



TABLE OF CONTENTS

	<u>Section</u>	<u>Page</u>
1.0	INTRODUCTION AND DESCRIPTION	1-1
1.1	Introduction	1-1
	1.1.1 Corporate Entities, Business, and Experience	1-1
	1.1.2 Plant Location	1-2
	1.1.3 Existing Facilities	1-3
	1.1.4 Fuel Type and Exposure	1-4
1.2	General Plant Description	1-5
	1.2.1 Site Characteristics	1-5
	1.2.2 Facility Descriptions	1-7
1.3	Fuel Storage Operations	1-9
	1.3.1 Receiving and Cleaning the Cask	1-9
1.4	Support Systems	1-10
	1.4.1 Radwaste System	1-10
	1.4.2 Ventilation System	1-11
	1.4.3 Basin Water Cleanup and Cooling Systems	1-12
	1.4.4 Leak Detection and Sump Systems	1-15
	1.4.5 Sewage Systems	1-16
	1.4.6 Energy Systems	1-17
1.5	Radiological and Other Monitoring	1-17
1.6	Emergency Provisions	1-17
1.7	References	1-17
2.0	SUMMARY SAFETY ANALYSIS	2-1
3.0	SITE CHARACTERISTICS	3-1
3.1	Introduction	3-1
3.2	Geography and Demography of Site	3-1
	3.2.1 Site Location	3-1
	3.2.2 Site Description	3-1
	3.2.3 Population, Distribution and Trends	3-4
	3.2.4 Users of Nearby Land and Waters	3-6
3.3	Nearby Industrial, Transportation and Military Facilities	3-9
	3.3.1 Nearby Nuclear Facilities	3-10
	3.3.2 Industrial and Military	3-10
	3.3.3 Transportation	3-11
3.4	Meteorology	3-12
	3.4.1 Regional Climatology	3-12
	3.4.2 Local Meteorology	3-15
	3.4.3 On-Site Meteorological Measurement Program	3-17
	3.4.4 Atmospheric Diffusion Characteristics	3-19
3.5	Surface Hydrology	3-20
	3.5.1 Surface Features and Drainage Patterns	3-20



	<u>Section</u>	<u>Page</u>
	3.5.2 Site Flood Potential	3-21
	3.5.3 Surface Water Quality	3-22
3.6	Subsurface Hydrology	3-23
	3.6.1 Regional and Area Characteristics	3-23
	3.6.2 Site Characteristics	3-24
	3.6.3 Groundwater Investigation - 1977	3-25
3.7	Geology and Seismology	3-27
	3.7.1 Geologic Studies	3-27
	3.7.2 Regional and Tract Geology	3-29
	3.7.3 Investigation of Faults	3-31
	3.7.4 Earthquake and Seismicity	3-35
	3.7.5 Earthquake Design Basis	3-36
3.8	Transportation of Irradiated Fuel	3-36
3.9	Summary of Site Conditions Affecting Facility Operating Requirements	3-37
	3.9.1 Meteorology	3-37
	3.9.2 Hydrology	3-37
	3.9.3 Geology and Seismology	3-38
3.10	References	3-38
4.0	DESIGN CRITERIA AND COMPLIANCE	4-1
4.1	Introduction	4-1
	4.1.1 Material to be Stored	4-1
	4.1.2 Storage Conditions	4-2
4.2	Structural and Mechanical Safety Criteria	4-4
	4.2.1 Wind and Tornado Loadings	4-5
	4.2.2 Tornado Missile Protection	4-5
	4.2.3 Water Level (Flood) Design	4-5
	4.2.4 Seismic Design	4-6
	4.2.5 Combined Loads	4-17
	4.2.6 Subsurface Hydrostatic Loadings	4-20
	4.2.7 Basin Water Cooling	4-21
4.3	Safety Protection Systems	4-21
	4.3.1 General	4-21
	4.3.2 Protection by Multiple Confinement Barriers & Systems	4-21
	4.3.3 Building Ventilation	4-22
	4.3.4 Protection by Equipment and Instrumentation	4-22
	4.3.5 Nuclear Criticality Safety	4-23
	4.3.6 Radiological Protection	4-24
	4.3.7 Fire and Explosion Protection	4-27
	4.3.8 Fuel Handling and Storage	4-27
	4.3.9 Radioactive Waste Treatment	4-27
	4.3.10 Utility Systems	4-28
4.4	Classification of Structures, Components, and Systems	4-28
	4.4.1 Intensity of Natural Phenomena	4-28
4.5	Decommissioning	4-28



