D.A. Dreyfus, DOE, letter informing that deadline for stakeholder comments on "Draft 5-Year Plan for Advanced Reactor Activities Under Energy Policy Act of 1992," extended until May 2, 1994.
Fiche: 79004:345-79004:346
acn: 9404250174

April 19, 1994 — J. Fox, GE, letter forwarding SSAR and CDM markups modifying selected pages of SSAR Chapter 12 and CDM Section 3.2.
Fiche: 78965:242-78965:256
acn: 9404210179

April 19, 1994 — C. Poslusny, NRC, letter forwarding final SNL report on Melcor analysis for ABWR.
Fiche: 78983:028-78983:292
acn: 9404250060

April 25, 1994 — J. Fox, GE, letter forwarding SSAR markups resulting from April 20, 1994, telecon. Changes will be incorporated into next amendment.
Fiche: 79044:244-79044:248
acn: 9404280237

April 26, 1994 — J.M. Taylor, NRC, letter submitting comments regarding draft report, "5-year Plan for Advanced Reactor Activities Under Energy Policy Act of 1992."
Fiche: 79078:237-79078:287
acn: 9405030173

April 28, 1994 — J. Fox, GE, letter forwarding revised SSAR markups addressing suppression pool strainers issue.
Fiche: 79181:056-79181:068
acn: 9405050322

April 28, 1994 — J. Fox, GE, letter forwarding FMCRD scram times for nominal charge pressure of 2134 psig and for minimum allowable charge pressure of 1850 psig.
Fiche: 79181:053-79181:055
acn: 9405050327

April 28, 1994 — M.A. Rowden, Fried, Frank, Harris, Shriver & Jacobson, letter forwarding draft environ assessment for proposed rulemaking on advanced boiling water reactor design certification application and draft notice of issuance of environ assessment and draft finding of no significant impact.
Fiche: 79181:281-79181:304
acn: 9405060057

April 29, 1994 — J. Fox, GE, letter forwarding revised SSAR markups responding to commitments made at April 15, 1994, meeting in Rockville, MD, including additional information reflecting locking mechanisms of subassemblies and European experience and finalized TS for CRD removal - refueling.
Fiche: 79181:025-79181:036
acn: 9405050360

May 3, 1994 — R.W. Borchardt, NRC, letter identifying remaining actions by GE needed to complete ABWR review.
Fiche: 79274:071-79274:107
acn: 9405110082

May 11, 1994 — J. Fox, GE, letter submitting supporting accelerated ABWR schedule, proposed technical specification changes for LCOs 3.7.1, 3.7.2, and 3.7.3.
Fiche: 80225:328-80225:354
acn: 9407140146

May 13, 1994 — R.W. Borchardt, NRC, letter providing GE with additional staff comments on Amendment 34 to ABWR SSAR.
Fiche: 79511:001-79511:047
acn: 9405250139

May 20, 1994 — J.F. Quirk, GE, letter forwarding proprietary SSAR Sections 11A.2 and 11A.4 to specified NRR recipients listed on Attachment 1. Enclosure withheld.
Fiche: 79518:229-79518:241
acn: 9405260145

May 25, 1994 — J.F. Quirk, GE, letter resubmitting affidavit for GE ABWR, proprietary information Section 18H, "Supporting Analysis for Emergency Control Operation Information."
Fiche: 79539:333-79539:336
acn: 9405270098

May 25, 1994 — J.F. Quirk, GE, letter submitting Amendment 35, proprietary information to GE's ABWR SSAR.
Fiche: 79806:177-79806:196
acn: 9406100224

May 25, 1994 — J.F. Quirk, GE, letter submitting Amendment 35, nonproprietary information to GE's ABWR SSAR and certified design material, Revision 4.
Fiche: 79769:001-79769:169
acn: 9406130022

May 25, 1994 — J. Fox, GE, letter submittal supporting accelerated ABWR schedule - response to staff comments on Amendment 34 markups.
Fiche: 80241:309-80241:325
acn: 9407140169

May 26, 1994 — J. Fox, GE, letter providing information on ABWR containment sprays.
Fiche: 80222:316-80222:326
acn: 9407130176

May 31, 1994 — R.W. Borchardt, NRC, letter revising FSER for the ABWR to discuss the concern related to the potential for fuel pool boiling.
Fiche: 79709:141-79709:144
acn: 9406070275

June 7, 1994 — R.W. Borchardt, NRC, letter approving request for withholding ABWR SSAR information from public disclosure.
Fiche: 79757:047-79768:353
acn: 9406140019

June 8, 1994 — J. Fox, GE, letter submittal supporting accelerated ABWR schedule - TMI Item III.D.1.1(1).
Fiche: 80243:310-80243:311
acn: 9407140165

June 8, 1994 — J. Fox, GE, letter submittal supporting accelerated ABWR schedule - codes and standards.
Fiche: 80243:321-80243:325
acn: 9407140168

June 9, 1994 — R.W. Borchardt, NRC, letter providing results of Inspection Report No. 99900403/94-01 to GE.
Fiche: 79827:825-79827-302
acn: 9406170317

June 16, 1994 — R.W. Borchardt, NRC, letter providing revised Inspection Report.
Fiche: 79853:004-79853:020
acn: 9406210355

June 23, 1994 — J. Fox, GE, letter submitting Revision 6 to the ABWR SSAR Amendment 5 and Revision 5 to the CDM.
Fiche: 800247:001-80024:243
acn: 9406270333

July 8, 1994 — D.M. Crutchfield, NRC, letter providing reliability assurance program requirements to GE.
Fiche: 80188:333-80188:334
acn: 9407120142

July 12, 1994 — J. Fox, GE, letter submitting proposed modifications to the ABWR SSAR Amendment 35 and the CDM.
Fiche: 80222:247-80222:292
acn: 9407130180

July 13, 1994 — T.H. Boyce, NRC, letter providing resolutions of DSER and DFSER issues relating to PRA.
Fiche: *
acn: 9407250150

July 13, 1994 — W.T. Russell, NRC, letter providing final design approval (FDA) for the ABWR design to GE.
Fiche: 80268:037-80268:043
acn: 9407180203

* NOT AVAILABLE AT TIME OF PUBLICATION

APPENDIX D

FSER CONTRIBUTORS

NAME	RESPONSIBILITY
S. Adams	Secretary
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A. Andrade	Secretary
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H. Brammer	Mechanical Engineering
W. Burton	Plant Systems
C. Carpenter	Reactor Systems
J. Carter	Operations Events Analysis
M. Case	Project Management
T. Chandrasekaran	Plant Systems
T. Cheng	Structural Engineering
M. Chiramal	Instrumentation & Control
M. Clark	Secretary
T. Collins	Reactor Systems
R. Correia	Reliability Assurance
R. Denning	Operations Events Analysis
A. DiAngelo	Plant Systems
D. Diec	Reactor Systems
R. Dube	Safeguards
R. Eckenrode	Human Factors
A. El-Bassioni	PRA
E. Fox	Emergency Preparedness
G. Galletti	Plant Procedures & Training
G. Georgiev	Materials Engineering
C. Goodman	Human Factors
R. Gramm	Reliability Assurance
S. Green	Secretary
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P. Harich	Secretary
R. Hasselberg	Project Management
J. Holmes	Plant Systems, (Fire Protection)
P. Hearn	Technical Specifications
T. Hiltz	Project Management
C. Hinson	Radiation Protection
S. Hoffman	Project Management
S. Hou	Mechanical Engineering
A. Howe	Project Management
W. Huffman	Project Management
M. Hum	Materials Engineering (ISI)
G. Kelly	PRA
S. Koenick	Project Management
J. Knox	Electrical Engineering
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P. J. Langston	Secretary
E. Lee	Instrumentation & Control
J. Lee	Radiation Protection
S. Lee	Structural Engineering
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R. Palla	PRA
K. Parczewski	Chemical Engineering
R. Pedersen	Radiation Protection
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Northwest Laboratories	
Energy Technology Engineering Center	Mechanical Engineering
Idaho National Engineering Laboratory	USIs, GSIs
Lawrence Livermore National Laboratory	Geotechnical & Structural Engineering
SAIC	Plant Systems

APPENDIX E

STAFF POSITION ON SHELL BUCKLING DUE TO INTERNAL PRESSURE

INTRODUCTION

Generally, when people speak of shell buckling, they refer to the buckling of the shell under external pressure. Therefore, the first reaction of most people to the suggestion that internal pressure in a shell container can cause buckling is skepticism. This is quite understandable, because from experience with the design of spheres and cylinders closed by hemispheres, for instance, containment vessels in nuclear power plants, the membrane stresses in these shells are tensile when subjected to internal pressure. Containment vessels with the above-mentioned configurations are assessed for buckling due to potential external pressure. In addition, considerations are given to compressive and shear membrane stress fields, which can occur in containment shells during earthquakes or as a result of an internal asymmetric pressure due to a loss-of-coolant accident (LOCA) or a variant distribution of pressure around the circumference. This results in axial compression in some portions of the containment shell and shear across the shell section. Compressive hoop stress can also occur at the point of support of a containment vessel under internal pressure where the movement of the shell is restrained.

Because of their geometrical configurations, torispherical and ellipsoidal shells under internal pressure have a stress field in which membrane tension in the meridian direction and compression in the hoop direction exist with the potential for buckling if not properly designed. This can be shown theoretically and has been demonstrated experimentally. Most of the steel containments for pressurized water reactor (PWR) plants in the United States are of spherical or cylindrical with hemispherical dome configurations. For boiling water reactor (BWR) plants, steel containment configurations vary from an inverted bulb surrounded by a torus cylinder topped by a conical frustum, to a cylinder with an ellipsoidal shallow dome. It appears that all the drywell heads in BWR plants are torispherical. The steel containments and their appended steel components are designed in accordance with the requirements of the ASME Codes acceptable to the NRC at the time of the licensing application.

To determine the viability of the containment during a reactor severe accident including a core melt, it becomes necessary to know the ultimate capacity of the containment more precisely and with a margin of safety. This can be observed from Item D, "Containment Performance," contained in the enclosure to SECY-90-016, "Evolutionary Light Water Reactor Certification Issues and Their Relationship to Current Regulatory Requirements," which states:

> The containment should maintain its role as a reliable leaktight barrier by assuring that containment stresses do not exceed ASME service level C limits for a minimum period of 24 hours following the onset of core damage and that following this 24-hour period the containment should continue to provide a barrier against the uncontrolled release of fission products.

This requirement appears to be applicable only to the steel containment and its appended components, which are under internal pressure, and does not mention how buckling is to be considered because buckling is generally perceived to be a problem mainly for thin shells under external pressure as evidenced by the requirements in ASME Code, Section III, Subsection NE. In view of these facts, it is essential that a rational criterion be established for evaluating buckling of shells under internal pressure. In the following, the criteria for buckling as contained in ASME Code, Section III, Subsection NE, and in Code Case N-284 are first examined to discern the relationship between the two and the basic philosophy behind them. On the basis of this understanding supported by the extensive theoretical and experimental studies available in the literature, it is believed that a determination can be made as to whether the stipulations in the NE subsections or Code Case N-284 on buckling can be applied to the buckling of the shell under internal pressure or separate new criteria need to be established.

REVIEW OF ASME CODE BUCKLING CRITERIA

Subsection NE

The design of the steel containment against buckling is based on requirements contained in NE-3133 and in NE-3222. NE-3133 gives formulae to determine the allowable external pressure for different shell configurations. The external pressure thus determined is assumed to include factors of safety and capacity reduction factors. NE-3222.1 specifies the allowable values for the basic compressive stress that may arise from mechanical, thermal, and pressure loads. The basic maximum buckling stress values to be used for the evaluation of stability are to be either (1) one-third of the value of the critical buckling stress determined by one of the following methods: (a) rigorous analysis considering all effects that can influence buckling, (b) classical analysis reduced by margins (knockdown factors), and (c) model testing or (2) the value obtained from NE-3133. NE-3222.2 stipulates stability stress limits in percentages of the value given in NE-3222.1 as follows: (1) for design conditions

and Level A and B service limits use 100 percent, (2) for Level C service limits use 120 percent, and (3) for Level D service limits use 150 percent, which can be translated into factors of safety of 3, 2.5, and 2, respectively, for NE-3222.1(a). NE-3324.4 and NE-3322.6 give the formulae for determining the thicknesses of ellipsoidal and torispherical heads, respectively, for internal pressure with limitations on radii to avoid compressive stresses. The thicknesses are determined on the basis of Level A and B service limits.

Code Case N-284

The purpose of this case is to provide stability criteria for determining the structural adequacy against buckling of containment shells with more complex shell geometries and loading conditions than those covered by NE-3133. Even though the case lists a number of complex conditions, a careful reading of the case will lead one to conclude that the case applies basically to local buckling of stiffened and unstiffened shells under external or internal pressure, stringer buckling and general instability of the stiffened shell under external pressure. The basic compressive allowable stress values referred to by NE-3222.1 will correspond to a factor of 2 in this case. The stability stress limits referred to by NE-3222.2 in this case will correspond to the following factors of safety: 2, 1.67 and 1.34, respectively, for the three conditions of service limits as indicated under NE-3222.1(a). These factors of safety are the minimum values required for local buckling. The respective factors of safety for stringer buckling and general stability failures are required to be 20 percent higher than those for critical local buckling; that is, the factors of safety to be applied are 2.4, 2.0, and 1.6 for the three conditions of service limits. It is to be noted that in addition to the factors of safety, capacity reduction factors that account for the effects of imperfections and nonlinearity in geometry and boundary conditions and plasticity reduction factors that account for nonlinearity in material properties are to be applied in accordance with the guidance given in the Code Case. Further, it should be mentioned that Code Case N-284 has been endorsed in RG 1.84, Revision 27, with a condition that the effect of the presence of a large opening on the shell be considered.

From the above it can be stated that Code Case N-284 is a supplement to NE-3133 and NE-3222 and takes into consideration local buckling of the shell, whether stiffened or unstiffened, stringer buckling and general instability of the stiffened shell as a whole. Such consideration is lacking in either NE-3133 or NE-3222. As observed from above, the factors of safety for local buckling of the shell, whether stiffened or unstiffened, for stringer buckling, and for general stability failure of the stiffened shell are smaller than those for general buckling of unstiffened shells because, with stiffeners, the shell is less sensitive to imperfections and the stiffened shell has a higher resistance against buckling. Furthermore, local buckling of the shell, whether stiffened or unstiffened, has no effect on the stability of the shell as a whole. Therefore, it would be unnecessarily conservative to use the factors of safety as specified in NE-3222 for general stability of the shell for local buckling. Code Case N-284 states that the basic factor of safety of 2 is applied to buckling stress values that are determined by classic (linear) analysis that has been reduced by capacity reduction factors determined from lower bound values of test data. It should be noted that when Code Case N-284 is applied to shells under internal pressure, the influence of the internal pressure may reduce the initial imperfections and, therefore, higher values of capacity reduction factors may be used.

CRITERIA FOR SHELL BUCKLING DUE TO INTERNAL PRESSURE

From the above review and observation, the staff concludes that shell buckling due to internal pressure, as in the case of ellipsoidal and torispherical shells, should be evaluated on the basis of ASME Code Case N-284 as local buckling because the buckling of such shells under internal pressure is of the stable kind. After the first one or two buckles have formed, it is possible to keep on increasing the internal pressure with additional buckles appearing periodically, but there is no effect on the stability of the overall shell. However, it should be noted, that the formation of these circumferential buckling waves on the shell can fracture the joints with any components appended to this portion of the shell and damage such components as bellows, closure of openings, and other attachments. There is also the possibility that the shell wall itself will fracture during the formation of the buckles, if the shell steel material is brittle. With the continuous increase in the internal pressure, and after the cessation of the formation of buckles without any fracture, the shell will most likely fail by axisymmetric yielding.

CONCLUSION

On the basis of a careful review and evaluation of the NE subsections and Code Case N-284 on buckling, the staff recommends that the buckling of ellipsoidal and torispherical shell due to internal pressure be considered as local buckling and evaluated on the basis of the criteria contained in Code Case N-284.

APPENDIX F

STAFF POSITION ON STEEL EMBEDMENTS

INTRODUCTION

GE used American Concrete Institute (ACI) 349 for the design of seismic Category I structures for the ABWR. The staff has reviewed Appendix B to ACI 349 (up to the 1985 Edition), "Code Requirements for Nuclear Safety Related Concrete Structures," and test data for anchor bolts from both the United States and foreign countries. The staff's primary concerns regarding Appendix B to ACI 349 are discussed below and exceptions to Appendix B are noted.

The staff's primary concern about Appendix B to ACI 349 is the use of a basic assumption regarding the 45-degree concrete failure cone. This assumption might have been chosen for the sake of convenience. However, tests have not confirmed this assumption even for single anchors. The problem becomes greater (less conservative) when an anchor is located near the free edge of the concrete or a group of anchors are closely spaced.

Appendix B to ACI 349 is deficient in that it has no provisions for anchor strength reduction when the anchor is located in cracked concrete, such as in the tension zone of a concrete slab. The 1988 Edition of the Uniform Building Code (UBC) has provisions for anchor strength reduction when an anchor is located in the tension zone.

EXCEPTIONS TO APPENDIX B TO ACI 349

(1) Section B.4.2, Tension, and Figures B.4.1 and B.4.2

This section and the figures specify that the tensile strength of concrete for any anchorage can be calculated using a 45-degree failure cone theory. The staff has disseminated the German test data questioning the validity of the 45-degree failure cone theory to licensees, architect/engineer, bolt manufacturers, and members of the ACI 349 Code Committee. The data indicated that the more appropriate failure cone was about 35 degrees and the use of the 45-degree cone theory could be unconservative for anchorages of deep embedment and for the anchorage of groups of bolts. The ACI 349 Code Committee, having done some research of its own, recently agreed with the staff's position. The Code Committee is making changes to this section. In the meantime, the staff position on issues related to this section is to ensure adoption of design approaches consistent with the test data through case-by-case review.

(2) Section B.5.1.1, Tension

This section presents the following criterion for ductile anchors: the design pullout strength (force) of the concrete, as determined in Section B.4.2, shall exceed the minimum specified tensile strength (force) of the steel anchor. Any anchor that meets this criterion is qualified as a ductile anchor; thus, a low safety factor can be used. The staff believes that the criterion is deficient in two areas. One is that the design pullout strength of the concrete so calculated could be higher than the actual strength, which is stated in Section B.4.2 above. The other is that anchor steel characteristics are not taken into consideration. For example, Drillco Maxi-Bolt Devices, Ltd., claims that its anchors are ductile anchors, thus allowing the use of a low safety factor. The strength of the Maxi-Bolt is based on the yield strength of the anchor steel, which is 724 megapascal MPa (105 ksi). The embedment length of the anchor, which is used to determine the pullout strength of the concrete, is based on the minimum specified tensile strength of the anchor steel of 862 MPa (125 ksi). The staff believes that the 19-percent margin (125/105) for the embedment length calculation is insufficient considering the variability of parameters affecting the concrete cone strength. The staff also questions the energy absorption capability (deformation capability after yield) of such a high-strength anchor steel. Therefore, in addition to the position taken with regard to Section B.4.2 above, the staff will review vendor- or manufacturer- specific anchor bolt behaviors to determine the acceptable design margins between anchor bolt strengths and their corresponding pullout strengths based on a concrete cone.

Section B.5.1.1(a) - Lateral Bursting Concrete Strength

This section states that the lateral bursting concrete strength can be determined by the 45-degree concrete failure cone assumption. Since this assumption is wrong and is likely to be replaced as stated before, the staff believes that the lateral bursting concrete strength determination is also inappropriate and needs to be replaced. The staff will review the lateral bursting concrete strength provided by the concrete cover around anchor bolts and the lateral bursting force created by the pulling of anchor bolts against test data to determine if reinforcement against lateral bursting force needs to be provided on a case-by-case basis.

(3) **Section B.5.1.2.1, Anchor, Studs, or Bars**

This section states that the concrete resistance for shear can be determined by a 45-degree half-cone to the concrete free surface from the centerline of the anchor at the shearing surface. Since the 45-degree concrete failure cone for tension has been found to be incorrect, the staff believes that the use of the 45-degree half-cone for shear should also be reexamined. Thus, the staff will review the adequacy of the shear capacity calculation of concrete cones on a case-by-case basis with emphasis on the verification of methodology through vendor-specific test data.

(4) **Section B.5.1.2.2(c), Shear Lugs**

This section states that the concrete resistance for each shear lug in the direction of a free edge shall be determined on the basis of the 45-degree half-cone assumption by considering the concrete free surface from the bearing edge of the shear lug. This is the same assumption as that used in Section B.5.1.2.1, and the staff has the same comment as stated in that section. Therefore, the staff's position related to the design of shear lugs is to perform case-by-case reviews. The staff review will emphasize verification of methodology through vendor-specific test data.

(5) **Section B.7.2, Alternative Design Requirements for Expansion Anchors**

This section states that the design strength of expansion anchors shall be 0.33 times the average tension and shear test failure loads, which provides a safety factor of 3 against anchor failure. The staff position is that the safety factor for design against anchor failure is 4 for wedge anchors and 5 for shell anchors, unless a lower safety factor can be supported by vendor-specific test data.

(6) **Anchors in Tension Zone of Supporting Concrete**

When anchors are located in a tensile zone of supporting concrete, the reduction in anchor capacity due to concrete cracking should be accounted for in the anchor design.

APPENDIX G

STAFF POSITIONS AND TECHNICAL BASES ON THE USE OF AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) N690, "NUCLEAR FACILITIES - STEEL SAFETY-RELATED STRUCTURES"

The use of ANSI/AISC N690 (1984 Edition) for the design, fabrication, and erection of safety-related structures in the ABWR is acceptable when supplemented by the following provisions:

STAFF POSITIONS

(1) In Section Q1.0.2, the definition of secondary stress should apply to stresses developed by temperature loading only.

(2) The following notes should be added to Section Q1.3.6:

- When any load reduces the effects of other loads, the corresponding coefficient for that load should be taken as 0.9, if it can be demonstrated that the load is always present or occurs simultaneously with other loads. Otherwise, the coefficient for that load should be taken as zero.
- Where the structural effects of differential settlement are present, they should be included with the dead load D.
- For structures or structural components subjected to hydrodynamic loads resulting from a loss-of-coolant accident (LOCA) and/or safety/relief valve (SRV) actuation, the consideration of such loads should be as indicated in the appendix to Standard Review Plan (SRP) Section 3.8.1. Any fluid structure interaction associated with these hydrodynamic loads and those from the postulated earthquake(s) should be taken into account.

(3) The stress limit coefficients (SLC) for compression in Table Q1.5.7.1 should be as follows:

- 1.6 instead of 1.7 in load combination 11.
- 1.4 instead of 1.6 in load combinations 7, 8, and 9.
- 1.3 instead of 1.5 (stated in footnote (c)) for load combinations 2, 5, and 6.

(4) The following note should be added

For constrained (rotation and/or displacement) members supporting safety-related structures, systems, and components (SSCs), the stresses under load combinations 9, 10, and 11 should be limited to those allowed in Table Q1.5.7.1 as modified by Provision 3 above. The ductility factors of Table Q1.5.8.1 (or Provision 5 below) should not be used in these cases.

(5) For ductility factors μ in Sections Q1.5.7.2 and Q1.5.8, the provisions of Item II.2 of Appendix A to SRP Section 3.5.3 should be substituted for the ductility factors in Table Q1.5.8.1.

(6) In load combination 9 of Section Q2.1, the load factor applied to load P_a should be $1.5/1.1 \approx 1.37$, instead of 1.25.

(7) Sections Q1.24 and Q1.25.10 should be supplemented with the following requirements regarding the painting of structural steel:

- Shop painting is to be in accordance with Section M3 of load and resistance factor design (LRFD) specifications (American Institute of Steel Construction, "Load and Resistance Factor Design for Structural Steel Buildings and Its Commentary," Chicago, IL, 1986).
- All exposed areas after installation are to be field painted (or coated) in accordance with the applicable portion of Section M3 of the LRFD specification.
- The quality assurance requirements for the painting (or coating) of structural steel are to be in accordance with ANSI N101.4 (American Institute for Chemical Engineers, "Quality Assurance for Protective Coatings Applied to Nuclear Facilities," New York, 1972) as endorsed by Regulatory Guide 1.54, "Quality Assurance Requirements for Protective Coatings Applied to Water Cooled Nuclear Power Plants," Revision 0.

TECHNICAL BASES

(1) The standard defines "secondary stress" as "any normal stress or shear stress developed by the constraint of adjacent material or by self-constraint of the structure. The basic characteristic of a secondary stress is that it is self limiting due to deformation-limited effects." This definition has been interpreted by some to be applicable to the stresses generated by mechanical (i.e., non-thermal) loads at the structural discontinuities. The position clarifies the staff's interpretation.

(2) These notes provide guidance to the users regarding consideration of additional load effects in designing steel structures. The notes are parts of SRP Sections 3.8.3 and 3.8.4.

(3) The research done in the last 12 years on the strength and stability of compression members indicates that the base curve (Structure Stability Research Council (SSRC) curve in Figure G-1 of this appendix) used in arriving at the SLCs in SRP Sections 3.8.3 and 3.8.4 and in the standard does not reflect available test data. In developing the American Institute of Steel Construction (AISC) building specification based on the load and resistance factor design (LRFD) concept, the AISC changed the formula for compression members to reflect the test data. The LRFD curve (with $\phi = 1.0$) is also shown in Figure G-1. On the basis of the test data, this curve has a minimum reliability index, β[1] of 2.6 (American Institute of Steel Construction, "Load and Resistance Factor Design Specification for Structural Steel Buildings and Its Commentary," Chicago, Illinois, September 1, 1986). The LRFD specification requires $\phi = 0.85$ in establishing the resistance of compression members.

Figure G-1 shows the curves reflecting the SLCs of 1.0, 1.4, 1.5, 1.6 and 1.7 as applied to the stresses specified for the allowable stress design (ASD) of AISC. On the basis of the comparison with the LRFD curve($\phi = 1.0$), the following SLCs are recommended:

- SLC of 1.6 ($\phi \approx 0.95$) for load combination 11. This is reasonable for load combinations containing the effects of the two low probability events, that is, safe shut down earthquake (SSE)+LOCA.
- SLC of 1.4 ($\phi \approx 0.84$) for load combinations 7, 8, and 9. This is appropriate for combinations containing the effects of the single low-probability events, that is, SSE, tornado, or LOCA.
- SLC of 1.3 ($\phi \approx 0.80$) for load combinations 2, 5, and 6 is recommended when the secondary stresses due to T_o are included in the load combinations. This is consistent with the current position of allowing higher stresses under the effects of operating temperature.

(4) Neither the SRP nor the standard provide any guidance regarding the tolerable deformation of the constrained steel members subjected to temperature growth under sustained T_a or other LOCA loads. Statistically meaningful test data simulating the inelastic behavior of such constrained members under representative load combinations (including T_a and E_a) are not available. This provision precludes the instability condition arising from the effects of T_a or other LOCA loads under load combinations 9, 10, and 11.

(5) The ductility factors in Table Q1.5.8.1 are either more liberal than those in SRP Appendix A to Section 3.5.3 (e.g., μ for compression members) or involve some inconsistencies in the definitions and interpretation of the formulas (e.g., formulas in Item 2.D of the table) given in the table. Therefore, until sufficient test-based justification for ductility factors listed in Table Q1.5.8.1 is provided, the staff position as stated in the appendix is recommended for use.

(6) This provision makes the load combination consistent with that in the SRP.

(7) An additional provision regarding the painting of structural steel is provided.

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[1] - β is defined as a ratio of $\ln(R_m/Q_m)$ to $(V_R^2+V_Q^2)^{1/2}$
where: R_m = median value of resistance
Q_m = median value of load
V_R and V_Q are the corresponding coefficients of variation.

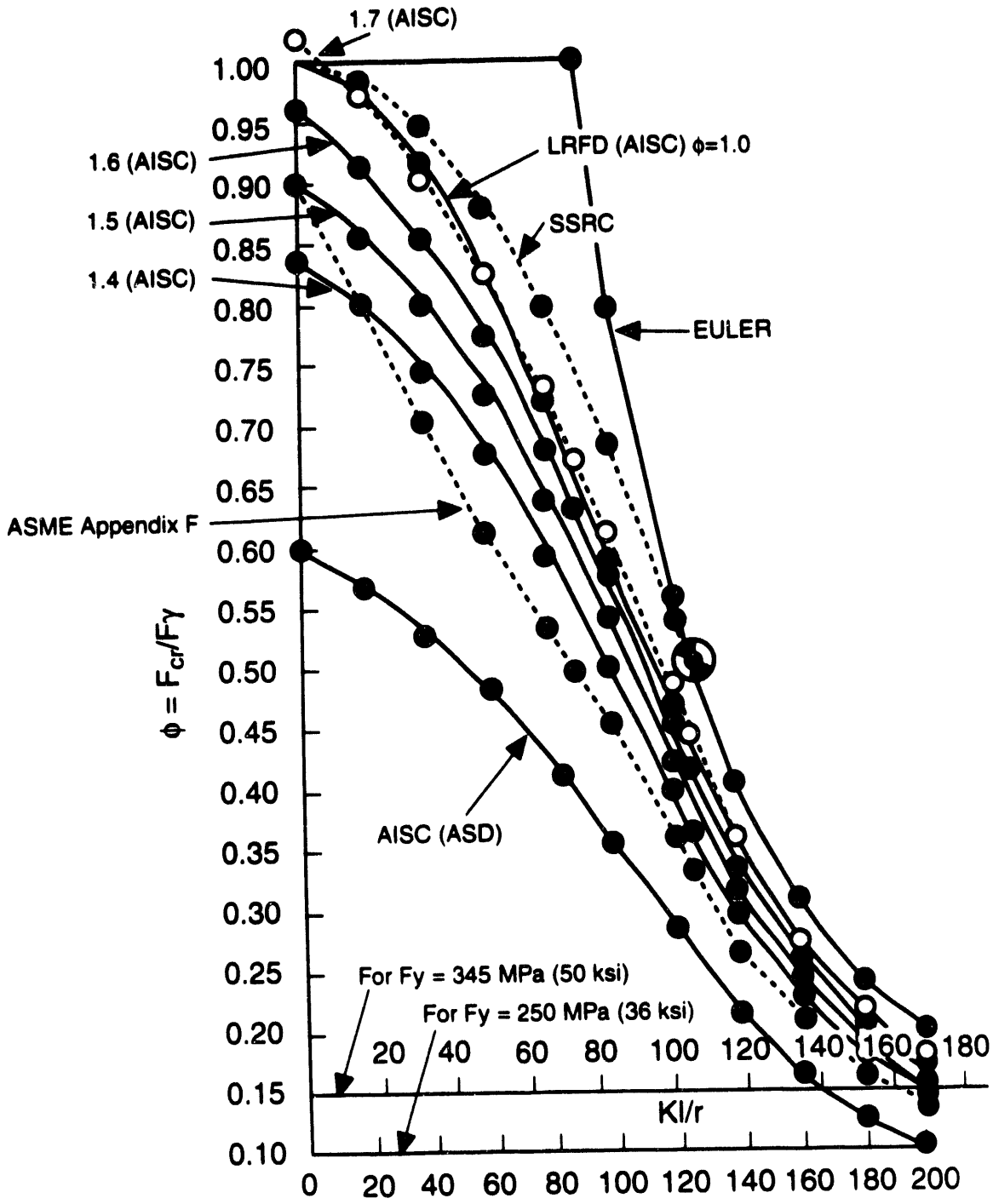

Figure G-1 Stability curves for axially loaded compression members, E = 200 GPa (29,000 ksi)

Appendix H

DYNAMIC LATERAL SOIL PRESSURES ON EARTH RETAINING WALLS AND EMBEDDED WALLS OF NUCLEAR POWER PLANT STRUCTURES

INTRODUCTION

In the design of earth retaining walls and embedded exterior walls of nuclear power plant structures, it is important to include the loads due to seismically induced lateral soil pressures. Standard Review Plan (SRP) Section 2.5.4, which deals with the stability of subsurface materials and foundations, does not provide specific review criteria regarding acceptable procedures to determine the dynamic lateral soil pressures. However, it makes a generic statement that the applicant should satisfy the requirements of applicable codes and standards in designing the structures, systems, and components (SSCs) (in accordance with 10 CFR 50.55a). In addition, this SRP section states that state-of-the-art methods are to be used to design the structures. Section 3.5.3 of American Society of Civil Engineers (ASCE) 4-86 ("Seismic Analysis of Safety Related Nuclear Structures and Commentary on Seismic Analysis of Safety Related Nuclear Structures," New York, NY, 1986), which is currently being revised by ASCE, identifies certain analytical methods to be used to establish dynamic lateral soil pressures for the design of retaining walls or structures founded below grade surface (J.H. Wood, "Earthquake-Induced Soil Pressures on Structures," Report No. EERL 73-05, Earthquake Engineering Research Laboratory, California Institute of Technology, Pasadena, CA, August 1973, and H.B. Seed and R.V. Whitman, "Design of Earth Retaining Structures for Dynamic Loads," *Proceedings of the ASCE Specialty Conference on Lateral Stresses in the Ground and Design of Earth Retaining Structures*, Cornell University, Ithaca, NY, 1970). These methods are based on the original analysis of this problem by Mononobe and Okabe (M-O) in the 1920s (ASCE 4-86).

Seed and Whitman (1970) presented a classical state-of-the-art report at the ASCE Specialty Conference on Lateral Stresses in the Ground and Design of Earth-Retaining Structures held in 1970. They presented data to show that seismic lateral pressure coefficients for cohesionless backfills computed by the M-O method agreed reasonably well with the values developed in small-scale (model) tests. Subsequently, several researchers made significant contributions to this important subject area: (1) R.V. Whitman, "Seismic Design and Behavior of Gravity Retaining Walls," *Proceedings of the ASCE Conference on Design and Performance of Earth Retaining Structures*, Cornell University, Ithaca, NY, 1990; (2) R. Richards, Jr. and D.G. Elms, "Seismic Behavior of Gravity Retaining Walls," ASCE Journal, GT Division, Vol. 105, April 1979; (3) R.V. Whitman, "Seismic Design of Earth Retaining Structures," *Proceedings of the Second International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics*, St. Louis, MO, March 11 through 15, 1991; (4) C.Y. Chang et al., "Analysis of Dynamic Lateral Soil Pressures Recorded on Lotung Reactor Containment Model Structure," *Proceedings of the 4th U.S. National Conference on Earthquake Engineering*, Palm Springs, CA, May 20 through 24, 1990; and (5) C. Soydemir, "Seismic Design of Rigid Underground Walls in New England," *Proceedings of the 2nd International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics*, St. Louis, MO, March 11 through 15, 1991. In November 1992, the U.S. Army Corps of Engineers, acting as a consultant for the U.S. Naval Civil Engineering Laboratory, published a comprehensive technical report (with about 30 sample problems and solutions) on the seismic design of waterfront retaining structures (U.S. Army Corps of Engineers Technical Report ITL-92-11, "The Seismic Design of Waterfront Retaining Structures," Vicksburg, MS, November 1992). This report (prepared with input from a team of experts in the United States and Canada) summarizes the procedures recommended for computing dynamic lateral soil pressures and grouping them according to the expected displacement of the backfill and wall during seismic events. The Department of Energy is currently engaged in research and development work related to the area of dynamic lateral soil pressures. This brief summary of work done in the area of lateral pressures is not, by any means, complete; however, it gives a good indication of the apparently large uncertainties that appear to be unresolved in this area.

Bechtel Power Corporation, a consultant for General Electric for the ABWR standardized design of seismic Category I structures, has calculated the dynamic lateral soil pressures on retaining walls and embedded exterior walls of structures, using the M-O method mentioned previously. In a section of Bechtel's proprietary report (Bechtel Power Corporation Proprietary Design Guide, C-2.44, Revision 0, August 1980 (version of Bechtel Topical Report, BC-TOP-4A, Revision 3, "Seismic Analysis of Structures and Equipment for Nuclear Power Plants," San Francisco, CA, November 1974)), it is stated that the M-O method was modified, where necessary, by procedures suggested by Wood in 1973 (EERL 73-05), and by some other researchers. Judging from the large amount of work reported in this area after 1979 (Whitman 1990, Richards and Elms 1979, Whitman 1991, C.Y. Chang et el. 1990, and Soydemir 1991, it appears that the procedures recommended in Bechtel's design guide mentioned above may not fully reflect the advances made

in the state of the art in this area since 1979. The objective of this paper is to review as many significant research papers available in the literature as possible, and comment on the appropriateness of Bechtel's procedures for calculating dynamic lateral soil pressures, for the staff guidance in the review of the advanced light water reactor (ALWR), including ABWR, standard design.

REVIEW OF CURRENT ANALYTICAL PROCEDURES

Mononobe and Okabe (ASCE 4-86) proposed a somewhat complicated equation to calculate the dynamic lateral soil pressures due to both horizontal and vertical earthquake accelerations. Their method, developed for dry cohesionless backfill materials, was essentially based on the classical Coulomb's theory of earth pressures with the following assumptions:

(1) The wall yields sufficiently to produce minimum active earth pressures.

(2) A soil wedge behind the wall is at the point of incipient failure and the maximum soil shear strength is mobilized along the potential sliding surface, which passes through the toe of the wall.

(3) The soil wedge behind the wall acts as a rigid body so that seismic accelerations may be considered uniform throughout the mass.

Seed and Whitman (1970) stated that Mononobe and Okabe apparently assumed that the total pressure computed by their analytical approach would act on the wall at the same position as the initial static pressure, that is, at one-third the height of the wall above the base. Other researchers, however, subsequently found that this assumption was not correct and that the dynamic lateral force increment acted at about the middle height of the wall (EERL 73-05 and Whitman 1970). In view of the complex nature of the M-O equation that gives the total dynamic lateral pressure, Seed and Whitman also proposed a simplification of the M-O method to calculate the dynamic active lateral force increment. Seed and Whitman (1970) cited the work by Kapila, in 1962, on the determination of both active and passive lateral pressures by the M-O method, utilizing graphical construction.

