## CHAPTER 15 - ACCIDENT ANALYSIS

# TABLE OF CONTENTS

### SECTION TITLE

- 15.0 <u>GENERAL INTRODUCTION</u>
- 15.0.1 Analytical Objective
- 15.0.2 Approach to Safety Analysis
- 15.0.2.1 Abnormal Operational Transients
- 15.0.2.2 Design Basis Accidents
- 15.0.3 Reload Licensing Methods

#### 15.1 INCREASE IN HEAT REMOVAL BY THE SECONDARY SYSTEM

- 15.1.1 Decrease in Feedwater Temperature
- 15.1.1.1 Identification of Causes and Frequency Classification
- 15.1.1.2 Event Description
- 15.1.1.3 Assumptions and Initial Conditions
- 15.1.1.4 Results of Analysis
- 15.1.2 Feedwater Controller Failure
- 15.1.2.1 Identification of Causes and Frequency Classification
- 15.1.2.2 Event Description
- 15.1.2.3 Assumptions and Initial Conditions
- 15.1.2.4 Results of Analysis
- 15.1.3 Increase in Steam Flow
- 15.1.3.1 Identification of Causes and Frequency Classification
- 15.1.3.2 Event Description
- 15.1.3.3 Assumptions and Initial Conditions
- 15.1.3.4 Results of Analysis
- 15.1.4 Inadvertent Opening of a Steam Generator Relief/Safety Valve
- 15.1.5 Steam System Piping Failures Outside Containment
- 15.1.5.1 Identification of Causes and Frequency Classification
- 15.1.5.2 Event Description
- 15.1.5.3 Assumptions and Initial Conditions
- 15.1.5.4 Results of Analysis
- 15.1.5.5 Radiological Consequences

#### 15.2 DECREASE IN HEAT REMOVAL BY THE SECONDARY SYSTEM

- 15.2.1 Steam Pressure Regulator Failure
- 15.2.2 Loss of External Load
- 15.2.2.1 Identification of Causes and Frequency Classification
- 15.2.2.2 Event Description
- 15.2.2.3 Assumptions and Initial Conditions

## TABLE OF CONTENTS (cont'd)

- 15.2.2.4 Results of Analysis
- 15.2.3 Turbine Trip (Stop Valve Closure)
- 15.2.3.1 Identification of Causes and Frequency Classification
- 15.2.3.2 Event Description
- 15.2.3.3 Assumptions and Initial Conditions
- 15.2.3.4 Results of Analysis
- 15.2.4 Inadvertent Closure of Main Steam Isolation Valves
- 15.2.4.1 Identification of Causes and Frequency Classification
- 15.2.4.2 Event Description
- 15.2.4.3 Assumptions and Initial Conditions
- 15.2.4.4 Results of Analysis
- 15.2.5 Loss of Condenser Vacuum
- 15.2.6 Loss of All AC Power/Loss of Auxiliary Power
- 15.2.6.1 Loss of All AC Power
- 15.2.6.2 Loss of Auxiliary Power
- 15.2.6.2.1 Identification of Causes and Frequency Classification
- 15.2.6.2.2 Event Description Assumptions
- 15.2.6.2.3 Results of Analysis
- 15.2.7 Loss of Normal Feedwater Flow
- 15.2.7.1 Identification of Causes and Frequency Classification
- 15.2.7.2 Event Description
- 15.2.7.3 Assumptions and Initial Conditions
- 15.2.7.4 Results of Analysis
- 15.2.8 Feedwater Pipe Break
- 15.2.9 Loss of Stator Cooling
- 15.2.9.1 Identification of Causes and Frequency Classification
- 15.2.9.2 Event Description
- 15.2.9.3 Assumptions and Initial Conditions
- 15.9.2.4 Results of Evaluation

## 15.3 DECREASE IN REACTOR COOLANT SYSTEM FLOW RATE

- 15.3.1 Single and Multiple Recirculation Pump Trips
- 15.3.1.1 Identification and Causes and Frequency Classification
- 15.3.1.2 Event Description
- 15.3.1.3 Assumptions and Initial Conditions
- 15.3.1.4 Results of Analysis
- 15.3.2 Recirculation Flow Controller Malfunctions (Flow Decrease)