	<u>Section</u>	<u>Page</u>
	4.5.1 Criterion	4-29
	4.5.2 Compliance	4-29
4.6	References	4-30
5.0	FACILITY DESIGN AND DESCRIPTION	5-1
5.1	Introduction	5-1
5.2	Controlled, Restricted, and Property Protection	5-1
	5.2.1 Restricted and Protected Areas	5-1
	5.2.2 Gates	5-3
5.3	Principal Structure	5-3
	5.3.1 Main Building Design Basis	5-3
	5.3.2 Fuel Storage Facility Layout	5-3
5.4	Cask Handling and Fuel Storage Systems	5-5
	5.4.1 Cask Receiving Area	5-5
	5.4.2 Decontamination Area	5-5
	5.4.3 Cask Unloading Pit	5-6
	5.4.4 Fuel Storage System	5-10
5.5	Fuel Storage Basins and Systems	5-14
	5.5.1 Storage Basin Description	5-15
	5.5.2 Basin Water Clean-Up System	5-19
	5.5.3 Basin Water Cooling System	5-22
	5.5.4 Ventilation Exhaust System	5-23
	5.5.5 Main (Process) Building Facilities	5-25
5.6	Waste Vaults	5-31
	5.6.1 Cladding Vault	5-32
5.7	Support Facilities	5-33
	5.7.1 Utility and Service Building	5-33
5.8	Utility Systems	5-34
	5.8.1 Water Supply	5-34
	5.8.2 Electrical Supply	5-35
	5.8.3 Site Natural Gas Supply	5-37
	5.8.4 Sewer Systems	5-37
	5.8.5 Rail Transportation Facilities	5-37
5.9	Items Requiring Further Development	5-38
5.10	References	5-38
6.0	WASTE MANAGEMENT	6-1
6.1	Underground Waste Vaults	6-1
	6.1.1 Dry Chemical Vault	6-1
	6.1.2 LAW Vault	6-1
	6.1.3 Cladding Vault	6-1
6.2	Radwaste System	6-1
6.3	Solid Radioactive Waste	6-1
6.4	Nonradioactive Waste	6-1



	<u>Section</u>	<u>Page</u>
7.0	RADIATION PROTECTION	7-1
7.1	Introduction	7-1
7.2	Maintaining Occupational Radiation Exposures ALARA	7-1
7.3	Radiation Sources	7-1
	7.3.1 Irradiated Fuel	7-1
	7.3.2 Storage Basin Water	7-2
	7.3.3 Airborne Radioactive Material Sources	7-6
7.4	Radiation Protection Design Features	7-7
	7.4.1 Facility Design Features	7-7
	7.4.2 Shielding	7-7
	7.4.3 Ventilation	7-8
	7.4.4 Airborne Effluent Monitoring Instrumentation	7-9
	7.4.5 Radiation Monitors	7-10
7.5	Personnel Exposure Assessment	7-12
7.6	Health Physics Program	7-13
7.7	Estimated Man-Rem Off-Site Dose Assessment	7-13
	7.7.1 Effluent and Environmental Monitoring Program	7-13
	7.7.2 Estimated Exposures	7-18
	7.7.3 Liquid Releases	7-19
7.8	References	7-19
8.0	ACCIDENT SAFETY ANALYSIS	8-1
8.1	Introduction	8-1
	8.1.1 Release Pathways	8-1
	8.1.2 Accident Description/Discussion	8-2
	8.1.3 Exposure Paths	8-3
8.2	Loss of Fuel Basin Cooling	8-3
	8.2.1 Basin Water Temperature	8-3
8.3	Drainage of Fuel Basins	8-3
	8.3.1 Basin Liner Rupture Experience	8-4
8.4	Cask Drop into the Cask Unloading Basin	8-4
8.5	Fuel Drop Accidents	8-4
	8.5.1 Fuel Bundle Drop Accident	8-8
	8.5.2 Fuel Basket Drop Accident	8-10
	8.5.3 Recovery Practice	8-11
8.6	Tornado-Generated Missile Accident	8-11
	8.6.1 Accident Analysis	8-12
	8.6.2 Assumptions	8-13
	8.6.3 Dose Rate Calculations	8-14
8.7	Chiller System Leak	8-14
8.8	Criticality Accident	8-14
	8.8.1 Fuel Handling Procedures	8-15
	8.8.2 Reactivity Calculations	8-15
	8.8.3 Missile Impact	8-16
	8.8.4 Consequences of a Criticality Accident	8-17