While the M-O method was developed for yielding retaining walls, Wood (EERL 73-05) and Seed and Whitman (1970) found a solution for nonyielding walls, using elastic theory and assuming that material properties are constant with depth. Wood's solution predicted that the dynamic lateral force increment would act at about 0.63 times the height of the wall, which corresponded approximately to a parabolic distribution of earth pressure unlike M-O's inverted triangular distribution. Wood's theoretical work was corroborated by experimental shake table tests conducted by others who found that the measured lateral pressures on nonyielding walls exceeded those predicted by the M-O method by a factor of 2 to 3 (Whitman 1990). Finite element analyses in which the soil modulus increased with depth resulted in 5 percent to 15 percent smaller dynamic lateral pressures, with the resultant acting closer to 0.5 times the height of the wall (Whitman 1990).

According to Whitman (1990), Richards and Elms made a major advance in the area of dynamic lateral pressures by formulating a displacement-oriented solution that used the concept of allowable permanent movement of the gravity retaining walls (Soydemir 1991). Their approach, called the displacement-controlled method, differs from that of the M-O method which is strength controlled. Whereas some traditional designers using the M-O method are reported to have assumed less than the maximum design earthquake, the displacement-controlled approach of Richards and Elms permits the selection of a proper design acceleration coefficient (Whitman 1990). Further, their method, based on Newmark's sliding block analogy and retaining the M-O equation, permits an evaluation of permanent displacement of retaining walls following an earthquake (Whitman 1991).

On the basis of a review of several researchers in this area, Whitman concluded that model test results have given continuing support for the use of the M-O equation for the design of relatively simple walls, 9.14 m (30 ft) or less in height; however, for higher walls and nonyielding walls, he recommends more careful analysis (Whitman 1990). Regarding basement walls, Whitman, in his second state-of-the-art paper (Whitman 1991), stated that the use of Wood's theory (EERL 73-05) for nonyielding walls may seem logical, if the basement rests directly on hard rock and if the outside walls of the basement are well braced by floors. He further states that actual peak acceleration should be used if any yielding or cracking of the walls is to be avoided. These requirements, according to Whitman (1991), can lead to quite large lateral soil pressures.

Chang et al. (1990) described a study that evaluated the uncertainties of several analytical solutions by comparing the computed and recorded dynamic lateral soil pressures on the embedded wall of the Lotung, Taiwan 1/4-scale model structure during several moderate earthquakes. In this study, a 1/4-scale reactor containment model structure was embedded at a depth of 4.57 m (15 ft) below the ground surface. The analysis of recorded data showed that the magnitude of dynamic lateral soil pressures was

significantly lower than that predicted by published elastic solutions (ASCE 4-86 and EERL 73-05). The recorded dynamic lateral pressure increments were similar to, or lower than, those calculated by the M-O method. On the basis of the results of this study, Whitman concluded that it may suffice to use the M-O equation together with the actual expected peak acceleration Whitman 1991.

Although the above conclusion may be generally true, it appears that Whitman's conclusion did not cover certain additional field data and discussions provided by Chang et al. (1990). These relate to (1) the effect of variation of the backfill shear modulus with depth and (2) the effect of the rocking motion on the dynamic lateral pressure distribution, which were measured at the Lotung site. The soil shear modulus is generally smaller at the ground surface because of low confining pressure and gradually increases with depth, contrary to the constant modulus assumption in elastic solutions. Probably because of this factor, the recorded dynamic earth pressures were substantially smaller than those given by the elastic solutions (Chang et el. 1990). On the basis of a detailed study of the Lotung site data, Chang et al. (1990) have concluded that the dynamic earth pressures acting on an embedded symmetrical structure are related primarily to soil-structure interaction (SSI) and that this phenomenon is different from that of a yielding retaining wall being acted upon by an active earth pressure. Thus, the concept of limiting equilibrium used in the M-O method is not strictly applicable to the dynamic earth pressures on embedded structures.

Soydemir (1991) has also recommended caution in using the M-O method indiscriminately. He points out that the M-O method is being used without checking whether the retaining structures yield or not, and whether the conditions assumed in the M-O analysis are satisfied. Soydemir states that, even though the M-O equation for active earth pressure conditions is quite appropriate for yielding walls, it may underestimate the dynamic lateral pressures acting on rigid, nonyielding earth retaining walls or structures.

Section 4.5 of Bechtel Design Guide C-2.44 (1980) states that the M-O method is used to evaluate the seismically induced lateral soil pressures in the earthquake-resistant design of both the retaining walls and the embedded portions of exterior walls of nuclear power plant structures. The Design Guide further states that, when the wall does not experience sliding or rotation, the elastic solution (EERL 73-05) becomes more appropriate. In such cases, in addition to the "at rest" static pressures, all the resulting dynamic forces are to be increased by a factor of 2 for consideration of such nonyielding conditions (e.g., the embedded walls of massive structures.) The report states that the value of 2 is based on the findings of Wood (EERL 73-05) and also on the fact that "at rest" pressures are about twice the active pressures. Since the factor 2 is for an infinitely long backfill, the Design Guide says that the appropriate elastic solution can be used for shorter lengths of backfills. Section 4.5 of the Design Guide is silent about the seismic lateral pressures due to submerged backfill, for which procedures are available in the literature (H. Matsuzawa et al., "Dynamic Soil and Water Pressures on Submerged Soils," ASCE Journal of Geotechnical Engineering, Vol. 111, No. 10, October 1985).

CONCLUSION AND RECOMMENDATIONS

On the basis of a review of the papers and reports cited above and also conversations with experienced engineers working in this area at universities, industry, and Government agencies, the staff believes that the calculation procedures suggested in Bechtel Design Guide C-2.44 (1980) are generally adequate for walls with shallow embedment. However, the Design Guide does not specifically address several factors, such as the effect of depth of embedment of exterior walls of nuclear power plant structures which have embedments ranging from 12.2 m (40 ft) to 25.9 m (85 ft), in the case of ABWR.

The results of reviewing those papers and reports can be summarized as follows:

(1) In determining the dynamic lateral soil pressures, it is necessary to distinguish three different types of structures, each of which may require a distinct analysis and evaluation. They are (a) gravity retaining walls and sheetpile walls, etc., with level or sloping backfill starting at the same elevation as the top of the retaining wall; (b) basement walls in buildings with the superstructure above the ground (e.g., embedded walls of nuclear power plant structures); and (c) completely buried underground structures (e.g., tunnels, underground tanks).

(2) For rigid walls with shallow embedment, it seems appropriate to use the M-O method using the peak ground acceleration coefficient.

(3) For deeply embedded basement walls with a massive superstructure above ground, which may experience rocking components of motion, and for rigid gravity walls, which may undergo rotational displacements about the vertical axis, the use of the M-O method does not seem appropriate. For such cases, the procedures

recommended in Bechtel Design Guide C-2.44 (1980) need to be modified, in view of the extensive amount of more recent work done in this area. Proper consideration should be given to the actual conditions (e.g., variations of soil properties and seismic accelerations with depth, flexibility and expected deformations of embedded walls) while determining the appropriate method to calculate the lateral soil pressures, as the U.S. Army report (ITL-92-11) has attempted to do. In such complex cases, the lateral soil pressures derived from the results of an SSI analysis may be used in conjunction with the pressures predicted by the M-O method to determine a range of dynamic lateral pressures that could be expected to act on the embedded walls. These results may also be compared, as a check, with the lateral soil pressures that could be estimated by using the Uniform Building Code provisions for the base shear. In case an applicant wishes to use the elastic solution proposed by Wood (EERL 73-05), a case-by-case justification for the factor 2 for nonyielding walls mentioned in Bechtel Design Guide C-2.44 (1980) must be provided by the applicant.

APPENDIX I

EVALUATION OF ABWR PUMP AND VALVE INSERVICE TESTING PLAN (SSAR TABLES 3.9-8 AND 3.9-9)

INTRODUCTION

The staff evaluated the ABWR pump and valve inservice testing (IST) plan, principally Section 3.9.6 and Tables 3.9-8 and 3.9-9 of the SSAR, in accordance with SRP Section 3.9.6, "Inservice Testing of Pumps and Valves." This SRP section provides review guidelines for the IST plan to comply with 10 CFR Part 50, Appendix A, GDC 37, 40, 43, 46, 54, and 10 CFR Part 50, 50.55a(f). GE stated that the ABWR pump and valve IST plan would meet the requirements of the 1989 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, which references the ASME Operations and Maintenance (OM)-6 and -10, 1988 Addenda, for rules for IST of pumps and valves. Therefore, this review focused on an evaluation of compliance of the ABWR IST plan with the ASME OM-6 and OM-10, 1988 Addenda.

EVALUATION

The GE ABWR pump and valve IST plan is documented in Section 3.9.6 of the SSAR. Specific pump and valve IST parameters and frequencies for safety- related pumps and valves are delineated in Table 3.9-8 of the SSAR. Table 3.9-9 of the SSAR lists the pressure isolation valves. Table 3.9-8 refers to specific SSAR figures that are piping and instrumentation diagrams (P&IDs) of the systems included in the IST plan. In addition, some performance characteristics of pumps and valves are presented in system descriptions located in other sections of the SSAR.

The ABWR IST plan includes 27 systems in which certain valves and pumps have been specified for testing requirements in accordance with the ASME Code. The staff reviewed in detail the following eight ABWR systems: control rod drive, containment isolation, main steam (nuclear boiler), service water, instrument air, standby liquid control, residual heat removal (RHR), and reactor core isolation cooling (RCIC). These systems were selected because they were the subject of BWR ASME Code relief submittals. The staff also performed a limited review for the remaining 19 systems.

Evaluation of the ABWR pump and valve IST plan consisted of a detailed review of Table 3.9-8 of the SSAR and its supporting P&IDs, which are presented as figures in the SSAR. Table 3.9-8 gives the following information for each pump or valve in the IST plan: identification number, quantity, description, safety class, test parameters, test frequency, and SSAR figure number. In addition, it provides code category and function for the valves. All the pumps are grouped into a single listing in Table 3.9-8; the valves are grouped by their associated systems.

The detailed review of the IST plan included an independent confirmation of each of the parameters delineated in Table 3.9-8 by analysis of the P&ID SSAR figures and comparison with the requirements in ASME Code, Section XI. Previous experience from BWR IST relief submittals to the NRC was also factored into this evaluation. In addition, guidance from NRC Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," was included in this review. The IST plan was examined to ensure internal consistency between pumps and valves that serve the same function and have the same safety classification and design.

As a result of the detailed review, the NRC sent a letter to GE on May 4, 1992, with an enclosed list of 57 general and specific questions regarding the ABWR pump and valve IST plan. Significant findings included are following: pumps, valves, and systems missing from the IST plan; inadequate design to allow for IST; deviations from the requirements in ASME Code, Section XI, and impractical or unrealistic test frequencies for some pumps and valves. GE responded to all the questions in five separate letters submitted on June 19, July 10, July 22, July 30, and August 14, 1992. In these letters, GE submitted draft revisions of Table 3.9-8, certain P&IDs, and sections of the ABWR SSAR. Whenever the staff discussed an apparent conflict between two GE submittals, it considered the most recent one to be applicable. As a result of a telephone conversation with the staff on October 6, 1992, to discuss unresolved issues after the review of the five submittals, GE submitted a telefax revision on October 8, 1992, which responded to the issues. This response was discussed with GE in a telephone call on October 9, 1992. After that call, GE documented additional IST plan changes by a telefax dated October 12, 1992.

As a result of the review process, GE significantly revised the ABWR pump and valve IST plan. Numerous P&ID changes were made, which incorporated test lines between check valves in series and around other valves to allow for the capability to perform the IST of each valve. The diesel generator fuel oil storage and transfer system was added to the IST plan. The most significant changes were (1) the inclusion of exceptions to the Section XI base testing frequency requirement of once every 3 months and (2) a proposed alternative to the code testing requirement for the RHR system fill pumps.

GE included numerous ASME Code exceptions for valves in Table 3.9-8 of the SSAR. The exceptions to the Section XI base testing frequency requirement of once every 3 months fall into one of the following seven categories:

(1) inaccessibility during power operation because of inerted containment and/or radiation in the main steam tunnel

(2) avoidance of valve damage and impacts to power operation

(3) Need for temporary crosstie to carry ongoing cooling loads; a permanent crosstie would violate divisional separation

(4) avoidance of cold/hot water injection into the reactor pressure vessel during power operation

(5) maintenance of pressure isolation during power operation

(6) availability of inventory only during refueling outage

(7) pressurization of the secondary containment above its operating limit, thus affecting power operations caused by a test connection of sufficient size for full-flow testing

Of these valve testing exceptions identified in SSAR Table 3.9-8, the most predominant bases for an exception were Categories 1 and 2. The next most frequent was Category 5.

In reviewing the Code exception categories, guidance regarding the exception categories is given in the Code itself. Sections 4.2.1.2 and 4.3.2.2 of ASME OM-10 specifically permit extension of the valve test interval if testing "during power operation is not practicable." This criterion is also applied to quarterly and cold shutdown testing to allow for testing during refueling outages.

The staff evaluated each valve in the ABWR IST plan in Category 1 or 2 and found them to be correctly characterized. In each case, either the location of the valve or its function precluded its testing during power operation or cold shutdown. Thus, relaxation of the test frequency for these valves is based on practicability. For these valves, the IST plan is in conformance with the ASME Code.

Category 3 is used only for the three testable check valves (F083) in the cooling water return line from nonessential coolers that are part of the reactor building cooling water system. This exception is based on requiring a temporary crosstie to carry the ongoing cooling loads during a refueling outage. The underlying reason for this exception is that a permanent crosstie for this system would result in a violation of the required separation between divisions during power operation. Since this is generally prohibited by staff criteria in the SRP, this exception is another form of the Category 2 exception because it affects power operation. Therefore, the proposed valve testing frequency for this category is in conformance with Section XI of the ASME Code since testing every 3 months is not practicable.

Categories 4, 5, and 6 all pertain to different aspects of power operation. Category 4 applies only to the standby liquid control system injection line outboard check valve F007. Stroke testing this valve during power operation would introduce cold borated water into the coolant and thereby affect power operation. Thus, this category is actually analogous to Category 2 and is acceptable in accordance with Section XI of the ASME Code. The six Category 5 exceptions involve valves in the RHR, RCIC, and HPCF (high pressure core flooder) systems, which serve as the pressure isolation valves delineated in SSAR Table 3.9-9 and are subject to plant technical specifications (TSs) for testing. Maintaining the reactor coolant system (RCS) pressure isolation boundary during power operation is an acceptable reason for an exception to the Section XI base testing frequency requirement of once every 3 months. The two Category 6 check valves (F023 and F094) are in the fuel pool cooling and cleanup system. The description of the function of these valves in the system substantiates the explanation that fluid inventory would not be available for testing except during a refueling outage. The justification for this exception is acceptable.

Category 7 applies to check valves F005A and F005B in the flammability control system. These two valves are both located in the secondary containment in a 15.2-cm (6-in.) diameter pipe that is connected to the hydrogen recombiners. To full-flow test these valves during power operation, a high air flow would have to be introduced through this piping and exhaust into the secondary containment. This air would pressurize the secondary containment beyond its operational limit and thus affect power operation. Because it would be impracticable to perform this testing at power, this exception is acceptable.

In Table 3.9-8 of the SSAR, GE proposed not to meet the ASME Code, Section XI requirement to measure flow rate for the three RHR system fill pumps (denoted E11-C002 in the P&IDs). To justify its proposed alternative, GE

stated that the piping will be maintained full by a small fraction of the pump's flow capacity. GE also stated that the pumps will be designed so that they will normally operate in the flat region of the pump pressure-flow performance curve. The pumps will be designed and analyzed to continuously operate in this low-flow regime without any significant pump degradation. In addition, GE stated that the ABWR TSs require the physical confirmation of a water solid RHR pipeline by opening a high point vent to confirm solid water flow of a 30-day frequency.

The primary function of the RHR system fill pumps is to maintain a water solid condition in the RHR pump discharge piping. The RHR fill pumps are expected to run continuously providing a small makeup flow to compensate for any backleakage through the RHR system. These pumps will provide a low flow rate that is dependent on the piping system leakage characteristics at any given time. Without a constant, explicit, and definable piping system leak rate and path, the system resistance and makeup requirements cannot be set. Therefore, the pump flow rate may vary considerably around a small value and these variations likely would exceed the Section XI allowable limits, but actually be due to variations in backleakage rather than the pump's hydraulic performance. Since the pump will normally be operating on the flat region of the pump performance curve, the pump differential pressure is the hydraulic parameter of interest in monitoring pump performance. The ABWR IST plan requirement for measuring pump inlet and outlet pressure as well as peak vibration velocity will allow detection of any significant degradation in the pumps' hydraulic or mechanical performance. In lieu of measuring flow rate, the commitment to use pumps that are designed and analyzed to ensure both that the expected flow rate stays well within the flat portion of the pressure-flow curve and that no significant degradation occurs with the expected continuous lowflow operation combined with the proposed testing will provide an acceptable level of quality and safety. Therefore, this alternatives to the ASME Code, Section XI, requirement is acceptable, pursuant to 10 CFR 50.55a(a)(3)(i).

SUMMARY AND CONCLUSIONS

The staff reviewed the GE ABWR pump and valve IST plan in accordance with requirements in ASME Code, Section XI, and applicable staff guidance. The IST plan is documented in Section 3.9.6 of the SSAR. The staff's evaluation was based on a detailed review of some selected systems in the IST plan and a partial assessment of the remaining systems.

The staff concludes that the ABWR pump and valve IST plan is in compliance with the 1989 Edition of ASME Code Section XI, except for the testing of the RHR system fill pumps. The staff reviewed proposed testing of the RHR fill pumps and determined that it will ensure an acceptable level of quality and safety.

APPENDIX J

HUMAN FACTORS ENGINEERING PROGRAM REVIEW MODEL AND ACCEPTANCE CRITERIA FOR EVOLUTIONARY REACTORS

1. MODEL DEVELOPMENT

1.1 Objectives

One issue to emerge from the review process of evolutionary reactor control room designs was that complete detailed HSI design information would not be available for review prior to design certification and that certification would be based partially on the approval of a design and implementation process plan. The process must contain: (1) descriptions of all required HFE program elements for the design, development and implementation of the evolutionary reactor human-system interfaces, (2) identification of predetermined NRC conformance review points, and (3) design acceptance criteria (DAC) and inspection, test, analysis and acceptance criteria (ITAAC) for the conformance reviews.

To review the designers process, it is necessary to: (1) assess whether all the appropriate HFE elements are included, (2) identify what materials are to be reviewed for each element, and (3) evaluate the proposed DAC/ITAAC to verify each of the elements. Since a process review has not been conducted previously by the NRC as part of reactor licensing and is not addressed in the presently available guidance, i.e., NUREG-0800, a firm technical basis for such a review is not available. To conduct the review, it is important to identify which aspects of the process are required to assure that HFE design goals in support of safe plant operation are achieved and to identify the review criteria by which each element can be assessed. Review criteria independent of that provided by the designer is required to assure that the design plan reflects currently acceptable human factors engineering practices and that it is a thorough, complete, and workable plan. Thus, a technical basis for review of the process was developed and is described in this section. The specific objectives of this effort are:

1. To develop an HFE program review model to serve as a technical basis for the review of the process proposed for certification. The model requirements are that it be: (1) based upon currently accepted practices, (2) well-defined, and (3) validated through experience with the development of complex, high-reliability systems.

2. To identify the HFE elements in a system development, design, and evaluation process that are necessary and sufficient requisites to successful integration of the human component in complex systems.

3. To identify which aspects of each HFE element are key to a safety review and are required to monitor the process.

4. To specify the specific acceptance criteria by which HFE elements can be evaluated.

1.2 Scope

The scope of the HFE program review model was restricted by two factors. First, those elements of a complete HFE program that are already adequately addressed by existing NRC requirements for license applicants were excluded from the scope of the model. Included in this category were training program development and the details of procedure development. The second category of exclusion were those elements that are the responsibility of other NRC review teams. This category includes human reliability analysis which, while important to HFE program development, is the responsibility of the SSAR Chapter 19 reviewers. Therefore, the scope of the model development described below was restricted to those aspects of HFE design review remaining after the above elements are excluded.

1.3 Development Method

A technical review of current HFE guidance and practices was conducted to identify important human factors program plan elements relevant to a design process review. Sources reviewed included a wide range of nuclear industry and non-nuclear industry documents, including those currently under development as part of the Department of Defense (DOD) MANPRINT program (Booher, 1990, DOD, 1989; DOD, 1990a). From this review a generic system development, design, and evaluation process was defined. Once specified, key HFE elements were identified and criteria by which they are assessed (based upon a review of current literature and accepted practices in the field of human factors engineering) were developed.

The generic HFE program review model was developed based largely on applied general systems theory (Bailey, 1982; DeGreen, 1970; Gagne, et al., 1988; VanCott et al., 1972; Woodson, 1981) and the DOD system development process which is rooted in systems theory (DOD, 1979a; DOD, 1990b; Kockler et al., 1990). Other DOD documents were utilized as well (see References section).

Applied general systems theory provides a broad approach to system design and development, based on a series of

clearly defined developmental steps, each with clearly defined and goals, and with specific management processes to attain them. System engineering has been defined as "...the management function which controls the total system development effort for the purpose of achieving an optimum balance of all system elements. It is a process which transforms an operational need into a description of system parameters and integrates those parameters to optimize the overall system effectiveness (Kockler et al., 1990).

Utilization of the DOD system development as an input to the development of the Generic HFE Program Model was based on several factors. DOD policy identifies the human as a specific element of the total system (DOD, 1990a). A systems approach implies that all system components (hardware, software, personnel, support, procedures, and training) are given adequate consideration in the developmental process. A basic assumption is that the personnel element receives serious consideration from the very beginning of the design process. In addition, the military has applied HFE for the longest period of time (as compared with industrial/commercial system developers), thus the process is highly evolved and formalized and represents the most highly developed model available. Finally, since military system development and acquisition is tightly regulated by federal, DOD, and military branch laws, regulations, requirements, and standards, the model provides the most finely grained, specifically defined HFE process available.

Within the DOD system, the development of a complex system begins with the mission or purpose of the system, and the capability requirements needed to satisfy mission objectives. Systems engineering is essential in the earliest planning period to develop the system concept and to define the system requirements. During the detailed design of the system, systems engineering assures:

- balanced influence of all required design specialties;
- resolution of interface problems;
- the effective conduct of trade-off analyses;
- the effective conduct of design reviews; and
- the verification of system performance.

The effective integration of HFE considerations into the design is accomplished by: (1) providing a structured top-down approach to system development which is iterative, integrative, interdisciplinary and requirements driven and (2) providing a management structure which details the HFE considerations in each step of the overall process. A structured top-down approach to NPP HFE is consistent with the approach to new control room design as described in Appendix B of NUREG-0700 (NRC, 1981) and the more recent internationally accepted standard, IEC 964 (1989) for advanced control room design. The approach is also consistent with the recognition that human factors issues and problems emerge throughout the NPP design and evaluation process and therefore, human factors issues are best addressed with a comprehensive top-down program.

The systems engineering approach was expanded to develop an HFE Program Review Model to be used for the evolutionary reactor design and implementation process review by the incorporation of NRC HFE requirements.

2. GENERAL MODEL DESCRIPTION

In this section an overview of the model is presented to generally describe the HFE elements, products reviewed for each element, and the acceptance criteria used to evaluate the element.

The model is intended as the programmatic approach to achieving a design commitment to HFE. The overall commitment and scope of the HFE effort can be stated as follows: Human-system interfaces (HSI) shall be provided for the operation, maintenance, test, and inspection of the NPP that reflect "state-of-the-art human factors principles" (10 CFR 50.34(f)(2)(iii)) as required by 10 CFR 52.47(a)(1)(ii). For the purposes of model development "state of the art" human factors principles are defined as those principles currently accepted by human factors practitioners. "Current" is defined with reference to the time at which this model was developed. "Accepted" is defined as a practice, method, or guide which is (1) documented in the human factors literature within a standard or guidance document that has undergone a peer-review process, and/or (2) justified through scientific/industry research practices.

All aspects of HSI should be developed, designed, and evaluated based upon a structured top-down system analysis using accepted HFE principles based upon current HFE practices. HSI is used here in the very broad sense and shall include all operations, maintenance, test, and inspection interfaces, procedures, and training materials.

The model developed to achieve this commitment contains eight elements:

- **Element 1** - Human Factors Engineering Program Management
- **Element 2** - Operating Experience Review
- **Element 3** - System Functional Requirements Analysis
- **Element 4** - Allocation of Function
- **Element 5** - Task Analysis
- **Element 6** - Human-System Interface Design

- **Element 7 - Plant and Emergency Operating Procedure Development**
- **Element 8 - Human Factors Verification and Validation.**

The elements and their interrelationships are illustrated in Figure J.1. Also illustrated are the minimal set of items submitted to the NRC for review of the COL's HFE efforts. All NRC review items are identified as falling into one of the five review stages:

- HF Management Planning Review
- Implementation Plan Review
- Analysis Results Review
- HSI Results Review
- Human Factors Verification and Validation

The materials reviewed at each stage are shown in Figure J.2.

A brief description of the purpose of each element follows:

Element 1 - Human Factors Engineering Program Management

To assure the integration of HFE into system development and the achievement of the goals of the HFE effort, an HSI design team and an HFE Program Plan shall be established to assure the proper development, execution, oversight, and documentation of the human factors engineering program. As part of the program plan an HFE issues tracking system (to document and track HFE related problems/concerns/issues and their solutions throughout the HFE program) will be established.

Element 2 - Operating Experience Review

The accident at Three Mile Island in 1979 and other reactor incidents have illustrated significant problems in the actual design and the design philosophy of NPP HSIs. There have been many studies as a result of these accidents/incidents. Utilities have implemented both NRC mandated changes and additional improvements on their own initiative. However, the changes were formed based on the constraints associated with backfits to existing control rooms (CRs) using early 1980s technology which limited the scope of corrective actions that might have been considered, i.e., more effective fixes could be used in the case of a designing a new CR with the modern technology typical of advanced CRs. Problems and issues encountered in similar systems of previous designs shall be identified and analyzed so that they are avoided in the development of the current system or, in the case of positive features, to ensure their retention.

Element 3 - System Functional Requirements Analysis

System requirements shall be analyzed to identify those functions which must be performed to satisfy the objectives of each functional area. System function analysis shall: (1) determine the objective, performance requirements, and constraints of the design; and (2) establish the functions which must be accomplished to meet the objectives and required performance.

Element 4 - Allocation of Functions

The allocation of functions shall take advantage of human strengths and avoids allocating functions which would be impacted by human limitations. To assure that the allocation of functions is conducted according to accepted HFE principles, a structured and well-documented methodology of allocating functions to personnel, system elements, and personnel-system combinations shall be developed.

Element 5 - Task Analysis

Task analysis shall provide the systematic study of the behavioral requirements of the tasks the personnel subsystem is required to perform in order to achieve the functions allocated to them. The task analysis shall:

- provide one of the bases for making design decisions; e.g., determining before hardware fabrication, to the extent practicable, whether system performance requirements can be met by combinations of anticipated equipment, software, and personnel,
- assure that human performance requirements do not exceed human capabilities,
- be used as basic information for developing procedures,
- be used as basic information for developing manning, skill, training, and communication requirements of the system, and
- form the basis for specifying the requirements for the displays, data processing and controls needed to carry out tasks.

Element 6 - Human-System Interface Design

Human engineering principles and criteria shall be applied along with all other design requirements to identify, select, and design the particular equipment to be operated/maintained/controlled by plant personnel.

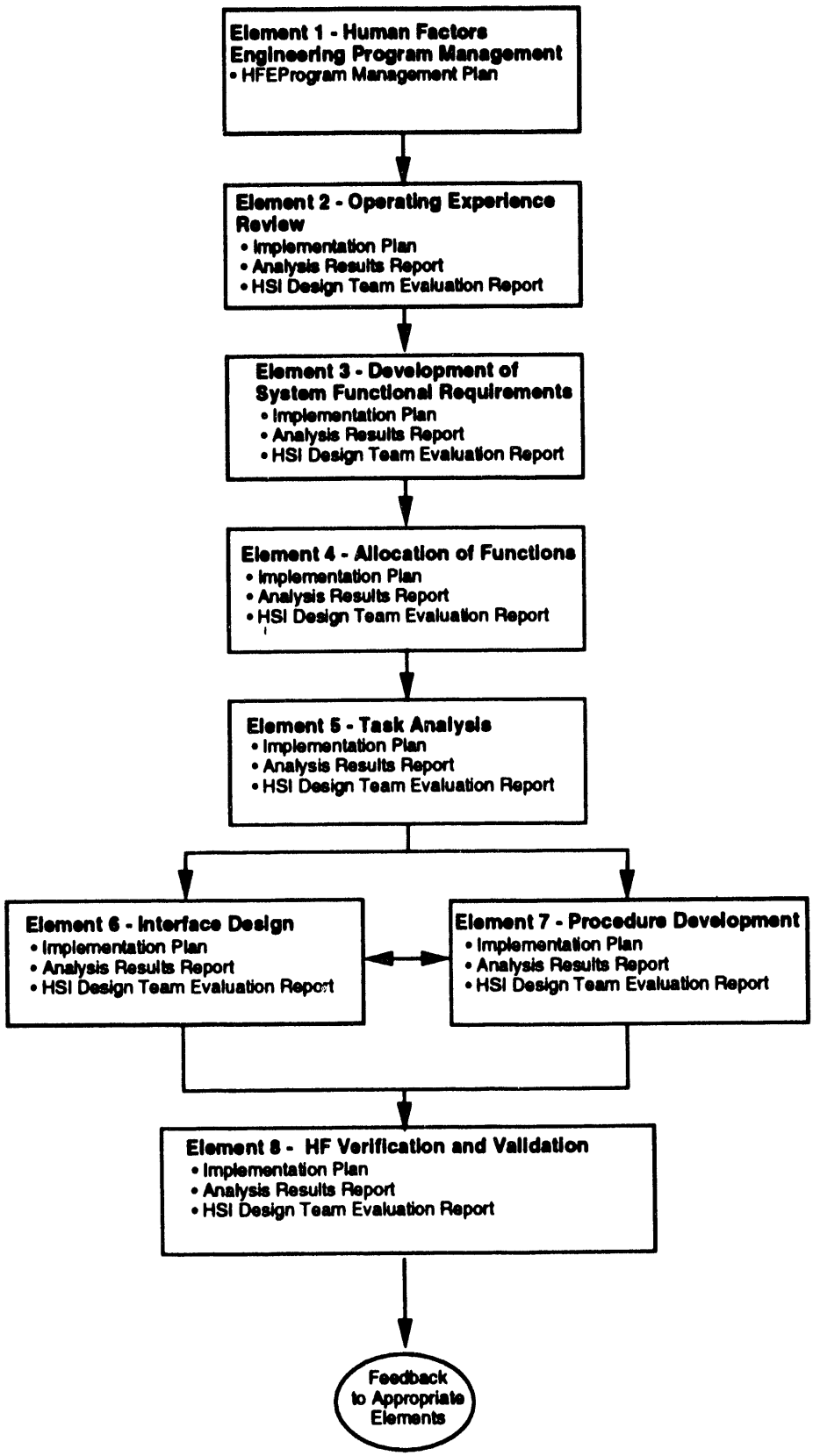

Figure J-1 Human factors engineering program review model elements

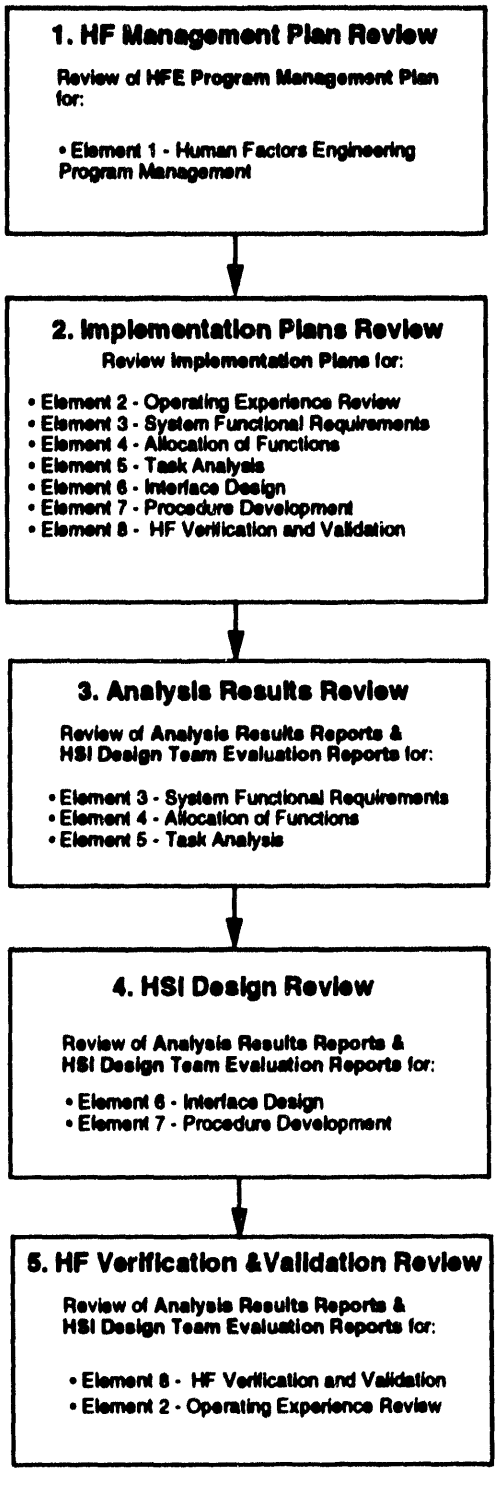

Figure J-2 Human factors engineering program review stages

Element 7 - Plant and Emergency Operating Procedure Development

Plant and Emergency Operating Procedures shall be developed to support and guide human interaction with plant systems and to control plant-related events and activities. Human engineering principles and criteria shall be applied along with all other design requirements to develop procedures that are technically accurate, comprehensive, explicit, easy to utilize, and validated. The types of procedures covered in the element are:

- plant and system operations (including start-up, power, and shutdown operations),
- abnormal and emergency operations,
- preoperational, start-up, and surveillance tests, and
- alarm response.

Element 8 - Human Factors Verification and Validation

The successful incorporation of human factors engineering into the final HSI design and the acceptability of the resulting HSI shall be thoroughly evaluated as an integrated system using HFE evaluation procedures, guidelines, standards, and principles.

The specification for the NRC review materials and the acceptance criteria to be used for their evaluation are identified in the next section. Generically, each element is divided into three sections: Design Commitment, Inspection/Test/Analysis, and Design Acceptance Criteria.

Design Commitment

A concise and general statement as to the HFE objective of the Element.

Inspection/Test/Analysis

A specification of the inspections, tests, analysis, or other actions (i.e., some action that is required but which is not a specific inspection, test, or analysis, such as development of a program plan) to assure the achievement of the objective. Generally these are divided into three activities: planning, "analysis," and review. The set of materials to be provided to the NRC for review of the element is specified.

Design Acceptance Criteria

Acceptance criteria are typically divided into four sections: General Criteria, Implementation Plan, Analysis Report, and HSI Design Team Review Report. The General Criteria represent the major statement of design acceptance criteria. These are the criteria the element is required to meet and which should govern the Implementation Plan, Analysis Report, and HSI Design Team Review Report development. The general criteria are derived from accepted HFE practices. These are the criteria derived from the HFE model development and HFE literature and current practices review.

The HFE Program Review Model requires that HFE elements be governed by accepted HFE practices as specified in applicable codes, standards, and guidelines. Each element requires an identification of the codes, standards, and guidelines which are to be applied. Applicable codes, standards, and guidelines for the HFE Program Review Model Elements are provided below. With respect to Element 2 - Operating Experience Review, the documents listed also provide further issue description. While these documents contain generally recognized acceptable approaches to the conduct of the HFE activity described by the element, several caveats should be identified:

- There may be inconsistencies or contradictions within and between documents. Such conflicts should be resolved on a case-by-case basis depending upon the specific application under review.
- Not each document listed under a given element necessarily address all aspects of the element. In the conduct of a review of each element a combination of the applicable section of several of the identified document may be appropriate.
- It should not be inferred that the listed documents provide complete guidance for each and every activity encompassed by the element. HFE is not at a state of maturity to be confident that all HFE activities are adequately covered in codes, standards, and guidelines.
- The listed documents represent currently accepted documents in the human factors community. Alternative approached can be found acceptable if judged by the reviewer to be based in firm rationale. Proposed alternative approaches should be evaluated on a case-by-case basis.

3 ELEMENT DESCRIPTIONS AND ACCEPTANCE CRITERIA

3.1 Element 1 - Human Factors Engineering Program Management

DESIGN COMMITMENT:

Human-system interfaces (HSI) shall be provided for the operation, maintenance, test, and inspection of the NPP that reflect "state-of-the-art human factors principles" (10 CFR 50.34(f)(2)(iii)) as required by 10 CFR 52.47(a)(1)(ii). All aspects of HSI shall be developed, designed, and evaluated based upon a structured top-down system analysis using accepted human factors engineering (HFE) principles based upon current HFE practices. HSI is used here in the broad sense and shall include all operations, maintenance, test, and inspection interfaces, procedures, and training needs. The tier 1 commitment addresses main control room and remote shutdown system functions and equipment. Local control stations should be included in the overall program.

State of the art human factors principles is defined as those principles currently accepted by human factors practitioners. "Current" is defined with reference to the time at which a program management or implementation plan is prepared. "Accepted" is defined as a practice, method, or guide which is (1) documented in the human factors literature within a standard or guidance document that has undergone a peer-review process and/or (2) can be justified through scientific/industry research/practices.

INSPECTION/TEST/ANALYSIS:

To assure the integration of HFE into system development: a HSI Design Team shall be established and a HFE Program Plan shall be established to assure the proper development, execution, oversight, and documentation of the human factors engineering program.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The primary goal of the HFE program shall be to developing an HSI which makes possible safe, efficient, and reliable operator performance and which satisfy all regulatory requirements as stated in 10 CFR. The general objectives of this program shall be stated in "human-centered" terms which, as the HFE program develops, shall be objectively defined and shall serve as criteria for test and evaluation activities. Generic "human-centered" HFE design goals include:
   - The operating team can accomplish all assigned tasks within system defined time and performance criteria.
   - The system and allocation of functions will provide acceptable workload levels to assure vigilance and to assure no operator overload.
   - The system will support a high degree of operating crew "situation awareness."
   - Signal detection and event recognition requirements will be kept within the operators' information processing limits and will minimize the need for operators to mentally transform data in order to be usable.
   - The system will minimize operator memory load.
   - The operator interfaces will minimize operator error and will provide for error detection and recovery capability.
2. The program shall be developed using the following documents as guidance:

MIL-H-46855B: *Human engineering requirements for military systems, equipment and facilities*, 1979, (Department of Defense).

AR 602-1: *Human factors engineering program*, 1983, (Department of Defense).

DI-HFAC-80740: *Human engineering program plan*, 1989, (Department of Defense).

AR 602-2: *Manpower and personnel integration (MANPRINT) in the material acquisition process*, 1990, (Department of Defense).

DOD-HDBK-763: *Human engineering procedures guide*, 1991, (Department of Defense).

IEEE Std 1023-1988: *IEEE guide to the application of human factors engineering to systems, equipment, and facilities of nuclear power generating stations*, 1988, (IEEE).

HSI Design Team

1. An HSI design team shall have the responsibility, authority and placement within the organization (as defined below) to ensure that the design commitment is achieved.

2. The team shall be responsible for (1) the development of all HFE plans and procedures; (2) the oversight and review of all HFE design, development, test, and evaluation activities; (3) the initiation, recommendation, and provision of solutions through designated channels for problems identified in the implementation of the HFE activities; (4) verification of implementation of team recommendations, (5) assurance that all HFE activities comply to the HFE plans and procedures, and (7) scheduling of activities and milestones.

3. The scope of the team's responsibility shall include:

   - Control and instrumentation equipment
   - all operations, maintenance, test, and inspection of interfaces and facilities both within and outside the control room,
   - procedures
   - training requirements development.

4. The team shall have the authority and organizational freedom to ensure that all its areas of responsibility are accomplished and to identify problems in the implementation of the HSI design. The team shall have the authority to determine where its input is required, access work areas, design documentation. The team shall have the authority to control further processing, delivery, installation or use of HFE/HSI products until the disposition of a non-conformance, deficiency or unsatisfactory condition has been achieved.

5. The HSI design team shall be placed at the level in the COL organization required to execute its responsibilities and authorities. The team shall report to a level of management such that required authority and organizational freedom are provided, including sufficient independence from cost and schedule considerations.

6. The HSI Design Team shall include the following expertise:

Technical Project Management

- Bachelor's degree,
- five years' experience in nuclear power plant design or operations, and
- three years' management experience.

Systems Engineering

- Bachelor's of Science degree, and
- four years' cumulative experience in at least three of the following areas of systems engineering; design, development, integration, operation, and test and evaluation.

Nuclear Engineering

- Bachelor's of Science degree, and
- four years' nuclear design, development, test or operations experience

Control and Instrumentation Engineering

- Bachelor's of Science degree,
- four years' experience in design of process control systems, and
- experience in at least one of the following areas of C&I engineering; development, power plant operations, and test and evaluation.

Architect Engineering

- Bachelor's of Science degree, and
- four years' experience in design of power plant control rooms

Human Factors

- Bachelor's degree in human factors engineering, engineering psychology or related science,
- four years' cumulative experience related to the human factors aspects of human-computer interfaces. Qualifying experience shall include experience in at lease two of the following human factors related activities; design, development, and test and evaluation, and
- four years' cumulative experience related to the human factors field of ergonomics. Again, qualifying experience shall include experience in at least two of the following areas of human factors activities; design, development, and test and evaluation.

Plant Operations

- Have or have held a senior reactor operator license, and
- two years' experience in relevant nuclear power plant operations.

Computer System Engineering

- Bachelor's degree in Electrical Engineering or Computer Science, or graduate degree in other engineering discipline (e.g., Mechanical Engineering or Chemical Engineering), and
- four years' experience in the design of digital computer systems and real time systems applications.

Plant Procedure Development

- Bachelor's degree, and
- four years' experience in developing nuclear power plant operating procedures.

Personnel Training

- Bachelor's degree,
- four years' experience in the development of personnel training programs for power plants, and
- experience in the application of systematic training development methods.

Systems Safety Engineering

- Bachelor's degree in Science,
- certification by the Board of Certified Safety Professionals in System Safety, and
- four years' experience in System Safety Engineering.

Reliability/Availability/Maintainability/Inspectability (RAMI) Engineering

Maintainability/Inspectability Engineering

- Bachelor's of Science degree,
- four years' cumulative experience in at least two of the following areas of power plant maintainability and inspectability engineering activity; design, development, integration and test and evaluation, and
- experience in analyzing and resolving plant system and/or equipment related maintenance problems.

Reliability/Availability Engineering

- Bachelor's degree,
- four years' cumulative experience in at least two of the following areas of power plant reliability engineering activity; design, development, integration, and test and evaluation, and
- knowledge of computer-based, human-interface systems.

7. The education and related professional experience of the HSI Design Team personnel shall satisfy the minimum personal qualification requirements specified in (6) above, for each of the areas of required skills. In those skill areas where related professional experience is specified, qualifying experience of the individual HFE design team personnel shall include experience in the technologies and techniques, of the particular skill area, utilized in the HSI design and implementation activities. The required professional experience presented in those personal qualifications are to be satisfied by the HSI design team as a collective whole. Therefore, satisfaction of the professional experience requirements associated with a particular skill area may be realized through the combination of the professional experience of two or more members of the HSI design team who each, individually, satisfy the other defined credentials of the particular skill area but who do not possess all of the specified professional experience. Similarly, an individual member of the HSI design team may possess all of the credentials sufficient to satisfy the qualification requirements for two or more of the defined skill areas.

8. Alternative personal credentials may be accepted as the basis for satisfying the minimum personal qualification requirements specified in 6 above. Acceptance of such alternative personal credentials shall be evaluated on a case-by-case basis and approved, documented and retained in auditable plant construction files by the COL Applicant. The following factors are examples of alternative credentials which are considered acceptable:

   - A professional engineer's license in the required skill area may be substituted for the required Bachelor's degree.
   - Successful completion of all technical portions of an engineering, technology or related science

baccalaureate program may be substituted for the Bachelor's degree. The successful completion will be determined by a transcript or other certification by an accredited institution. For example, completion of 80 semester credit hours may be substituted for the baccalaureate requirement. The courses shall be in appropriate technical subjects relevant to the required skill areas of the HFE MMIS design team for which the individual will be responsible.

- Related experience may substitute for education at the rate of six semester credit hours for each year of experience up to a maximum of 60 hours credit.

- Where course work is related to job assignments, post secondary education may be substituted for experience at the rate of two years of education for one year experience. Total credit for post secondary education shall not exceed two years experience credit.

HFE Issue Tracking System

1. The tracking system shall address human factors issues that are (1) known to the industry (defined in the operating experience review,see Element 2) and (2) those identified throughout the life cycle of the ABWR system design, development and evaluation.

2. The method shall document and track human factors engineering issues and concerns, from identification until elimination or reduction to a level acceptable to the Team.

3. Each issue/concern that meets or exceeds the threshold effects established by the Team shall be entered on the log when first identified, and each action taken to eliminate or reduce the issue/concern should be thoroughly documented. The final resolution of the issue/concern, as accepted by the Team, shall be documented in detail, along with information regarding Team acceptance (e.g., person accepting, date, etc.).

4. The tracking procedures shall carefully spell out individual responsibilities when an issue/concern is identified, identify who should log it, who is responsible for tracking the resolution efforts, who is responsible for acceptance of a resolution, and who should enter closeout data.

HFE Program and Management Plan

1. An HFE program management plan shall be developed to describe how the human factors program shall be accomplished, i.e., the plan shall describe the HSI Design Team's organization and composition and which lays out the effort to be undertaken and provides a technical approach, schedule, and management control structure and technical interfaces to achieve the HFE program objectives. The plan is the single document which describes the designer's entire HFE program, identifies its elements, and explains how the elements will be managed. Generally, it shall address:

   - The scope of the HSI design team's authority within the broader scope of the organization responsible for plant construction. Included within this scope shall be the authority to suspend from delivery, installation, or operation any equipment which is determined by the team to be deficient in regard to established human factors design practices and evaluation criteria.

   - The process through which the team will execute its responsibilities.

   - The processes through which findings of the team are resolved and how equipment design changes that may be necessary for resolution are incorporated into the actual equipment ultimately used in the plant.

   - The members and qualification of the team members.

   - The process through which the team activities will be assigned to individual team members, the responsibilities of each team member and the procedures that will govern the internal management of the Team.

   - The procedures and documentation requirements of the HFE Issues Tracking System.

2. The HFE Program Management Plan shall provide the following information:

   1. Purpose and organization of the plan

   2. Literature and current practices review

   3. Overall HFE program goals and objectives

4. The relationship between the HFE program and the overall plant design program (organization and schedule).

5. HSI Design Team

- Organization within the HFE program

  - Identify and describe the primary HFE organization or function within the organization of the total program, including charts to show organizational and functional relationships, reporting relationships, and lines of communication.

- Functions and internal structure of the HFE Organization

  - Describe the responsibility, authority and accountability of the HFE organization.

  - Identify the organizational unit responsible for each HFE task.

  - Describe the process through which management decisions will be made regarding HFE.

  - Describe the process through which design decisions will be made regarding HFE.

  - Describe all tools and techniques (e.g., review forms, documentation) to be utilized by the Team to ensure they fulfill their responsibilities.

- Staffing

  - Describe the staffing of the HSI design team.

  - Provide job descriptions of personnel of the HSI design team.

  - Indicate the assignment of key personnel and provide their qualifications with regard to the areas of expertise indicated above.

6. HFE Issue Tracking System

- Literature and current practices review
- Responsibilities

  - Responsibilities on issue identification

  - Responsibilities for issue logging

  - Responsibilities for issue resolution

  - Responsibilities for issue closeout

- Procedures

  - Issue identification
    Description
    Effects
    Criticality and likelihood

  - Issue resolution
    Proposed solutions
    Implemented solution
    Residual effects
    Resultant criticality and likelihood

- Documentation
- Audit of the issue identification and tracking system

7. HFE Requirements

- Identify and describe the HFE requirements imposed on the design process
- List the standards and specifications which are sources of HFE requirements

8. HFE program

Identify and describe the development of implementation plans, analyses, and evaluation/verification of:

- Operating experience review
- System functional requirements development
- Allocation of function
- Task analysis
- Interface design
- Plant and emergency operating procedure development
- HF verification and validation

9. HFE program milestones

- Identify HFE milestones, so that evaluations of the effectiveness of the HFE effort can be made at critical check points and show the relationship to the integrated plant sequence of events.

- Provide a program schedule of HFE tasks showing:

  - relationships between HFE elements and activities.
  - reports
  - reviews

- Identify integrated design activities applicable to the HFE program but specified in other areas.

10. HFE documentation

- Identify and briefly describe each required HFE documented item.
- Identify procedures for accessibility and retention.
- Describe the supporting documentation and its audit trail maintained for NRC audits.

11. HFE in subcontractor efforts

- Provide a copy of the HFE requirements proposed for inclusion in each subcontract.

- Describe the manner in which the designer proposes to monitor the subcontractor's compliance with HFE requirements.

3.2 Element 2 - Operating Experience Review

DESIGN COMMITMENT:

The accident at Three Mile Island in 1979 and other reactor incidents have illustrated significant problems in the actual design and the design philosophy of NPP HSIs. There have been many studies as a result of these accidents/incidents. Utilities have implemented both NRC mandated changes and additional improvements on their own initiative. However, the changes were formed based on the constraints associated with backfits to existing CRs using early 1980s technology which limited the scope of corrective actions that might have been considered, i.e., more effective fixes could be used in the case of a designing a new CR with the modern technology typical of advanced CRs. Problems and issues encountered in similar systems of previous designs shall be identified and analyzed so that they are avoided in the development of the current system or, in the case of positive features, to ensure their retention.

INSPECTION/TEST/ANALYSIS:

- An operating experience review implementation plan shall be developed.

- An analysis of operating experience shall be conducted in accordance with the plan and the findings will be documented in an Analysis Results Report.

- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The following industry operating experience issues shall be reviewed:

   - See the list of issues identified in the "Operating Experience Review Issues" attachment at the end of this document

2. The issues shall be reviewed and analyzed for:

   - Human performance issues, problems and sources of human error shall be identified.

   - Design elements which support and enhance human performance shall be identified.

3. The following topics should be included in interviews as a minimum:

   - Display factors
   - Control factors
   - Information processing factors
   - Communication factors
   - Procedures
   - Training factors
   - Staffing and Job Design

4. The review shall include both a review of literature pertaining the human factors issues related to similar systems and operator interviews.

5. The following sources both industry wide and plant or subsystem relevant should be included in review of the identified issues:

   - Government and industry studies of similar systems
   - Licensee event reports
   - Outage analysis reports
   - Final safety analysis reports and safety evaluation reports
   - Human engineering deficiencies identified in DCRDRs
   - Modifications of the technical specifications for operation
   - Internal memoranda/reports as available

6. Each operating experience issue shall be documented in the HFE tracking system.

7. The program shall be developed using the following documents as guidance and issue definition:

NUREG-0737: *Clarification of TMI action plan requirements* (Supplement 1, Item I.C.5 "Feedback of Operating Experience to Plant Staff"), 1983, (U.S. Nuclear Regulatory Commission).

NUREG-0933: *A prioritization of generic safety issues* (Main Report and Supplements 1-12), 1991, (U.S. Nuclear Regulatory Commission).

Draft NUREG-1449: *Shutdown and low-power operation at commercial nuclear power plants in the United States*, 1992, (U.S. Nuclear Regulatory Commission).

EGG-HFRU-9446: The onsite analysis of the human factors of operating events, 1991, (U.S. Nuclear Regulatory Commission - Meyer).

Implementation Plan

The plan shall describe the designer's approach to operating experience review. The plan shall address the following:

- Documentation review and analysis
- User survey methodology (for conducting interviews) and analysis plans
- Method of documenting lessons learned
- Integration of lessons learned into the design process

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the methods
- Identification of any deviations from the implementation plan
- Results and discussion
- Conclusions
- Recommendations/implications for HSI design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.3 Element 3 - System Functional Requirements Analysis

DESIGN COMMITMENT:

System requirements shall be analyzed to identify those functions which must be performed to satisfy the objectives of each functional area. System function analysis shall: (1) determine the objective, performance requirements, and constraints of the design; and (2) establish the functions which must be accomplished to meet the objectives and required performance.

INSPECTION/TEST/ANALYSIS:

- A system functional requirements analysis implementation plan shall be developed.
- An analysis of system functional requirements shall be conducted in accordance with the plan and the findings will be documented in an analysis results report.
- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. System requirements shall determine system functions and the function shall determine the performance necessary to carry out the function.
2. Critical functions shall be defined (i.e., those functions required to achieve major system performance requirements; or those functions which, if failed, could degrade system or equipment performance or pose a safety hazard to plant personnel or to the general public),
3. Safety functions shall be identified and any functional interrelationship with non-safety systems shall be identified.
4. Functions shall be defined as the most general, yet differentiable means whereby the system requirements are met, discharged, or satisfied. Functions shall be arranged in a logical sequence so that any specified operational usage of the system can be traced in an end-to-end path.

5. Functions shall be described initially in graphic form. Function diagramming shall be done at several levels, starting at a "top level" where a very gross picture of major functions is described, and continuing to decompose major functions to several lower levels until a specific critical end-item requirement will emerge, e.g., a piece of equipment, software, or an operator.

6. Detailed narrative descriptions shall be developed for each of the identified functions and for the overall system configuration design itself. Each function shall be identified and described in terms of inputs (observable parameters which will indicate system status), functional processing (control process and performance measures required to achieve the function), outputs, feedback (how to determine correct discharge of function), and interface requirements from the top down so that subfunctions are recognized as part of larger functional areas.

7. Functional operations or activities shall include:

   - detecting signals
   - measuring information
   - comparing one measurement with another
   - processing information
   - acting upon decisions to produce a desired condition or result on the system or environment (e.g., system and component operation, actuation, and trips)

8. The function analysis shall be kept current over the life cycle of design development.

9. Verification

   - All the functions necessary for the achievement of safe operation are identified.
   - All requirements of each function are identified.

10. The effort shall be performed using the following documents as guidance:

IEC 964: *Design for control rooms of nuclear power plants*, 1989, (Bureau Central de la Commission Electrotechnique Internationale).

MIL-H-46855B: *Human engineering requirements for military systems, equipment and facilities*, 1979, (Department of Defense).

AD/A223 168: *Systems engineering management guide*, 1990, (Department of Defense - Defense Systems Management College - Kockler, F. et al.).

Implementation Plan

The plan shall describe the designer's approach to system functional requirements analysis.

The system functional requirements analysis implementation plan shall address:

- Literature and current practices review
  - Describe the technical basis for the plan.
- List required system level functions
  - Based on system performance requirements.
- Graphic function descriptions
  - e.g., functional flow block diagrams and time line diagrams
- Detailed function narrative descriptions addressing:
  - Observable parameters which will indicate system status
  - Control process and measure/data required to achieve the function
  - How to determine proper discharge of function
- Analysis
  - Define an integration of subfunctions that are closely related so that they can be treated as a unit
  - Divide identified subfunctions into two groups
  - Common achievement is an essential condition for the accomplishment of a higher level function
  - Alternative supporting functions to a higher level function or whose accomplishment is not necessarily a requisite for higher level function
  - Identify for each integrated subfunction:
    * Logical requirements for accomplishment (Why accomplishment is required)
    * Control actions necessary for accomplishment

  * Parameters necessary for control action
  * Criteria for evaluating the result of control actions
  * Parameters necessary for the evaluation
  * Evaluation criteria
  * Criteria for choosing alternatives

- Identify characteristic measurement and define for each measurement important factors such as Load, Accuracy, Time factors, Complexity of action logic, Types and complexities of decision making, Impacts resulting from the loss of function and associated time factors.

- Verification

  - Describe system function verification methodology.

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the Methods
- Identification of any deviations from the implementation plan
- Results and Discussion
- Conclusions
- Recommendations/Implications for HSI Design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.4 Element 4 - Allocation of Function

DESIGN COMMITMENT:

The allocation of functions shall take advantage of human strengths and avoids allocating functions which would be impacted by human limitations. To assure that the allocation of function is conducted according to accepted HFE principles, a structured and well-documented methodology of allocating functions to personnel, system elements, and personnel-system combinations shall be developed.

INSPECTION/TEST/ANALYSIS:

- An allocation of function implementation plan shall be developed.
- An analysis of allocation of function shall be conducted in accordance with the plan and the findings will be documented in an analysis results report.
- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. All aspects of system and functions definition must be analyzed in terms of resulting human performance requirements based on the expected user population.
2. The allocation of functions to personnel, system elements, and personnel-system combinations shall be made to reflect (1) sensitivity, precision, time, and safety requirements, (2) required reliability of system performance, and (3) the number and level of skills of personnel required to operate and maintain the system.
3. The allocation criteria, rational, analyses, and procedures shall be documented.
4. As alternative allocation concepts are developed, analyses and trade-off studies shall be conducted to determine adequate configurations of personnel- and system- performed functions. Analyses shall confirm that the personnel elements can properly perform tasks allocated to them while maintaining operator situation awareness, workload, and vigilance. Proposed function assignment shall take the maximum advantage of the capabilities of human and machine without imposing unfavorable requirements on either.
5. Functions shall be re-allocated in an iterative manner, in response to developing design specifics and the outcomes of on-going analyses and trade studies.
6. Function assignment shall be evaluated.
7. The effort shall be performed using the following documents as guidance:

NUREG/CR-2623: *The allocation of functions in man-machine systems: A perspective and literature review*, 1982, (U.S. Nuclear Regulatory Commission - Price, H., et al.).

NUREG/CR-3331: *A methodology for allocation nuclear power plant control functions to human and automated control*, 1983, (U.S. Nuclear Regulatory Commission - Pulliam, R., et al.).

IEC 964: *Design for control rooms of nuclear power plants*, 1989, (Bureau Central de la Commission Electrotrotechnique Internationale).

AD/A223 168: *Systems engineering management guide*, 1990, (Department of Defense - Defense Systems Management College - Kockler, F. et al.).

Implementation Plan

The plan shall describe the designer's approach to Allocation of Function. The Allocation of Function Implementation Plan shall address:

- Establishment of a structured basis for function allocation
- Alternative systems analyses
  - Specification of criteria for selection
- Trade studies
  - Define objectives and requirements
  - Identify alternatives
  - Formulate selection criteria
  - Weight criteria
  - Prepare utility functions
  - Evaluate alternatives
  - Perform sensitivity check
  - Select preferred alternatives
- Evaluation of function assignment
  - The plan shall describe the tests and analyses that will be performed to evaluate the function allocation

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the methods
- Identification of any deviations from the implementation plan
- Results and discussion
- Conclusions
- Recommendations/implications for HSI design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.5 Element 5 - Task Analysis

DESIGN COMMITMENT:

Task analysis shall identify the behavioral requirements of the tasks the personnel subsystem is required to perform in order to achieve the functions allocated to them. A task shall be a group of activities that have a common purpose, often occurring in temporal proximity, and which utilize the same displays and controls. The task analysis shall:

- provide one of the bases for making design decisions; e.g., determining before hardware fabrication, to the extent practicable, whether system performance requirements can be met by combinations of anticipated equipment, software, and personnel,
- assure that human performance requirements do not exceed human capabilities,
- be used as basic information for developing manning, skill, training, and communication requirements of the system, and
- form the basis for specifying the requirements for the displays, data processing and controls needed to carry out tasks.

INSPECTION/TEST/ANALYSIS:

- A task analysis implementation plan shall be developed.
- An analysis of tasks shall be conducted in accordance with the plan and the findings will be documented in an analysis results report.
- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The scope of the task analysis shall include all operations, maintenance, test and inspection tasks. The analyses shall be directed to the full range of plant operating modes, including start-up, normal operations, abnormal operations, transient conditions, low power and shutdown conditions. The analyses shall include tasks performed in the control room as well as outside of the control room.

2. The analysis shall link the identified and described tasks in operational sequence diagrams. A review of the descriptions and operational sequence diagrams shall identify which tasks can be considered "critical" in terms of importance for function achievement, potential for human error, and impact of task failure. Human actions which are found to affect plant risk in PRA sensitivity analyses shall also be considered "critical." Where critical functions are automated, the analyses shall consider all human tasks including monitoring of an automated safety system and back-up actions if it fails.

3. Task analysis shall begin on a gross level and involve the development of detailed narrative descriptions of what personnel must do. Task analyses shall define the nature of the input, process, and output required by and of personnel. Detailed task descriptions shall address (as appropriate):

   - Information Requirements
     - Information required, including cues for task initiation
     - Information available
   - Decision-Making Requirements
     - Description of the decisions to be made (relative, absolute, probabilistic)
     - Evaluations to be performed
     - Decisions that are probable based on the evaluation (opportunities for cognitive errors, such as capture error, will be identified and carefully analyzed)
   - Response Requirements
     - Action to be taken
     - Overlap of task requirements (serial vs. parallel task elements)
     - Frequency
     - Speed/Time line requirements
     - Tolerance/accuracy
     - Operational limits of personnel performance
     - Operational limits of machine and software
     - Body movements required by action taken
   - Feedback Requirements
     - Feedback required to indicate adequacy of actions taken
   - Workload
     - Cognitive
     - Physical
     - Estimation of difficulty level
   - Task Support Requirements
     - Special/protective clothing
     - Job aids or reference materials required
     - Tools and equipment required
     - Computer processing support aids
   - Workplace Factors
     - Workspace envelope required by action taken
     - Workspace conditions
     - Location and condition of the work
     - Environment
   - Staffing and Communication Requirements
     - number of personnel, their technical specialty, and specific skills
     - Communications required, including type
     - Personnel interaction when more than one person is involved
   - Hazard Identification
     - Identification of hazards involved

4. The task analysis shall be iterative and become progressively more detailed over the design cycle. The

task analysis shall be detailed enough to identify information and control requirements to enable specification of detailed requirements for alarms, displays, data processing, and controls for human task accomplishment.

5. The task analysis results shall provide input to the personnel training programs.

6. The effort shall be performed using the following documents as guidance:

NUREG/CR-3371: *Task analysis of nuclear power plant control room crews*, 1983, (U.S. Nuclear Regulatory Commission - Burgy, D. et al.).

IEC 964: *Design for control rooms of nuclear power plants*, 1989, (Bureau Central de la Commission Electrotrotechnique Internationale).

DI-H-7055: *Critical task analysis report*, 1979, (Department of Defense).

MIL-STD-1478: *Task performance analysis*, 1991, (Department of Defense).

Implementation Plan

The plan shall describe the designer's approach to task analysis. The task analysis implementation plan shall address:

- General methods and data sources
- Gross task analysis
  - Convert functions to tasks
  - Develop narrative task descriptions
  - General statement of task functions
  - Detailed task descriptions
  - Breakdown of tasks to individual activities
  - Develop operational sequence diagrams
- Critical task analysis
  - Identification of critical tasks
  - Detailed task descriptions
- Information and control requirements
- Initial alarm, display, processing, and control requirements analysis
  - Develop a task-based I&C inventory
- Application of task analysis results to training development
- Evaluation of task analysis
  - The plan shall describe the methods that will be used to evaluate the results of the task analysis.

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the methods
- Identification of any deviations from the implementation plan
- Results and discussion
- Conclusions
- Recommendations/implications for HSI design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.6 Element 6 - Human-System Interface Design

DESIGN COMMITMENT:

Human engineering principles and criteria shall be applied along with all other design requirements to identify, select, and design the particular equipment to be operated/maintained/controlled by plant personnel.

INSPECTION/TEST/ANALYSIS:

- A Human-System interface design implementation plan shall be developed.
- An analysis of Human-System interface design shall be conducted in accordance with the plan and the findings will be documented in an analysis results report.
- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The design configuration shall satisfy the functional and technical design requirements and insure that the HSI will meet the appropriate HFE guidance and criteria.

2. **The HFE effort shall be applied to HSI both inside and outside of the control room (local HSI).**

3. **HSI design shall utilize the results of the task analysis and the I&C inventory to assure the adequacy of the HSI.**

4. **The HSI and working environment shall be adequate for the human performance requirements it supports. The HSI shall be capable of supporting critical operations under the worst credible environmental conditions.**

5. **The HSI shall be free of elements which are not required for the accomplishment of any task.**

6. **The selection and design of HSI hardware and software approaches shall be based upon demonstrated criteria that support the achievement of human task performance requirements. Criteria can be based upon test results, demonstrated experience, and trade studies of identified options.**

7. **HFE standards shall be employed in HSI selection and design. Human engineering guidance regarding the design particulars shall be developed by the HSI designer to (1) insure that the human-system interfaces are designed to currently accepted HFE guidelines and (2) insure proper consideration of human capabilities and limitations in the developing system. This guidance shall be derived from sources such as expert judgement, design guidelines and standards, and quantitative (e.g., anthropometric) and qualitative (e.g., relative effectiveness of differing types of displays for different conditions) data. Procedures shall be employed to ensure HSI adherence with standards.**

8. **HFE/HSI problems shall be resolved using studies, experiments, and laboratory tests, e.g.**

   - **Mockups and models may be used to resolve access, workspace and related HFE problems and incorporating these solutions into system design**
   - **Dynamic simulation and HSI prototypes shall be evaluated for use to evaluate design details of equipment requiring critical human performance**
   - **The rationale for selection of design/evaluation tools shall be documented**

9. **Human factors engineering shall be applied to the design of equipment and software for maintainability, testing and inspection.**

10. **HSI design elements shall be evaluated to assure their acceptability for task performance and HFE, criteria, standards, and guidelines.**

11. **The effort shall be performed using the following documents as guidance:**

NUREG-0696: *Functional criteria for emergency response facilities*, 1980, (U.S. Nuclear Regulatory Commission).

NUREG-0700: *Guidelines for control room design reviews*, 1981, (U.S. Nuclear Regulatory Commission).

NUREG-0800: *Standard review plan* (Rev 1), 1984, (U.S. Nuclear Regulatory Commission).

NUREG/CR-5908: *Advanced human-system interface design review guideline*, 1992, (U.S. Nuclear Regulatory Commission - O'Hara, et al.).

EPRI NP-4350: *Human engineering design guidelines for maintainability*, 1985, (Electric Power Research Institute - Pack R., et al.).

EPRI NP-3659: *Human factors guide for nuclear power plant control room development*, 1984, (Electric Power Research Institute - Kinkade, R.G., and Anderson, J.).

EPRI NP-3701: *Computer-generated display system guidelines (Vols 1&2)*, 1984, (Electric Power Research Institute - Frey, R. et al.).

IEC 964: *Design for control rooms of nuclear power plants*, 1989, (Bureau Central de la Commission Electrotrotechnique Internationale).

ANSI HFS-100: *American national standard for human factors engineering of visual display terminal workstations*, 1988, (American National Standards Institute).

Human-computer interface style guide (Version 1), 1992, (Department of Defense - Defense Information Systems Agency).

MIL-HDBK-759A: *Human factors engineering design for army materiel*, 1981, (Department of Defense).

MIL-STD-1472D: *Human engineering design criteria for military systems, equipment and facilities*, 1989, (Department of Defense).

DOD-HDBK-761A: *Human engineering guidelines for management information systems*, 1990, (Department of Defense).

ESD-TR-86-278: *Guidelines for designing user interface software*, 1986, (Department of Defense).

Implementation Plan

The plan shall describe the designer's approach to Human-System interface design. The Human-System interface design implementation plan shall address:

- I&C requirements analysis and design
  - compare task requirements to I&C availability
  - Modifications to I&C Inventory
- General HSI approach selection
  - Trade Studies
  - Analyses
- The criteria to be used to meet General Criterion (selection and design of HSI hardware and software approaches), described above
- HFE design guidance development and documentation
- HSI detailed design and evaluations
  - Use of design/evaluation tools such as prototypes shall be specifically identified and rationale for selection

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the methods
- Identification of any deviations from the implementation plan
- Results and discussion
- Conclusions
- Recommendations/implications for HSI design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.7 Element 7 - Plant and Emergency Operating Procedure Development

DESIGN COMMITMENT:

Plant and emergency operating procedures shall be developed to support and guide human interaction with plant systems and to control plant-related events and activities. Human engineering principles and criteria shall be applied along with all other design requirements to develop procedures that are technically accurate, comprehensive, explicit, easy to utilize, and validated. The types of procedures covered in the element are:

- plant & system operations (including start-up, power, and shutdown operations)
- abnormal & emergency operations
- preoperational, start-up, and surveillance tests
- alarm response

INSPECTION/TEST/ANALYSIS:

- A plant and emergency operating procedure development implementation plan shall be developed.
- The procedures shall be developed in accordance with the plan and the results will be documented in a procedure development report.
- The procedure development shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The task analysis shall be used to specify the procedures for operations (normal, abnormal, and emergency), test, maintenance and inspection.
2. The basis for procedure development shall include:

- Plant design bases
- system-based technical requirements and specifications
- the task analyses for operations (normal, abnormal, and emergency)

- significant human actions identified in the HRA/PRA
- initiating events to be considered in the EOPs shall include those events present in the design bases.

3. A Writer's Guide shall be developed to establish the process for developing technical procedures that are complete, accurate, consistent, and easy to understand and follow. The Guide shall contain sufficiently objective criteria so that procedures developed in accordance with the Guide shall be consistent in organization, style, and content. The Guide shall be used for all procedures within the scope of this Element. The Writer's Guide shall provide instructions for procedure content and format (including the writing of action steps and the specification of acceptable acronym lists and acceptable terms to be used).

4. The content of the procedures shall incorporate the following elements:

- Title
- Statement of applicability
- References
- Prerequisites
- Precautions (including warnings, cautions, and notes)
- Limitations and actions
- Required human actions
- Acceptance criteria
- Checkoff lists

5. All procedures shall be verified and validated. A review shall be conducted to assure procedures are correct and can be performed. Final validation of operating procedures shall be performed in a simulation of the integrated system as part of V&V activities described in Element 8.

6. An analysis shall be conducted to determine the impact of providing computer-based procedures and to specify where such an approach would improve procedure utilization and reduce operating crew errors related to procedure use.

7. The effort shall be performed using the following documents as guidance:

NUREG-0899: *Guidelines for the preparation of emergency operating procedures*, 1982, (U.S. Nuclear Regulatory Commission).

NUREG-1358: *Lessons learned from the special inspection program for emergency operating procedures*, 1989, (U.S. Nuclear Regulatory Commission).

NUREG/CR-5228: *Techniques for preparing flowchart format emergency operating procedures* (Vols. 1&2), 1989, (U.S. Nuclear Regulatory Commission - Barnes, V. et al.).

NRC Regulatory Guide 1.33 (Rev. 2): *Quality assurance program requirements*, 1978, (U.S. Nuclear Regulatory Commission).

ANSI-N18. 7-1976: *Administrative controls and quality assurance for the operational phase of nuclear power plants*, 1976, (American National Standards Institute).

Implementation Plan

The plant and emergency operating procedure development implementation plan shall address:

- Identification of source data/information to be used as a basis for procedure development
- Methodology for the evaluation of procedures (plan shall describe tests and analyses that will be used to evaluate procedures)
- Requirements for the effective development and use of a Procedural Writer's Guide
- Procedures for training program - procedure integration
- Verification and validation procedures
- Procedure development documentation requirements

Procedure Development Report

The report shall address the following:

- Objectives
- Description of the methods Used
- Identification of any deviations from the implementation plan
- Results, including a list of procedures developed, and a discussion of the resulting procedures including sample procedures
- Conclusions
- Recommendations/implications for HSI design

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

3.8 Element 8 - Human Factors Verification and Validation

DESIGN COMMITMENT:

The successful incorporation of human factors engineering into the final HSI design and the acceptability of the resulting HSI shall be thoroughly evaluated as an integrated system using HFE evaluation procedures, guidelines, standards, and principles.

INSPECTION/TEST/ANALYSIS:

- A human factors verification and validation implementation plan shall be developed.
- An analysis of human factors verification and validation shall be conducted in accordance with the plan and the findings will be documented in an analysis results report.
- The analyses shall be reviewed by the HSI design team and shall be documented in an evaluation report.

DESIGN ACCEPTANCE CRITERIA:

General Criteria

1. The evaluation shall verify that the performance of the HSI, when all elements are fully integrated into a system, meets (1) all HFE design goals as established in the program plan; and (2) all system functional requirements and support human operations, maintenance, test, and inspection task accomplishment.

2. The evaluation shall address:

   - Human-Hardware interfaces
   - Human-software interfaces
   - Procedures
   - Workstation and console configurations
   - Control room design
   - Remote shutdown system
   - Design of the overall work environment

3. Individual HSI elements shall be evaluated in a static and/or "part-task" mode to assure that all controls, displays, and data processing that are required are available and that they are designed according to accepted HFE guidelines, standards, and principles.

4. The integration of HSI elements with each other and with personnel shall be evaluated and validated through dynamic task performance evaluation using evaluation tools which are appropriate to the accomplishment of this objective. A fully functional HSI prototype and plant simulator shall be used as part of these evaluations. If an alternative to a HSI prototype is proposed its acceptability shall be documented in the implementation plan. The evaluations shall have as their objectives:

   - Adequacy of entire HSI configuration for achievement of HFE design goals
   - Confirm allocation of function and the structure of tasks assigned to personnel
   - Adequacy of staffing and the HSI to support staff to accomplish their tasks
   - Adequacy of Procedures
   - Confirm the adequacy of the dynamic aspects of all interfaces for task accomplishment
   - Evaluation and demonstration of error tolerance to human and system failures

5. Dynamic evaluations shall evaluate HSI under a range of operational conditions and upsets, and shall include:

   - Normal plant evolutions (e.g., start-up, full power, and shutdown operations)
   - Instrument Failures (e.g., Safety System Logic & Control (SSLC) Unit, Fault Tolerant Controller (NSSS), Local "Field Unit" for MUX system, MUX Controller (BOP), Break in MUX line)
   - HSI equipment and processing failure (e.g., loss of VDUs, loss of data processing, loss of large overview display)
   - Transients (e.g., Turbine Trip, Loss of Offsite Power, Station Blackout, Loss of all FW, Loss of Service Water, Loss of power to selected buses/CR power supplies, and SRV transients)

- Accidents (e.g., Main steamline break, Positive Reactivity Addition, Control Rod Insertion at power, Control Rod Ejection, ATWS, and various-sized LOCAs)

6. Performance measures for dynamic evaluations shall be adequate to test the achievement off all objectives, design goals, and performance requirements and shall include at a minimum:

   - System performance measures relevant to safety
   - Crew Primary Task Performance (e.g., task times, procedure violations)
   - Crew Errors
   - Situation Awareness
   - Workload
   - Crew communications and coordination
   - Anthropometry evaluations
   - Physical positioning and interactions

7. A verification shall be made that all issues documented in the human factors issue tracking system have been addressed.

8. A verification shall be made that all critical human actions as defined by the task analysis and PRA/HRA have be adequately supported in the design. The design of tests and evaluations to be performed as part of HFE V&V activities shall specifically examine these actions.

9. The effort shall be performed using the following documents as guidance:

NUREG-0700: *Guidelines for control room design reviews*, 1981, (U.S. Nuclear Regulatory Commission).

NUREG-0800: *Standard Review Plan* (Rev 1), 1984, (U.S. Nuclear Regulatory Commission).

NUREG/CR-5908: *Advanced human-system interface design review guideline (Draft)*, 1992, (U.S. Nuclear Regulatory Commission - O'Hara, et al.).

EPRI NP-3701: *Computer-generated display system guidelines (Vols 1&2)*, 1984, (Electric Power Research Institute - Frey, R. et al.).

IEEE Std 845-1988: *IEEE guide to evaluation of man-machine performance in nuclear power generating station control rooms and other peripheries*, 1988, (IEEE).

IEC 964: *Design for control rooms of nuclear power plants*, 1989, (Bureau Central de la Commission Electrotrotechnique Internationale).

AR 602-1: *Human factors engineering program*, 1983, (Department of Defense).

TOP 1-2-610: *Test operating procedure* - Parts 1 & 2, 1990, (Department of Defense).

DODI 5000.2: *Defense acquisition management policies and procedures*, 1991, (Department of Defense).

Implementation Plan

The plan shall describe the designer's approach to human factors verification and validation. The human factors verification and validation implementation plan shall address:

- HSI element evaluation
  - Control, Data Processing, Display audit
  - Comparison of HSI element design to HFE guidelines, standards, and principles
- Dynamic performance evaluation of fully integrated HSI
  - General objectives
  - Test methodology and procedures
  - Test participants (operators to participate in the test program)
  - Test Conditions
  - HSI description
  - Performance measures
  - Data analysis
  - Criteria for evaluation of results
  - Utilization of evaluations
- Documentation requirements
  - Test & evaluation plans and procedures
  - Test Reports

Analysis Results Report

The report shall address the following:

- Objectives
- Description of the methods
- Identification of any deviations from the implementation plan
- Results and Discussion
- Conclusions
- Recommendations/implications for HSI design

Appendix J

HSI Design Team Evaluation Report

The report shall address the following:

- The review methodology and procedures
- Compliance with implementation plan procedures
- Review findings

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Attachment

Operating Experience Review Issues

The accident at Three Mile Island in 1979 and other reactor incidents have illustrated significant problems in the actual design and the design philosophy of NPP HSIs. There have been many studies as a result of these accidents/incidents. Utilities have implemented both NRC mandated changes and additional improvements on their own initiative. However, the changes were formed based on the constraints associated with backfits to existing control rooms (CRs) using early 1980s technology which limited the scope of corrective actions that might have been considered, i.e., more effective fixes could be used in the case of a designing a new CR with the modern technology typical of advanced CRs. Problems and issues encountered in similar systems of previous designs should be identified and analyzed so that they are avoided in the development of the current system or, in the case of positive features, to ensure their retention.

Many of the issues identified below are broad and involve system design considerations that are broader than human factors alone. However, each has a human factors component which should not be overlooked by the COL during the design and implementation process. Thus for each issue identified below, a brief explanation of the HFE aspects of the issue are provided. These explanations are provided as examples only and are not intended to be a complete specification of the HFE components of the issue (which should be addressed by the COL in the design specific treatment of the issue). Each of the issues listed below should be included in the operating experience review as part of the COL's design and implementation process.

The issues are organized into the following categories, based on the issues source:

- USI Issues
- TMI Issues
- NRC Generic Letters
- AEOD Studies
- Low Power and Shutdown Issues

I. USI ISSUES

1. A-44, Station blackout: This is a large and significant issue with many human factors related aspects, including controls, displays, training, and procedures.

2. A-47, Safety implications of control systems: This issue relates to the implications of failures of non-safety related control systems and their interaction with control room operators.

3. B-17, Criteria for safety related operator action: This issue involves the development of a time criterion for safety-related operator actions including a determination of whether automatic actuation is required.

4. B-32, Ice effects on safety related water supplies: The build-up of ice on service water intakes can occur gradually and can require improved instrumentation to allow operators to detect its occurrence before it causes system inoperability.

5. GI-2, Failure of protective devices on essential equipment: A large number of LERs have noted the incapacitation of safety-related equipment due to the failure of protective devices such as fuses and circuit breakers. Operators are not always aware of the failure of the equipment due to the design of the instrumentation.

6. GI-23, Reactor coolant pump seal failures: This is a multi-faceted issue, which includes a number of proposed resolutions. One sub-issue is the provision of adequate seal instrumentation to allow the operators to take corrective actions to prevent catastrophic failure of seals.

7. GI-51, Improving the reliability of open cycle service water systems: The build-up of clams, mussels, and corrosion products can cause the degradation of open cycle SW systems. Added instrumentation is one means of providing operators with the capability to monitor this build-up and take corrective action prior to loss of system functionality.

8. GI-57, Effects of fire protection system actuation on safety-related equipment: This issue resulted from spurious and inadvertent actuations of fire protection systems, often resulting from operator errors during testing or maintenance. Design of systems should prevent such errors to the extent possible.

9. GI-75, Generic implications of ATWS events at the Salem NPP: This GI has many sub-issues, several of which are related to human factors, for example, scram data for post-scram analysis, capability for post-maintenance testing of RPS, and a specific sub-issue titled "review of human factors issues."

10. GI-76, Instrumentation & control power interactions: This issue raises several concerns, including control & instrumentation faults the could

blind or partially blind the operators to the status of the plant.

11. GI-96, RHR suction valve testing: The design of the RHR suction valves with respect to valve position indication and instrumentation to detect potential leakage from high to low pressure areas is important to the prevention of ISLOCAs. This is important for normal operations and for testing.

12. GI-101, Break plus single failure in BWR water level instrumentation: This issue attempts to ensure that robust information is available to the operators for both reactor water level and for plant status during the progression of an accident.

13. GI-105, Interfacing system LOCA at BWRs: This issue relates to pressure isolation valves for BWRs. Many failures in this area were due to personnel errors. The design should address human factors considerations to correct these potential errors. (The NRC work in the ISLOCA area has generally determined that human factors is an area needing considerable attention and which has contributed to a number of the ISLOCA precursor events.)

14. GI-110, Equipment protective devices of engineered safety features: There have been failures and incapacitation of ESF equipment due to the failure or intentional bypass by protective devices. Both the design of these protective devices and the appropriate indication to control room operators is important.

15. GI-116, Accident management: This issue relates to improved operator training and procedures for managing accidents beyond the design basis of the plant.

16. GI-117, Allowable equipment outage times for diverse, simultaneous equipment outages: A key aspect of this item is providing operators with needed assistance in identifying risk significant combinations of equipment outages. The information needed would include valve alignments, switch settings, as well as components declared inoperable.

17. GI-120, Online testability of protection systems: The designs for online testability should be careful to include appropriate human factors to ensure safe testing.

18. GI-128, Electrical power reliability: This issue includes power to vital instrument buses, DC power supplies, and electrical interlocks. All of these issues are strongly dependent on proper indication and operator action for high reliability.

19. GI-130, Essential service water pump failures at multi-plant sites: This issue relates to the arrangement of SW pumps and piping, including cross-ties at multi-unit sites. Both the arrangement and the operators' ability to monitor the status of cross ties is important. This item mentions potential applicability to single unit sites also.

II. TMI ISSUES

1. 1v, HPCI and RCIC separation: the design should consider control room alarm and indication of the initiation levels and low:level restart values.

2. 1vi, Reduction of challenges to SRVs: the design should consider control room alarm and indication of SRV status and important parameters.

3. 1vii, ADS study: determination of the "optimum" ADS for elimination of manual activation should consider the operator's need to monitor the system and should include an analysis of the time required for operators to perform manual backup if required.

4. 1viii, Automatic restart of Core Spray and LPCI: this issue involves allocation of function considerations in terms of automatic restart of a system following manual stoppage by the operators. Considerations of whether automatic restart should be available, how it should be implemented, and what alarm and indications are needed in the control room are required.

5. 1xi, Depressurization by means other than ADS: consideration of depressurization will involve the provision of alarms and indication in the control room. Some methods may also require operator actions which should be subject to the full design and implementation process.

6. 1xii, Alternate hydrogen control systems: the evaluation of design alternatives for hydrogen control systems should include the information needs of the operators to assess the conditions which would require system initiation and the degree of automation of the systems.

7. 2iv, SPDS: the selection and display of important safety parameters and their integration into the overall design of the control room is a primary HFE issue.

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8. 2v, Automatic indication of bypassed and inoperable systems: providing operators with the capability to monitor the status of automatic systems is an important function of the control room information display system and an important component to the maintenance of the operators' situation awareness.

9. 2vi, Venting of noncondensible gases: operator monitoring of the status of noncondensible gases in the reactor coolant system and having clear, unambiguous indication of the conditions under which gas release must be initiated should be evaluated for HFE design implications.

10. 2xi, Direct indication of SRVs in control room: the alarming and indication of SRV status should be clear and unambiguous and should be evaluated for HFE design implications.

11. 2xvi, Number of actuation cycles for ECCS and RPS: as part of the specification allowable actuation cycles, the method that cycles will be defined, recorded, and tracked by the operating crew should be evaluated for HFE design implications.

12. 2xvii, Control room instrumentation for various parameters: the selection and display of important parameters and their integration into the overall design of the control room is a primary HFE issue.

13. 2xviii, Control room instrumentation for inadequate core cooling: the selection and display of important parameters and their integration into the overall design of the control room is a primary HFE issue.

14. 2xix, Instrumentation for post accident monitoring: the selection and display of important parameters and their integration into the overall design of the control room is a primary HFE issue.

15. 2xxi, Auxiliary heat removal systems design to facilitate manual/auto actions: the specification and evaluation of manual and automatic actions should be subject to the function allocation analyses performed as part of the design and implementation process.

16. 2xxiv, Recording of reactor vessel level: the selection and display of important parameters and their integration into the overall design of the control room is a primary HFE issue.

17. 2xxv, TSC, OSC and EOF: the design of the TSC, OSC and EOF should include HFE considerations to assure that the personnel located in these facilities can most effectively perform their safety:related functions. Poor HFE design of these facilities may interfere with the performance of operators in a well:designed control room.

18. 2xxvii, Monitoring of in:plant and airborne radiation: the selection and display of important parameters and their integration into the overall design of the control room is a primary HFE issue.

19. 2xxviii, Control room habitability: while potential pathways for radioactivity to impact control room habitability may be identified and design solutions developed to preclude such problems may be developed, the control room operating crew should be aware of potential pathways. If warranted, evaluations of methods to monitor in the control room the integrity of the design solutions and the presence of radiation in the pathways should be considered.

III. NRC GENERIC LETTERS

1. 91-06, Resolution of Generic Issue A-30, "Adequacy of Safety-Related DC Power Supplies," Pursuant to 10 CFR 50.54(f). In this generic letter, NRC proposes certain monitoring, surveillance, and maintenance provisions for safety-related DC systems.

2. 91-07 GI-23, "Reactor Coolant Pump Seal Failures" and its possible effect on Station Blackout.

This generic letter discusses the interaction between GI-23 and A-44, both of which have human factors aspects.

3. 91-11 Resolution of Generic Issues 48, "LCOs for Class 1E Vital Instrument Buses," and 49, "Interlocks and LCOs for Class 1E Tie Breakers" Pursuant to 10 CFR 50.54(f). This generic letter addresses several issues related to electrical systems including the reduction of human errors, control of equipment status, and testing.

IV. AEOD STUDIES

The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) conducted a program to identify human factors and human performance issues associated with operating events at nuclear power plants (e.g., Meyer, 1991). These reports should be reviewed by the COL in order to determine human factors issues that may impact the development, design, and evaluation of the ABWR.

V. LOW POWER AND SHUTDOWN ISSUES

A current area of active NRC work is that of the risk associated with operation during low power and shutdown. The NRC has identified the operator-centered and human factors issues as particularly important in this area. The COL applicant should address those human factors finally developed by the NRC as a resolution to this issue. The most current status of these issues is contained in Draft NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States."

APPENDIX K

IMPORTANT SAFETY INSIGHTS

Plant-Wide Insights

(1) The COL applicant is to perform a seismic walk-down following the procedures of EPRI NP-6041 to confirm that the as-built plant matches the assumptions in the advanced boiling water reactor (ABWR) probablistic risk assessment (PRA)-based seismic margins analysis and to confirm that spatial systems interactions do not exist.

(2) The integrity of divisions is a very important assumption in the ABWR PRA. The PRA assumes that no high pressure of high temperature piping lines penetrate walls or floors separating two different safety divisions. Piping penetrations are qualified to the same differential pressure requirements as the walls or floors they penetrate.

(3) To prevent inadvertent spray or dripping from failing equipment, electric motors are all of drip proof design and motor control centers have NEMA Type 4 enclosures.

(4) The fire analysis assumes that the routing of piping or cable trays during the detailed design phase will conform with the fire area divisional assignments documented in the fire hazard analysis.

(5) Subsection 9A.5.5 under "Special Cases - Fire Separation for Divisional Electrical Systems" lists the only areas of the plant where there is equipment from more than one safety division in a fire area. These should be the only areas where multiple divisions share the same fire area.

Combustion Turbine Generator

The combustion turbine generator (CTG), in conjunction with the ac-independent water addition (ACIWA) system, have significantly reduced the estimated frequency of core damage from station blackouts (SBO) (the dominant contributor to core damage in most boiling water reactor (BWR) PRAs). In the ABWR standard safety analysis report (SSAR), GE indicated that each of the emergency diesel generators (EDGs) and the CTG can be used to power any of the loads identified in the PRA success criteria by manually closing selected breakers (note: EDGs cannot power feedwater pumps). Even if offsite power is lost, the four onsite power sources can be used to power any safety or non-safety bus. This provides significant flexibility which helps reduce the risk from SBO and selected bus power losses. Procedures must be prepared by the COL applicant to direct this manual transfer of an EDG to a non-safety bus. GE has determined that the CTG has the highest fussell-vesely importance percentage (69.6 percent) of any plant SSC. This insight implies that the CTG should receive heightened attention in the COL applicant's DRAP and ORAP.

An important assumption about the CTG is that no plant support systems are needed to start or run the CTG. The CTG starts automatically and safety grade loads are to be added manually.

AC-Independent Water Addition System

This system is one of the single most important systems in the ABWR from the point of view of prevention and mitigation of severe accidents, since the accidents that have traditionally been identified in BWR PRAs as being the most challenging are SBO and transients with failure of various ECCS or cooling systems. This system also provides benefits for fires, internal floods, shutdown events, seismic events, and events where containment cooling is lost. It can provide water (as vessel makeup or drywell spray) from a diesel-driven pump or a fire truck.

The use of the system as a backup source of water to the drywell sprays is perhaps the single-most important feature for reducing the consequences of severe accidents in the ABWR. In this role the system serves to: (1) reduce containment overpressure and delay the time to actuation of containment overpressurization systems (COPS), (2) eliminate the potential for drywell overtemperature failure in those events in which debris may be dispersed to the upper drywell, and (3) mitigate the consequences of suppression pool bypass by condensing steam produced in the drywell.

The following are important aspects of the system, as represented in the PRA:

(1) a fire protection pump -- will survive a design bases earthquake, diesel-driven pump (i.e., ac-independent)

(2) connection provided outside of reactor building, which allows a fire truck to be used as a backup to the fire protection pumps

(3) system piping and valves configured to allow fire protection water to be used for either vessel makeup or drywell spray, but not both simultaneously

(4) all valves (including valves F017, F018, and F005 in the RHR system) and controls needed for system

operation can be accessed and manually operated in a straight-forward manner and can be operated successfully (including the environment the operator will be in, such as the radiation field following a vessel melt-through) following an earthquake, internal flood, fire, or internal event

(5) check valves provided to prevent backflow from the reactor coolant system

(6) orifices installed in the associated piping to restrict the injection rates to the vessel and drywell sprays

(7) water supply independent of the suppression pool and the condensate storage tank

RCIC

Reactor core isolation cooling (RCIC) is ac-independent and provides reliable high pressure injection. This makes RCIC particularly important in preventing SBO from leading to core damage. In addition RCIC is very important for mitigation of control room fires or other emergencies that require the evacuation of the control room. The following capabilities are important for RCIC:

1. RCIC needs to be able to operate for 8 hours following a SBO (using steam and dc power) and the batteries at the end of 8 hours need to have sufficient power in them to allow for RCS depressurization by the ADS. RCIC pump and turbine are assumed in the PRA to be able to operate for at least eight hours without room coolers.

2. For control room fires, the capability for local operation of RCIC outside the control room is very important.

3. Sensitivity studies that increased structures, systems and components (SSC) unavailabilities showed that an increase in RCIC unavailability would cause the greatest increase in estimated core damage frequency of any SSC. RCIC also was found to be the most sensitive system to increased outage time assumptions.

4. The suppression pool temperature up to which RCIC can operate is important for Class II sequences. The ABWR PRA assumes that RCIC can operate up to a suppression pool temperature of 76.7 °C (170 °F).

Reactor Building Cooling Water (RCW)/Reactor Service Water (RSW)

The RCW and RSW systems are each designed with two parallel loops in each division. Each loop is capable of removing all component heat loads associated with the operation of the emergency core cooling system (ECCS) pumps. The parallel loops within each division substantially reduce the estimated core damage frequency.

Automatic Standby Liquid Control System (SLCS) and Recirculation Pump Trip

The ABWR has a reliable and diverse scram system with both hydraulic and electric run-in capabilities to reduce the probability of an ATWS. SLCS and recirculation pump trip provide backup reactor shutdown capability. Automatic initiation of SLCS avoids the potential for operator error associated with manual SLCS initiation.

Reactor Internal Pump (RIP) Design and Maintenance

Every shutdown, a selected number of RIPs must be maintained. Maintenance on the secondary RIP seals requires removal of the motor, impeller and shaft, and the temporary bottom cover. The plug on the impeller shaft nozzle is the only protection against a major leak. If the operator were to remove the plug when the bottom cover was removed, the RPV would drain and recovery is improbable. GE has proposed that a new design of the plug be identified that will not allow plug removal with the bottom cover off. A design that solves this problem already exists overseas.

Reactor Building

A flood in the reactor building could fail ECCS equipment and other important equipment. The following are assumptions in the ABWR internal flooding analysis that limit the chances and increase the mitigation capabilities of the ABWR design:

1. The volume of the reactor building corridor on level B3F that surrounds the three ECCS divisions is sufficiently large to handle the biggest break that can occur (water from the suppression pool).

2. Suppression pool flooding in an ECCS room will reach equilibrium level below the ceiling of the ECCS room in which the flood occurred.

3. Floor drains direct potential flood waters to rooms where sumps and sump pumps are located. The drain system is sized to withstand the maximum flood rate from a break in the fire water system. Sizing of the drain system is to include provisions for plugging of some drains by debris.

4. Non-divisional drains will drain to the non-divisional sumps on appropriate floors.

5. Floor B1F of the reactor building has overfill lines on the non-divisional sumps outside secondary containment. If the sump pumps fail or the flow rate exceeds the sump pump capacity, the lines will direct water to the non-divisional corridor of the first floor (B3F) inside secondary containment.

6. A water seal in the overfill line is provided to maintain secondary containment integrity.

7. The ABWR PRA flooding analysis assumes that on the B3F level, all wall and ceiling penetrations are above the maximum water level of all potential floods. Doors communicating from the ECCS pump rooms to the corridor on the B3F level are water tight doors.

8. If a flood were to occur during shutdown, some of the ECCS rooms may be open for maintenance. ABWR procedures specify that one safety division will be maintained intact at all times during shutdown.

Similarly, a fire in the reactor building could damage important equipment. The smoke control system in secondary containment is important in helping to prevent the migration of smoke and hot gas layers from a faulted division to another. This is accomplished by pressurizing the surrounding areas so that the smoke will be contained. This capability and its adequacy should be confirmed.

Control Building

Flooding in the control room can lead to core damage. The following design features are important in preventing flooding in the control building:

1. The ABWR internal flooding analysis assumes that flooding of the control building from the UHS cannot be maintained by gravity alone. To limit the consequences of a RSW line break, the RSW system will be designed so that the UHS cannot drain into the Control Building by gravity.

2. To limit the consequences of a RSW line break, there is a maximum of 4000 meters of pipe (2000 each for supply and return) between the UHS and the RCW/RSW room, which can be discharged to the RCW/RSW room following RSW pump trip.

3. Floor drains direct potential flood waters to rooms where sumps and sump pumps are located. The drain system is sized to withstand the maximum flood rate from a break in the fire water system. Sizing of the drain system is to include provisions for plugging of some drains by debris.

Service Water Pump House

Previous PRAs and reliability studies have shown that loss of service water can be an important contributor to core damage. The service water pump house, which is outside the ABWR certification scope, is a building that must be designed to remove the following concerns:

1. Prevent fires or internal floods from impairing multiple safety trains.

2. Prevent common cause failures such as intake blockage from debris from affecting multiple trains.

Circulating Water System

Flooding from the circulating water system (an unlimited water supply) can lead to flooding of other buildings that do contain safety related equipment. The following design features help reduce the chances that a circulating water system break will cause core damage:

1. The circulating water system (CWS) has three pumps and each pump has an associated motor operated isolation valve. To limit the consequences of a CWS break in the turbine building, for cases where the heat sink is at an elevation higher than grade level of the turbine building, an additional isolation valve is installed in each line.

2. Internal floods are prevented/mitigated in part by automatic actions and operator actions. To prevent flooding of areas surrounding the condenser pit, there are to be water level sensors (two-out-of-four-logic) to alarm to the control room if the water level gets too high in the pit and trip the circulating water and turbine service water pumps and close isolation valves in both systems.

Turbine Service Water System

Flooding from the turbine service water system (TSW) (an unlimited water supply) can lead to flooding of other buildings that do contain safety related equipment. The following design features help reduce the chances that a TSW break will cause core damage:

1. The TSW has two pumps and each pump has an associated motor operated isolation valve. To limit the consequences of a TSW break in the turbine building, for cases where the heat sink is at an elevation higher than grade level of the turbine building, an additional isolation valve is installed in each line.

2. Internal floods are prevented/mitigated in part by automatic actions and operator actions. To prevent flooding of areas surrounding the condenser pit, there are to be water level sensors (two-out-of-four-logic) to alarm to the control room if the water level gets too high in the pit and trip the turbine service water and circulating water pumps and close isolation valves in both systems.

Reactor Service Water System

Flooding from the reactor service water (RSW) system (an unlimited water supply) can lead to core damage. The following design features help reduce the chances that a RSW system break will cause core damage:

1. A break in the RSW system can cause a flood in the control building that could lead to core damage. For this reason, an anti-siphon capability is installed in the RSW lines to prevent uncontrolled flooding of the Control Building should the RSW isolation valves fail to close on a RSW pipe break.

2. Water level sensors will be installed in the reactor building cooling water (RCW)/RSW rooms in the control building. These sensors are used to alert the operators to flooding in the rooms and send signals to trip RSW pumps and close isolation valves in the affected system. The high and low level sensors are diverse from one another and each set is arranged in a two-out-of-four logic.

Reactor Water Cleanup System

The reactor water cleanup (CUW) system provides some benefit in the ABWR PRA by removing decay heat at high pressure. It would only be used in this mode if the containment cooling mode of the RHR system was disabled.

The isolation valves in the RWCU system must be capable of isolating against a differential pressure equal to the operating pressure of the reactor coolant system in the event that there is a LOCA in the RWCU.

The reliability of these isolation valves should match the reliability assumed in the ABWR PRA [COL action item to include in RAP]. Temperature sensitive equipment in the reactor water cleanup system should be able to remain functional or should be isolated when the CUW system is used as a decay heat removal path at high temperatures. Temperature sensitive equipment such as the resin beds is to be isolated automatically on high water temperature or manually by operator action. The entire CUW system is not to isolate on high temperature of the incoming water.

Ultimate Heat Sink

The ABWR PRA assumed that the service water system and the ultimate heat sink (UHS) would work well in tandem to deliver adequate cooling to needed equipment. There was no detailed examination of these systems in the PRA since they are not in the certification scope. The UHS and the service water pump house should be designed in such a manner so that common cause failure of service water is extremely low. A site-specific PRA must be developed by the COL applicant to show that there are no vulnerabilities (e.g., due to debris clogging of the intake, internal or external fires, external or internal floods) in the ultimate heat sink and the service water pump house.

Remote Shutdown Panel

1. The ABWR PRA fire analysis found that use of the remote shutdown panel is very important in mitigating fires in the control room. The design of the remote shutdown panel was enhanced by GE adding controls for a fourth SRV (three needed to depressurize, plus one for a single failure).

2. The ABWR decay heat removal reliability study found that operator actions making use of the remote shutdown panel were important during modes 3, 4, and 5.

Residual Heat Removal System

The residual heat removal (RHR) system is very important for the removal of decay heat during normal shutdown and in its ECCS function as low pressure core flooder. The following design features and assumptions are important for assuring the RHR system is capable of removing decay heat in various modes and for various accident and transients:

1. An important failure mode for beyond design bases earthquakes is the failure of the RHR heat exchanger in such a manner as to drain the suppression pool. In the ABWR PRA-based seismic margins analysis, the RHR heat exchanger is assumed to have a HCLPF of 0.7g.

2. In modes 3, 4, and 5, the permissives and inhibits associated with the RHR Mode switch ensure that valve line ups are correct for most RHR functions, thereby helping to prevent inadvertent diversion of water from the RPV.

3. The ABWR PRA and the DHR reliability study have shown that it is important for the RHR not to fail as an intersystem LOCA. The RHR system has the capability to withstand normal reactor system pressures without the piping reaching its ultimate capacity. The DHR reliability study indicated that RHR valve interlocks are important in preventing low pressure RHR piping from being inadvertently connected to systems at high pressure.

4. The ABWR DHR reliability study determined a number of configurations of equipment for modes 3, 4, and 5 such that the estimated core damage frequency from decay heat removal failure conservatively was less than 1 in a million per year. An important assumption in this study was that the three RHR trains would be configured as follows during modes 3, 4, and 5: one loop would be isolated, in standby, and operable with no equipment in maintenance; a second loop would be the operating decay heat removal loop; the third loop would be in maintenance.

5. Shutdown cooling piping connects to a nozzle in the RPV at an elevation that is above the top of the active fuel. This reduces the chances of uncovering the core by vessel drain down.

High Pressure Core Flood System

1. HPCF pump B can be operated independently of the essential multiplexing system. This feature is an important factor in reducing the chances of the plant going to core damage since this design should reduce the chance of a common cause failure disabling all ECCS pumps.

2. The HPCF pumps will be able to pump water as hot as 171 °C (340 °F).

Three ECCS Trains

The barrier between each of the three safety divisions in the ABWR is at a minimum a 3 hour fire barrier that also resists internal flood pressures. This design assumption significantly reduces the chance of an internal flood or fire propagating and causing core damage.

Piping Upgrades to Prevent ISLOCAs

In SECY-93-087 it was recommended that ALWR designers reduce the possibility of a loss of coolant accident outside of containment by confirming that all systems (to the extent practical) and subsystems connected to the reactor coolant system (RCS) can withstand full RCS pressure. Intersystem LOCAs are a concern because many releases associated with them are not contained, held up, or scrubbed, but rather are released directly to the environment. GE has assured the NRC that the interfacing systems to the RCS can withstand full RCS pressure.

Lack of Recirculation Piping

There are no large pipes (i.e., > 2 inches in diameter) that penetrate the ABWR vessel below the level of the core. This has virtually eliminated loss-of-coolant accidents (LOCAs) as a severe accident concern for the ABWR.

Electrically Driven Control Rod Insertion

In many BWR PRAs, ATWS is a significant contributor to core damage frequency and risk. The diversity (electrically driven) of the fine motion control rod system is important in lowering the estimated core damage frequency for ATWS events for the ABWR.

Electrical Wiring Penetrations

Wiring penetrations between divisions should be rated as three hour fire barriers and should be capable of preventing water/oil from an internal flood from migrating to another division.

DC Power Supply

The ABWR PRA expects that loss of all dc power will lead to core damage. In the ABWR design, seismically induced failure of dc power cable trays or the batteries themselves will prevent the emergency diesel generators from starting and loading. DC power cable trays and the emergency batteries are the only non-building SSCs that could, by themselves, decrease the HCLPF of any accident sequence below 0.5g. This would occur if the HCLPF of the dc power cable trays or the batteries were to fall below

0.5g. The DC cable trays and power supplies should be well anchored and carefully designed to handle a design bases 0.3g earthquake. The ABWR PRA-based seismic margins analysis assumed that the HCLPF of the dc cable trays was 0.7g and the HCLPF of the dc power system (batteries and rectifier) is 0.74g.

Safety System Logic and Control

There are four divisions of self-tested safety system logic and control (SSLC) instrumentation (two-out-of-four logic). The ABWR PRA assumes that this will be a highly reliable configuration to actuate ESF core cooling and heat removal system as well as actuating the CRD scram system for defense against ATWS events. Assumptions about SSLC reliability and redundancy in the PRA substantially reduce the estimated core damage frequency.

Off-line testing for faults not detected by the continuous self-test feature were judged to be important in the PRA analysis.

Fire Truck

The ACIWA makes use of a fire truck connection to provide water if the motor and diesel-driven pumps are unavailable. The PRA assumes the reliability of the fire truck is 0.99.

Reactor Pressure Vessel Isolation on Low Water Level

The ABWR shutdown reliability study indicated that the isolation of lines connected to the RPV on a low water level signal in modes 3, 4, and 5 prevents uncovering of the fuel for many potential RPV drain down events.

Operator Check That Watertight Doors Are Dogged

The internal flooding analysis assumes that all watertight doors are closed and dogged to prevent floods from propagating from one area to another. The watertight doors are alarmed to alert the security that a watertight door is open, but will not alarm to indicate that a door is not dogged. To guard against a door being left undogged, operators should check the doors every shift to confirm that they are closed and dogged.

Suppression Pool Bypass

The suppression pool is an important containment feature for severe accident progression and fission product removal, since releases from the reactor vessel are either directly routed to the pool (e.g., transients with actuation of ADS) or pass through the pool via the drywell-wetwell connecting vents. However, the suppression pool function can be compromised in the ABWR design in the following ways:

- a single failure of a wetwell/drywell vacuum breaker (i.e., a stuck open vacuum breaker), or by excessive leakage of one or more vacuum breakers
- unisolated main steam line breaks
- rupture of the SRV discharge line(s) in the wetwell air space
- inadvertent opening and failure to close sample lines, drywell purge lines, and containment inerting lines
- unisolated LOCAs in the reactor water cleanup and RCIC systems

The following are important to assuring a low risk from wetwell/drywell vacuum breaker bypass, as modelled in the PRA and are to be included in DRAP:

(1) a low probability of vacuum breaker leakage (PRA assumes a leakage probability of 0.18 per demand on system)

(2) a low probability that the vacuum breakers fail to close (PRA assumes a failure to close probability of about 0.0005 per demand per valve)

(3) a high availability of drywell or wetwell sprays (and ACIWA as a backup) to condense steam which bypasses the suppression pool

(4) a position indication switch on each vacuum breaker valve that will indicate the valve to be open should the gap between the disk and seating surface exceed 0.9 cm. (A gap less than 0.9 cm is necessary to permit credit for aerosol plugging taken in the GE analysis.)

(5) placement and shielding of the vacuum breakers such that pool swell associated with COPS actuation will not impact operation of the valves.

In addition, it is important to verify that the vacuum breakers are closed. To achieve this control room alarms will be installed to indicate if all the vacuum breakers are closed. (This reduces the potential for suppression pool bypass by assuring that the plant is not operated with a stuck open vacuum breaker, and that pre-existing leakage paths will be limited to small flow areas.)

The following are important to assuring a low risk from unisolated main steam line breaks:

(1) two air-operated, spring close, failed closed isolation valves in each line.

(2) automatic MSIV actuation by redundant solenoids through two-out-of-four logic.

The following are important to assuring a low risk from rupture of the SRV discharge lines, particularly in seismic events:

(1) discharge lines are designed and fabricated to Quality Group C requirements.

(2) welds in the airspace region of the wetwell are non-destructively examined to the requirements of ASME Section III, Class 2 3. discharge lines are capable of accommodating seismic events at an acceleration level of 0.6g with a high confidence that there is a low probability of failure (HCLPF).

The following is important to assuring a low risk from suppression pool via the sample, drywell purge, and containment inerting lines:

(1) lines will be sealed closed during power operation, and under administrative control.

The following are important to assuring low risk from LOCAs outside containment:

(1) redundant and seismically-qualified CUW system isolation valves, qualified to close under postulated break conditions

(2) blowout panels in the RCIC and RWCU divisional areas which prevent overpressurization and impacts on equipment in adjacent areas and other divisions

(3) reliable seating of redundant feedwater, SLIC, and ECCS discharge check valves

Lower Drywell Design

The design of the ABWR lower drywell/reactor cavity is such that there is a low probability that the cavity will be flooded at the time of reactor vessel failure, but a high probability that the cavity will be flooded subsequent to vessel failure. A dry cavity at the time of vessel failure reduces the potential for large ex-vessel steam explosions, whereas the subsequent flooding of the cavity helps minimize the impact of core concrete interactions.

The following ABWR design features are important to assuring a dry cavity at the time of vessel failure:

(1) lack of any direct pathways by which water from the upper drywell (e.g., from drywell sprays) can drain to the lower drywell, other than by overflow of the suppression pool,

(2) negligible probability of premature or spurious actuation of the passive flooder valves at temperatures less than 500 F or under differential pressures associated with reactor blowdown and pool hydrodynamic loads, and

(3) a capability to accommodate approximately 7.2E5 kg of water in the suppression pool from external sources before the pool overflows into the lower drywell.

The following features are important to assuring reactor pedestal and containment integrity for beyond 24 hours following reactor vessel failure, and to rendering CCI-induced containment failure a relatively insignificant contributor to risk.

(4) a 1.7m thick reactor pedestal capable of withstanding approximately 1.55m of erosion from CCI without loss of structural integrity,

(5) the use of basaltic concrete in the floor of the lower drywell, which minimizes the production of non-condensable gases,

(6) a sump shield to prevent core debris from entering the lower drywell sump, and

(7) the lower drywell flooder system

Note: The lower drywell flooder system in the ABWR provides a passive means of adding water to the lower drywell following reactor vessel breach. This water would cover the core debris, thereby enhancing debris coolability, cooling the drywell, and providing fission product scrubbing. The passive flooder system is a backup to other means of lower drywell water addition in the ABWR, including: (1) continued water addition through the breached reactor vessel and (2) suppression pool overflow as a result of water addition from water sources outside containment. PRA-based sensitivity studies indicate that the incremental risk reduction offered by the passive flooder is system is minimal. This is because of credit taken in the ABWR for continued water addition using the ACIWA mode of RHR.

Containment Ultimate Pressure Capacity

The ultimate pressure capacity of the ABWR containment is limited by the drywell head, whose failure mode is plastic yield of the torispherical dome. Subsequent to the original SSAR submittal, GE increased the ultimate pressure capability of the drywell head from 100 psig to 134 psig, and increased the COPS setpoint from the original value of 80 psig to the final value of 90 psig. The strengthening of the drywell head increases the ability of the containment to withstand rapid pressurization events, such as direct containment heating, without loss of structural integrity, and provides additional margin between the COPS setpoint and the drywell failure pressure, thereby reducing the potential for drywell failure prior to COPS actuation. The drywell head is the limiting component in the containment pressure boundary during slow overpressure events.

Containment Overpressure Protection System (COPS)

COPS is part of the atmospheric control system in the ABWR, and consists of a pair of rupture disks installed in a 10-inch diameter line which connects the wetwell airspace to the stack. COPS provides for a scrubbed release path in the event that containment pressure cannot be maintained below the structural limit of the containment. Without this system, late containment overpressure failures would be expected to occur in the drywell, resulting in unscrubbed releases. COPS provides a significant benefit by reducing the source terms for late releases, and minimizing the potential for containment-failure-induced loss of core cooling (e.g., in Class II sequences). The following are important features of the system, as modelled in the PRA:

(1) COPS actuation at 90 psig +/- 5 percent

(2) piping (and disk) designed to flow steam at a rate equivalent to 2 percent reactor power, and accommodate peak pressure loads associated with system actuation

(3) no normally-closed or automatic isolation valves in vent path

(4) two normally-open, fail-open isolation valves in the vent path, manually operated from the control room, with key-lock switches

(5) capability of related isolation valves to close against full vent pressure.

Containment Inerting System

Because the ABWR containment will be inerted during power operation, hydrogen combustion is not considered to be an important containment challenge, and was not modelled in the PRA.

To confirm the validity of this treatment, strict controls must be placed on the period of time that the reactor can be operated with the containment de-inerted.

Direct Containment Heating (DCH)

DCH is the only severe accident phenomena that represents a significant challenge to containment integrity (5 percent probability of containment failure given reactor vessel failure at high pressure). The impact of DCH is "controlled" in ABWR by reducing the frequency of high pressure reactor vessel failure using ADS (30 percent of vessel failures). The following aspects of ADS should be confirmed by ITAAC and RAP:

(1) reliability/availability consistent with Level 1 PRA assumptions [DRAP],

(2) no dependency on ac-power,

(3) availability of sufficient dc power to actuate ADS in a long term SBO (following loss of RCIC due to battery depletion).

There are no specific ABWR containment design feature to deal with DCH loads other than the general arrangement of the drywell and wetwell, and connecting vents, which provide for a series of 90-degree bends that debris must traverse in order to reach the upper drywell.

Important Human Actions

Human actions with high risk impact for the ABWR were identified based on the PRA and supporting analyses. Section 19D.7 of the SSAR includes a listing of these actions, classified into three categories corresponding to the COL-actions necessary to confirm the validity of the PRA treatment of the action: (1) critical tasks, (2) maintenance items, and (3) COL procedures and planning.

1. The items identified as "critical tasks" in 19D.7, as well as actions to recover emergency diesels, have the greatest impact on core damage frequency and risk for the ABWR. Accordingly:

   - these actions are to be addressed by the COL applicant as part of the detailed design of human-system interfaces

- the following will be provided for each action:

  a. clear unambiguous indication of conditions requiring the action

  b. the operator must have the capability to perform the action in a straight-forward manner

  c. the operator must have clear written operating procedures regarding the actions to be taken

  d. the operator must have thorough training in the conditions requiring the action.

2. The probability of miscalibrating single and multiple sensors was assigned very low values on the basis that the COL-applicant would incorporate a special procedure governing calibration activities. At a minimum, the COL-applicants maintenance procedures for sensor calibration should require that whenever a sensor is found to be out-of-tolerance, before the sensor is recalibrated, the calibration instrument is first checked or an alternate instrument is used to confirm the condition.

3. For items identified as "COL Procedures and Planning" items, the COL-applicant is to develop procedures to confirm that these actions can be effectively implemented.

Importance/Uncertainty Analyses

Examination of the top ten events contributing to uncertainties in the estimate of the ABWR core damage frequency (CDF) revealed that nine of these events were identified by importance analyses as leading contributors to CDF.

The highest contributor to uncertainties in the CDF as well as the CDF estimate was RCIC test and maintenance. The remaining top contributors to uncertainties (and CDF) are listed in SSAR Table 19D.10-5.

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