# TABLE OF CONTENTS (cont'd)

- 15.3.2.1 Identification of Causes and Frequency Classification
- 15.3.2.2 Assumptions and Initial Conditions
- 15.3.2.3 Results of Analysis
- 15.3.3 Recirculation Pump Stall (Shaft Seizure)
- 15.3.3.1 Identification of Causes and Frequency Classification
- 15.3.3.2 Event Description
- 15.3.3.3 Assumptions and Initial Conditions
- 15.3.3.4 Results of Analysis
- 15.3.4 Recirculation Pump Shaft Break
- 15.4 REACTIVITY AND POWER DISTRIBUTION ANOMALIES
- 15.4.1 Uncontrolled Control Rod Withdrawal at Startup/Low Power
- 15.4.1.1 Identification of Causes
- 15.4.1.2 Event Description
- 15.4.1.3 Assumptions and Initial Conditions
- 15.4.1.4 Results of Analuysis
- 15.4.2 Uncontrolled Control Rod Withdrawal at Power
- 15.4.2.1 Identification of Causes and Frequency Classification
- 15.4.2.2 Event Description
- 15.4.2.3 Assumptions and Initial Conditions
- 15.4.2.4 Results of Analysis
- 15.4.3 Control Rod Maloperation (System Malfunction or Operator Error)
- 15.4.4 Startup of an Inactive Loop at an Incorrect Temperature
- 15.4.4.1 Identification of Causes and Frequency Classification
- 15.4.4.2 Event Description
- 15.4.4.3 Assumptions and Initial Conditions
- 15.4.4.4 Results of Analysis
- 15.4.5 Flow Controller Malfunction (Increase in Core Flow)
- 15.4.5.1 Identification of Causes and Frequency Classification
- 15.4.5.2 Event Description
- 15.4.5.3 Assumptions and Initial Conditions
- 15.4.5.4 Results of Analysis
- 15.4.6 Chemical and Volume Control System Malfunctions (PWR)
- 15.4.7 Inadvertent Loading and Operation of a Fuel Assembly in an Improper Position
- 15.4.7.1 Identification of Causes and Frequency Classification
- 15.4.7.2 Event Description
- 15.4.7.3 Assumptions and Initial Conditions
- 15.4.7.4 Results of Analysis
- 15.4.8 Spectrum of Rod Ejection Accidents (PWR)

## TABLE OF CONTENTS (cont'd)

- 15.4.9 Control Rod Drop Analysis
- 15.4.9.1 Identification of Causes and Frequency Classification
- 15.4.9.2 Event Description
- 15.4.9.3 Assumptions and Initial Conditions
- 15.4.9.3.1 Model Parameter and Sensitivities
- 15.4.9.3.2 Basic Conditions for Bounding Analysis
- 15.4.9.3.3 Analytical Methods
- 15.4.9.4 Results of Analysis
- 15.4.9.4.1 Effect of Fuel Densification
- 15.4.9.4.2 Results and Consequences

#### 15.5 INCREASE IN REACTOR COOLANT INVENTORY

- 15.5.1 Inadvertent Operation of ECCS During Power Operation
- 15.5.2 Chemical and Volume Control System Malfunction that Increases Reactor Coolant Inventory
- 15.5.3 Other BWR Transients (Including Items 2.1 through 2.6, and Item 1.2)