	<u>Section</u>	<u>Page</u>
8.9	References	8-21
9.0	CONDUCT OF OPERATIONS	9-1
9.1	Introduction	9-1
9.2	Corporate Organization	9-1
	9.2.1 Organization Functions, Responsibilities, and Authorities	9-2
	9.2.2 GENE MVO Components	9-2
	9.2.3 Morris Operation Organization	9-3
	9.2.4 Safety Committee	9-4
9.3	Training Programs	9-4
	9.3.1 Operator Qualification, Training, and Certification	9-5
	9.3.2 Trained and Certified Personnel	9-5
9.4	Normal Operations	9-5
	9.4.1 Facility Procedures	9-5
	9.4.2 Records and Reports	9-7
	9.4.3 Facility Modification	9-7
	9.4.4 Changes, Tests, and Experiments	9-8
9.5	Emergency Plan	9-9
	9.5.1 Purpose and Scope	9-9
	9.5.2 Responsibilities	9-9
	9.5.3 Action Procedures	9-10
	9.5.4 Activation of Emergency Organization	9-10
9.6	Decommissioning	9-11
10.0	OPERATION SPECIFICATIONS	10-1
10.1	Introduction	10-1
	10.1.1 Definitions	10-1
10.2	Functional and Operating Limits	10-1
	10.2.1 Authorized Materials	10-1
	10.2.2 Fuel Storage Provisions	10-3
10.3	Limiting Conditions	10-3
	10.3.1 Limiting Condition – Water Shield	10-3
	10.3.2 Limiting Condition – Criticality	10-3
10.4	Surveillance Requirements	10-4
	10.4.1 Effluent Air	10-4
	10.4.2 Holding Basins	10-4
	10.4.3 Sealed Sources	10-4
	10.4.4 Instrumentation	10-5
	10.4.5 Basin Water Chemical Characteristics	10-5
	10.4.6 Basin Water Radioactive Contaminants	10-6
10.5	Design Features	10-6
	10.5.1 Fuel Storage Basin	10-6
	10.5.2 Fuel Storage System	10-6



<u>Section</u>	<u>Page</u>
10.6 Administrative Controls	10-7
10.6.1 Control	10-7
10.6.2 Organization	10-8
10.6.3 Plans and Procedures	10-8
10.6.4 Review and Audit	10-8
10.6.5 Action Required for Specification Noncompliance	10-9
10.6.6 Logs, Records and Reports	10-10
10.7 References and Notes	10-10
10.8 Environmental Monitoring Program	10-10
10.9 Annual Environmental Report	10-11
11.0 QUALITY ASSURANCE	11-1
11.1 Introduction	11-1
11.2 Quality Assurance History	11-1
11.3 Structures, Systems, and Components Important to Safety	11-1

APPENDICES

A. See Index following divider	A-i
B. See Index following divider	B-i

TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
3-1	Cities Greater than 1,000 Population Within 30 Miles of Morris Operation	3-8
3-2	Nuclear Reactors Within 50 Miles of Morris Operation	3-10
3-3	Industrial, Transportation, and Military Activities (6-mile Radius)	3-11
3-4	VOR-Joliet Flights, September 1979	3-12
3-5	Local Temperature Data (°F) for Morris, Illinois	3-13
3-6	Total Precipitation and Total Snowfall (in.) for Morris and Joliet, Illinois	3-13
3-7	Thunderstorm Activity	3-16
3-8	Joint Frequency Distribution of Pasquill Stability Class and Wind Direction, