
CHAPTER 7— INSTRUMENTATION AND CONTROLS

LIST OF FIGURES

Figure 7.1-1—Chapter 7 Symbol Legend	7.1-77
Figure 7.1-2—U.S. EPR I&C Architecture	7.1-93
Figure 7.1-3—Safety Information and Control System Architecture (Safety-Related Portion)	7.1-94
Figure 7.1-4—Safety Information and Control System Architecture (Non-Safety-Related Portion)	7.1-95
Figure 7.1-5—Process Information and Control System Architecture	7.1-96
Figure 7.1-6—Protection System Architecture.....	7.1-97
Figure 7.1-7—Safety Automation System Architecture	7.1-98
Figure 7.1-8—Priority and Actuator Control System Architecture.....	7.1-99
Figure 7.1-9—Severe Accident I&C System Architecture.....	7.1-100
Figure 7.1-10—Reactor Control, Surveillance, and Limitation System Architecture	7.1-101
Figure 7.1-11—Process Automation System Architecture (Nuclear Island Subsystem).....	7.1-102
Figure 7.1-12—Process Automation System Architecture (Turbine Island and Balance of Plant Subsystem)	7.1-103
Figure 7.1-13—Process Automation System Architecture (Diverse Actuation Subsystem).....	7.1-104
Figure 7.1-14—Measuring Ranges of Excore Instrumentation.....	7.1-105
Figure 7.1-15—Excore Instrument Detector Locations.....	7.1-106
Figure 7.1-16—Boron Concentration Measurement System Arrangement	7.1-107
Figure 7.1-17—Implementation of Defense-In-Depth	7.1-108
Figure 7.1-18—Implementation of Diversity.....	7.1-109
Figure 7.1-19—Implementation of Independence Between Redundant Divisions.....	7.1-110
Figure 7.1-20—Implementation of Independence Between Safety and Non-Safety I&C	7.1-111
Figure 7.1-21—Levels of Defense for Cybersecurity	7.1-112
Figure 7.2-1—Typical RT Actuation.....	7.2-33

Figure 7.2-2—Typical SPND-based RT Actuation.....	7.2-34
Figure 7.2-3—Manual RT	7.2-35
Figure 7.2-4—Safety Related RT Devices.....	7.2-36
Figure 7.2-5—Low DNBR	7.2-37
Figure 7.2-6—Low DNBR	7.2-38
Figure 7.2-7—High Linear Power Density	7.2-39
Figure 7.2-8—High Neutron Flux Rate of Change.....	7.2-40
Figure 7.2-9—High Core Power Level & Low Saturation Margin.....	7.2-41
Figure 7.2-10—Low RCS Flow	7.2-42
Figure 7.2-11—Low - Low RCS Flow	7.2-43
Figure 7.2-12—Low RCP Speed	7.2-44
Figure 7.2-13—High Neutron Flux.....	7.2-45
Figure 7.2-14—Low Doubling Time	7.2-46
Figure 7.2-15—High Pressurizer Pressure & Low Pressurizer Pressure	7.2-47
Figure 7.2-16—High Pressurizer Level.....	7.2-48
Figure 7.2-17—Low Hot Leg Pressure	7.2-49
Figure 7.2-18—SG Pressure Drop.....	7.2-50
Figure 7.2-19—Low SG Pressure.....	7.2-51
Figure 7.2-20—High SG Pressure	7.2-52
Figure 7.2-21—Low SG Level.....	7.2-53
Figure 7.2-22—High SG Level.....	7.2-54
Figure 7.2-23—High Containment Pressure.....	7.2-55
Figure 7.2-24—RT Signal Generation	7.2-56
Figure 7.2-25—Permissive P2.....	7.2-57
Figure 7.2-26—Permissive P3.....	7.2-58
Figure 7.2-27—Permissive P5.....	7.2-59
Figure 7.2-28—Permissive P6.....	7.2-60
Figure 7.2-29—Permissive P7	7.2-61
Figure 7.2-30—Permissive P8.....	7.2-62
Figure 7.2-31—Permissive P12.....	7.2-63
Figure 7.2-32—Permissive P13.....	7.2-64
Figure 7.2-33—Permissive P14.....	7.2-65

Figure 7.2-34—Permissive P15	7.2-66
Figure 7.2-35—Permissive P16	7.2-67
Figure 7.2-36—Permissive P17	7.2-68
Figure 7.3-1—Typical ESF Actuation.....	7.3-38
Figure 7.3-2—SIS Actuation	7.3-39
Figure 7.3-3—EFWS Actuation.....	7.3-40
Figure 7.3-4—EFWS SG Level Control and Pump Flow Protection	7.3-41
Figure 7.3-5—EFWS Isolation	7.3-42
Figure 7.3-6—EFWS Actuators (Div. 1&2)	7.3-43
Figure 7.3-7—EFWS Actuators (Div. 3&4)	7.3-44
Figure 7.3-8—Partial Cooldown Actuation.....	7.3-45
Figure 7.3-9—MSRT Setpoint Formation	7.3-46
Figure 7.3-10—MSRT Opening (Div. 1&2)	7.3-47
Figure 7.3-11—MSRT Opening (Div. 3&4)	7.3-48
Figure 7.3-12—MSRCV Control	7.3-49
Figure 7.3-13—MSRT Isolation	7.3-50
Figure 7.3-14—MSIV Isolation (Div. 1&2).....	7.3-51
Figure 7.3-15—MSIV Isolation (Div. 3&4).....	7.3-52
Figure 7.3-16—MFWS Isolation - Full Load.....	7.3-53
Figure 7.3-17—MFWS Isolation - SSS	7.3-54
Figure 7.3-18—MFW Actuators (Div. 1&2)	7.3-55
Figure 7.3-19—MFW Actuators (Div. 3&4)	7.3-56
Figure 7.3-20—Containment Isolation	7.3-57
Figure 7.3-21—CVCS Isolation.....	7.3-58
Figure 7.3-22—Anti-Dilution.....	7.3-59
Figure 7.3-23—EDG Actuation	7.3-60
Figure 7.3-24—PSV Opening	7.3-61
Figure 7.3-25—SG Isolation (Div. 1&2)	7.3-62
Figure 7.3-26—SG Isolation (Div. 3&4)	7.3-63
Figure 7.3-27—RCP Trip	7.3-64
Figure 7.3-28—MCR Isolation and Filtering.....	7.3-65
Figure 7.3-29—Turbine Trip on Reactor Trip Confirmation	7.3-66

Figure 7.6-1—CCWS Switchover Valves Interlock	7.6-9
Figure 7.6-2—CCWS Containment Isolation Valves Interlock.....	7.6-10
Figure 7.7-1—Average Coolant Temperature Control Logic	7.7-28
Figure 7.7-2—Rod Speed Control Program.....	7.7-29
Figure 7.7-3—RCS Pressure Setpoints	7.7-30
Figure 7.7-4—Pressurizer Level Setpoints	7.7-31
Figure 7.7-5—Steam Generator Level Setpoints.....	7.7-32
Figure 7.8-1—RT on High Neutron Flux	7.8-13
Figure 7.8-2—Safety Injection Actuation	7.8-14
Figure 7.8-3—EFW Actuation	7.8-15
Figure 7.8-4—Containment Isolation	7.8-16