#### 15.6 DECREASE IN REACTOR COOLANT INVENTORY

- 15.6.1 Inadvertent Opening of a Safety or Relief Valve
- 15.6.1.1 Identification of Causes and Frequency Classification
- 15.6.1.2 Event Description
- 15.6.1.3 Results of Analysis
- 15.6.2 Break in an Instrument Line or Other Lines from Reactor Coolant Pressure Boundary that Penetrates Containment
- 15.6.3 Steam Generator Tube Failure
- 15.6.4 Steam Line Failures Outside of Containment
- 15.6.5 Loss-of-Coolant Accidents Resulting from the Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary
- 15.6.5.1 Identification of Causes and Frequency Classification
- 15.6.5.2 Event Description
- 15.6.5.3 Input to Analysis
- 15.6.5.3.1 LAMB Analysis
- 15.6.5.3.2 SCAT Analysis
- 15.6.5.3.3 SAFER/CORECOOL/GESTR-LOCA Analysis
- 15.6.5.4 LOCA Evaluation Methods and Models
- 15.6.5.4.1 BWR/2 Generic Analysis
- 15.6.5.4.2 Oyster Creek Specific Analysis
- 15.6.5.5 Break Spectrum Evaluation
- 15.6.5.5.1 Fuel Exposure Considerations

### TABLE OF CONTENTS (cont'd)

- 15.6.5.5.2 Recirculation Line Breaks
- 15.6.5.5.3 Non-Recirculation Line Breaks
- 15.6.5.6 Three or Four Loop Operation
- 15.6.5.6.1 Reduced Core Flow Operation (ELLLA)
- 15.6.5.6.2 Increased Core Flow (ICF)
- 15.6.5.6.3 Feedwater Temperature Reduction (FWTR)
- 15.6.5.7 Technical Specification MAPLHGR Limits
- 15.6.5.8 Radiological Consequences
- 15.6.6 A Number of BWR Transients (Including Items 1.7, 2.8 and 1.3)
- 15.6.6.1 Loss of Normal Feedwater Flow
- 15.6.6.2 Feedwater Piping Break
- 15.6.6.3 Increase in Steam Flow (Pressure Regulator Malfunction)
- 15.7 RADIOACTIVE RELEASE FROM A SUBSYSTEM OR COMPONENT
- 15.7.1 Waste Gas System Rupture Accident
- 15.7.1.1 Analytical Objective
- 15.7.1.2 Assumptions and Initial Conditions
- 15.7.1.3 Results of Analysis
- 15.7.2 Radioactive Liquid Waste System Leak or Failure
- 15.7.3 Postulated Radioactive Releases Due to Liquid Tank Failure
- 15.7.4 Design Basis Fuel Handling Accidents in the Containments
- 15.7.4.1 Identification of Causes and Frequency Classification
- 15.7.4.2 Effect of Fuel Densification
- 15.7.4.3 Methods, Assumptions and Conditions
- 15.7.4.4 Results and Consequences
- 15.7.4.5 Radiological Consequences
- 15.7.5 Spent Fuel Cask Drop Accident
- 15.8 ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)
- 15.8.1 Alternate Rod Injection (ARI) System
- 15.8.2 Standby Liquid Control System (SLCS)
- 15.8.3 Recirculation Pump Trip (RPT)
- 15.9 STATION BLACKOUT
- 15.10 <u>REFERENCES</u>

#### LIST OF TABLES (cont'd)

## TABLE NO. TITLE

#### CHAPTER 15 - ACCIDENT ANALYSIS

#### LIST OF TABLES

#### TABLE NO. TITLE

- 15.1-1 Main Steam Line Break Accident Evaluation Parameters
- 15.4-1 Deleted
- 15.4-2 Rod Drop Accident Evaluation Parameters
- 15.6-1 Operational and ECCS Parameters
- 15.6-2 Single-Failure Evaluation for Oyster Creek
- 15.6-3 Analysis Assumptions for Oyster Creek Calculations
- 15.6-3A Summary of Recirculation Line Break Results Nominal Evaluation
- 15.6-3B Summary of Recirculation Line Break Results Appendix K Evaluation
- 15.6-3C Summary of Recirculation Line Break Results Nominal Evaluation
- 15.6-3D OCGS Appendix K Large and Small Break Results for GE11 Fuel
- 15.6-4 Deleted
- 15.6-4A Four-Loop MAPLHGR Multipliers for P8x8R and GE8x8EB Fuel Types
- 15.6-5 Loss of Coolant Accident Evaluation Parameters
- 15.6-5A Deleted
- 15.6-5B Deleted
- 15.6-5C Deleted
- 15.6-5D Deleted
- 15.6-5E Deleted
- 15.6-5F Deleted
- 15.6-5G Deleted
- 15.6-6 (Deleted in Rev. 4)

# LIST OF TABLES (cont'd)

# TABLE NO. TITLE

- 15.7-1 Dose Summary for Waste Gas System Rupture Accident
- 15.7-2 Fuel handling Accident Evaluation Parameters
- 15A-1-1 Dose Computational Methods-Wind Direction Persistence (One Sector 22-1/20)
- 15A-1-2 Dose Computational Methods-Diffusion Constants Used
- 15A-1-3 Dose Computational Methods Deposition Velocities
- 15A-1-4 Dose Computational Methods Unit Integrated Air Concentration
- 15A-1-5 Dose Computational Methods Integrated Air Concentration Ground Source
- 15A-1-6 Radiobiological Factors for Halogens
- 15A-1-7 Radiobiological Factors for Volatile Solid Radioisotopes
- 15A-1-8 Radiological Factors Dose Computational Methods Nonvolatile Solid Radioisotopes

# CHAPTER 15 - ACCIDENT ANALYSIS

# LIST OF FIGURES

15.1-1	EOC Scram Reactivity
15.1-2	Deleted
15.1-3	Deleted
15.1-4	Pressure Regulator Malfunction
15.2-1	Deleted
15.2-2	Deleted
15.2-3	Deleted
15.2-4	Deleted
15.2-5	Deleted
15.2-6	Deleted
15.2-7	Deleted
15.2-7A	Deleted
15.2-8	Changes in Vessel Pressure – Loss of Feedwater
15.2-9	Changes in Vessel Water Level – Loss of Feedwater
15.3-1	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-2	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-3	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-4	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-5	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-6	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-7	Flow Controller Malfunction (Zero Flow Demand) - Type VB (8 x 8) Exxon Nuclear Fuel

### LIST OF FIGURES (cont'd)

- 15.3-8 Flow Controller Malfunction (Zero Flow Demand) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-9 Flow Controller Malfunction (Zero Flow Demand) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-10 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-11 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-12 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-1 Deleted
- 15.4-2 Idle Loop Startup from 1930 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-3 Idle Loop Startup from 1680 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-4 Idle Loop Startup from 1235 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-5 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-6 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-7 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-8 Accident Reactivity Shape Functions at 20°C
- 15.4-9 Accident Reactivity Shape Functions at 286°C
- 15.4-10 Doppler Reactivity Coefficient vs Average Fuel Temperature as a Function of Exposure and Moderator Condition
- 15.4-11 Scram Reactivity Function for Cold Startup
- 15.4-12 Scram Reactivity Function for Hot Startup
- 15.6-1 Inadvertent Opening of Relief Valve System Response 1930 MWt Plot 1
- 15.6-2 Inadvertent Opening of Relief Valve System Response 1930 MWt Plot 2
- 15.6-3 Nominal and (Appendix K) LOCA Recirculation Line Break Spectrum Comparison

### LIST OF FIGURES (cont'd)

- 15.6-4 DBA DSCG (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-5 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-6 DBA DSCG (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-7 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-8 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-9 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-10 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-11 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-12 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-13 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-14 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-15 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-16 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Oxide Thickness
- 15.6-17 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Water Level in Channel
- 15.6-18 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Reactor Vessel Pressure
- 15.6-19 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Peak Cladding Temperature

### LIST OF FIGURES (cont'd)

- 15.6-20 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
  15.6-21 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
  15.6-22 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
  15.6-23 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
  15.6-24 Eeedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor
- 15.6-24 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-25 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature

## CHAPTER 15 - ACCIDENT ANALYSIS

# TABLE OF CONTENTS

### SECTION TITLE

- 15.0 <u>GENERAL INTRODUCTION</u>
- 15.0.1 Analytical Objective
- 15.0.2 Approach to Safety Analysis
- 15.0.2.1 Abnormal Operational Transients
- 15.0.2.2 Design Basis Accidents
- 15.0.3 Reload Licensing Methods

#### 15.1 INCREASE IN HEAT REMOVAL BY THE SECONDARY SYSTEM

- 15.1.1 Decrease in Feedwater Temperature
- 15.1.1.1 Identification of Causes and Frequency Classification
- 15.1.1.2 Event Description
- 15.1.1.3 Assumptions and Initial Conditions
- 15.1.1.4 Results of Analysis
- 15.1.2 Feedwater Controller Failure
- 15.1.2.1 Identification of Causes and Frequency Classification
- 15.1.2.2 Event Description
- 15.1.2.3 Assumptions and Initial Conditions
- 15.1.2.4 Results of Analysis
- 15.1.3 Increase in Steam Flow
- 15.1.3.1 Identification of Causes and Frequency Classification
- 15.1.3.2 Event Description
- 15.1.3.3 Assumptions and Initial Conditions
- 15.1.3.4 Results of Analysis
- 15.1.4 Inadvertent Opening of a Steam Generator Relief/Safety Valve
- 15.1.5 Steam System Piping Failures Outside Containment
- 15.1.5.1 Identification of Causes and Frequency Classification
- 15.1.5.2 Event Description
- 15.1.5.3 Assumptions and Initial Conditions
- 15.1.5.4 Results of Analysis
- 15.1.5.5 Radiological Consequences

#### 15.2 DECREASE IN HEAT REMOVAL BY THE SECONDARY SYSTEM

- 15.2.1 Steam Pressure Regulator Failure
- 15.2.2 Loss of External Load
- 15.2.2.1 Identification of Causes and Frequency Classification
- 15.2.2.2 Event Description
- 15.2.2.3 Assumptions and Initial Conditions

## TABLE OF CONTENTS (cont'd)

- 15.2.2.4 Results of Analysis
- 15.2.3 Turbine Trip (Stop Valve Closure)
- 15.2.3.1 Identification of Causes and Frequency Classification
- 15.2.3.2 Event Description
- 15.2.3.3 Assumptions and Initial Conditions
- 15.2.3.4 Results of Analysis
- 15.2.4 Inadvertent Closure of Main Steam Isolation Valves
- 15.2.4.1 Identification of Causes and Frequency Classification
- 15.2.4.2 Event Description
- 15.2.4.3 Assumptions and Initial Conditions
- 15.2.4.4 Results of Analysis
- 15.2.5 Loss of Condenser Vacuum
- 15.2.6 Loss of All AC Power/Loss of Auxiliary Power
- 15.2.6.1 Loss of All AC Power
- 15.2.6.2 Loss of Auxiliary Power
- 15.2.6.2.1 Identification of Causes and Frequency Classification
- 15.2.6.2.2 Event Description Assumptions
- 15.2.6.2.3 Results of Analysis
- 15.2.7 Loss of Normal Feedwater Flow
- 15.2.7.1 Identification of Causes and Frequency Classification
- 15.2.7.2 Event Description
- 15.2.7.3 Assumptions and Initial Conditions
- 15.2.7.4 Results of Analysis
- 15.2.8 Feedwater Pipe Break
- 15.2.9 Loss of Stator Cooling
- 15.2.9.1 Identification of Causes and Frequency Classification
- 15.2.9.2 Event Description
- 15.2.9.3 Assumptions and Initial Conditions
- 15.9.2.4 Results of Evaluation

## 15.3 DECREASE IN REACTOR COOLANT SYSTEM FLOW RATE

- 15.3.1 Single and Multiple Recirculation Pump Trips
- 15.3.1.1 Identification and Causes and Frequency Classification
- 15.3.1.2 Event Description
- 15.3.1.3 Assumptions and Initial Conditions
- 15.3.1.4 Results of Analysis
- 15.3.2 Recirculation Flow Controller Malfunctions (Flow Decrease)

# TABLE OF CONTENTS (cont'd)

- 15.3.2.1 Identification of Causes and Frequency Classification
- 15.3.2.2 Assumptions and Initial Conditions
- 15.3.2.3 Results of Analysis
- 15.3.3 Recirculation Pump Stall (Shaft Seizure)
- 15.3.3.1 Identification of Causes and Frequency Classification
- 15.3.3.2 Event Description
- 15.3.3.3 Assumptions and Initial Conditions
- 15.3.3.4 Results of Analysis
- 15.3.4 Recirculation Pump Shaft Break
- 15.4 REACTIVITY AND POWER DISTRIBUTION ANOMALIES
- 15.4.1 Uncontrolled Control Rod Withdrawal at Startup/Low Power
- 15.4.1.1 Identification of Causes
- 15.4.1.2 Event Description
- 15.4.1.3 Assumptions and Initial Conditions
- 15.4.1.4 Results of Analuysis
- 15.4.2 Uncontrolled Control Rod Withdrawal at Power
- 15.4.2.1 Identification of Causes and Frequency Classification
- 15.4.2.2 Event Description
- 15.4.2.3 Assumptions and Initial Conditions
- 15.4.2.4 Results of Analysis
- 15.4.3 Control Rod Maloperation (System Malfunction or Operator Error)
- 15.4.4 Startup of an Inactive Loop at an Incorrect Temperature
- 15.4.4.1 Identification of Causes and Frequency Classification
- 15.4.4.2 Event Description
- 15.4.4.3 Assumptions and Initial Conditions
- 15.4.4.4 Results of Analysis
- 15.4.5 Flow Controller Malfunction (Increase in Core Flow)
- 15.4.5.1 Identification of Causes and Frequency Classification
- 15.4.5.2 Event Description
- 15.4.5.3 Assumptions and Initial Conditions
- 15.4.5.4 Results of Analysis
- 15.4.6 Chemical and Volume Control System Malfunctions (PWR)
- 15.4.7 Inadvertent Loading and Operation of a Fuel Assembly in an Improper Position
- 15.4.7.1 Identification of Causes and Frequency Classification
- 15.4.7.2 Event Description
- 15.4.7.3 Assumptions and Initial Conditions
- 15.4.7.4 Results of Analysis
- 15.4.8 Spectrum of Rod Ejection Accidents (PWR)

## TABLE OF CONTENTS (cont'd)

- 15.4.9 Control Rod Drop Analysis
- 15.4.9.1 Identification of Causes and Frequency Classification
- 15.4.9.2 Event Description
- 15.4.9.3 Assumptions and Initial Conditions
- 15.4.9.3.1 Model Parameter and Sensitivities
- 15.4.9.3.2 Basic Conditions for Bounding Analysis
- 15.4.9.3.3 Analytical Methods
- 15.4.9.4 Results of Analysis
- 15.4.9.4.1 Effect of Fuel Densification
- 15.4.9.4.2 Results and Consequences

#### 15.5 INCREASE IN REACTOR COOLANT INVENTORY

- 15.5.1 Inadvertent Operation of ECCS During Power Operation
- 15.5.2 Chemical and Volume Control System Malfunction that Increases Reactor Coolant Inventory
- 15.5.3 Other BWR Transients (Including Items 2.1 through 2.6, and Item 1.2)

#### 15.6 DECREASE IN REACTOR COOLANT INVENTORY

- 15.6.1 Inadvertent Opening of a Safety or Relief Valve
- 15.6.1.1 Identification of Causes and Frequency Classification
- 15.6.1.2 Event Description
- 15.6.1.3 Results of Analysis
- 15.6.2 Break in an Instrument Line or Other Lines from Reactor Coolant Pressure Boundary that Penetrates Containment
- 15.6.3 Steam Generator Tube Failure
- 15.6.4 Steam Line Failures Outside of Containment
- 15.6.5 Loss-of-Coolant Accidents Resulting from the Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary
- 15.6.5.1 Identification of Causes and Frequency Classification
- 15.6.5.2 Event Description
- 15.6.5.3 Input to Analysis
- 15.6.5.3.1 LAMB Analysis
- 15.6.5.3.2 SCAT Analysis
- 15.6.5.3.3 SAFER/CORECOOL/GESTR-LOCA Analysis
- 15.6.5.4 LOCA Evaluation Methods and Models
- 15.6.5.4.1 BWR/2 Generic Analysis
- 15.6.5.4.2 Oyster Creek Specific Analysis
- 15.6.5.5 Break Spectrum Evaluation
- 15.6.5.5.1 Fuel Exposure Considerations

### TABLE OF CONTENTS (cont'd)

- 15.6.5.5.2 Recirculation Line Breaks
- 15.6.5.5.3 Non-Recirculation Line Breaks
- 15.6.5.6 Three or Four Loop Operation
- 15.6.5.6.1 Reduced Core Flow Operation (ELLLA)
- 15.6.5.6.2 Increased Core Flow (ICF)
- 15.6.5.6.3 Feedwater Temperature Reduction (FWTR)
- 15.6.5.7 Technical Specification MAPLHGR Limits
- 15.6.5.8 Radiological Consequences
- 15.6.6 A Number of BWR Transients (Including Items 1.7, 2.8 and 1.3)
- 15.6.6.1 Loss of Normal Feedwater Flow
- 15.6.6.2 Feedwater Piping Break
- 15.6.6.3 Increase in Steam Flow (Pressure Regulator Malfunction)
- 15.7 RADIOACTIVE RELEASE FROM A SUBSYSTEM OR COMPONENT
- 15.7.1 Waste Gas System Rupture Accident
- 15.7.1.1 Analytical Objective
- 15.7.1.2 Assumptions and Initial Conditions
- 15.7.1.3 Results of Analysis
- 15.7.2 Radioactive Liquid Waste System Leak or Failure
- 15.7.3 Postulated Radioactive Releases Due to Liquid Tank Failure
- 15.7.4 Design Basis Fuel Handling Accidents in the Containments
- 15.7.4.1 Identification of Causes and Frequency Classification
- 15.7.4.2 Effect of Fuel Densification
- 15.7.4.3 Methods, Assumptions and Conditions
- 15.7.4.4 Results and Consequences
- 15.7.4.5 Radiological Consequences
- 15.7.5 Spent Fuel Cask Drop Accident
- 15.8 ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)
- 15.8.1 Alternate Rod Injection (ARI) System
- 15.8.2 Standby Liquid Control System (SLCS)
- 15.8.3 Recirculation Pump Trip (RPT)
- 15.9 STATION BLACKOUT
- 15.10 <u>REFERENCES</u>

#### LIST OF TABLES (cont'd)

## TABLE NO. TITLE

#### CHAPTER 15 - ACCIDENT ANALYSIS

#### LIST OF TABLES

#### TABLE NO. TITLE

- 15.1-1 Main Steam Line Break Accident Evaluation Parameters
- 15.4-1 Deleted
- 15.4-2 Rod Drop Accident Evaluation Parameters
- 15.6-1 Operational and ECCS Parameters
- 15.6-2 Single-Failure Evaluation for Oyster Creek
- 15.6-3 Analysis Assumptions for Oyster Creek Calculations
- 15.6-3A Summary of Recirculation Line Break Results Nominal Evaluation
- 15.6-3B Summary of Recirculation Line Break Results Appendix K Evaluation
- 15.6-3C Summary of Recirculation Line Break Results Nominal Evaluation
- 15.6-3D OCGS Appendix K Large and Small Break Results for GE11 Fuel
- 15.6-4 Deleted
- 15.6-4A Four-Loop MAPLHGR Multipliers for P8x8R and GE8x8EB Fuel Types
- 15.6-5 Loss of Coolant Accident Evaluation Parameters
- 15.6-5A Deleted
- 15.6-5B Deleted
- 15.6-5C Deleted
- 15.6-5D Deleted
- 15.6-5E Deleted
- 15.6-5F Deleted
- 15.6-5G Deleted
- 15.6-6 (Deleted in Rev. 4)

# LIST OF TABLES (cont'd)

# TABLE NO. TITLE

- 15.7-1 Dose Summary for Waste Gas System Rupture Accident
- 15.7-2 Fuel handling Accident Evaluation Parameters
- 15A-1-1 Dose Computational Methods-Wind Direction Persistence (One Sector 22-1/20)
- 15A-1-2 Dose Computational Methods-Diffusion Constants Used
- 15A-1-3 Dose Computational Methods Deposition Velocities
- 15A-1-4 Dose Computational Methods Unit Integrated Air Concentration
- 15A-1-5 Dose Computational Methods Integrated Air Concentration Ground Source
- 15A-1-6 Radiobiological Factors for Halogens
- 15A-1-7 Radiobiological Factors for Volatile Solid Radioisotopes
- 15A-1-8 Radiological Factors Dose Computational Methods Nonvolatile Solid Radioisotopes

# CHAPTER 15 - ACCIDENT ANALYSIS

# LIST OF FIGURES

15.1-1	EOC Scram Reactivity
15.1-2	Deleted
15.1-3	Deleted
15.1-4	Pressure Regulator Malfunction
15.2-1	Deleted
15.2-2	Deleted
15.2-3	Deleted
15.2-4	Deleted
15.2-5	Deleted
15.2-6	Deleted
15.2-7	Deleted
15.2-7A	Deleted
15.2-8	Changes in Vessel Pressure – Loss of Feedwater
15.2-9	Changes in Vessel Water Level – Loss of Feedwater
15.3-1	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-2	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-3	Trip of One Recirculation Pump – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-4	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-5	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-6	Trip of Five Recirculation Pumps – Type VB (8 x 8) Exxon Nuclear Fuel
15.3-7	Flow Controller Malfunction (Zero Flow Demand) - Type VB (8 x 8) Exxon Nuclear Fuel

### LIST OF FIGURES (cont'd)

- 15.3-8 Flow Controller Malfunction (Zero Flow Demand) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-9 Flow Controller Malfunction (Zero Flow Demand) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-10 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-11 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.3-12 Recirculation Pump Stall Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-1 Deleted
- 15.4-2 Idle Loop Startup from 1930 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-3 Idle Loop Startup from 1680 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-4 Idle Loop Startup from 1235 MWt Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-5 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-6 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-7 Flow Controller Malfunction (Maximum Flow Demand from 1025 MWt) Type VB (8 x 8) Exxon Nuclear Fuel
- 15.4-8 Accident Reactivity Shape Functions at 20°C
- 15.4-9 Accident Reactivity Shape Functions at 286°C
- 15.4-10 Doppler Reactivity Coefficient vs Average Fuel Temperature as a Function of Exposure and Moderator Condition
- 15.4-11 Scram Reactivity Function for Cold Startup
- 15.4-12 Scram Reactivity Function for Hot Startup
- 15.6-1 Inadvertent Opening of Relief Valve System Response 1930 MWt Plot 1
- 15.6-2 Inadvertent Opening of Relief Valve System Response 1930 MWt Plot 2
- 15.6-3 Nominal and (Appendix K) LOCA Recirculation Line Break Spectrum Comparison

### LIST OF FIGURES (cont'd)

- 15.6-4 DBA DSCG (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-5 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-6 DBA DSCG (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-7 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-8 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-9 1.0 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-10 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-11 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-12 0.1 Ft<sup>2</sup> DSCG (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-13 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
- 15.6-14 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-15 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
- 15.6-16 DBA DSCG High Exposure (Appendix K) 1 ADS Valve Failure, 2 CS + ADS Available Oxide Thickness
- 15.6-17 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Water Level in Channel
- 15.6-18 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Reactor Vessel Pressure
- 15.6-19 Core Spray Line (Nominal) 1 ADS Valve Failure, 1 CS + ADS Available Peak Cladding Temperature

### LIST OF FIGURES (cont'd)

- 15.6-20 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
  15.6-21 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
  15.6-22 Steam Line Inside Containment (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature
  15.6-23 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Water Level in Channel
  15.6-24 Eeedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor
- 15.6-24 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Reactor Vessel Pressure
- 15.6-25 Feedwater Line (Nominal) 1 ADS Valve Failure, 2 CS + ADS Available Peak Cladding Temperature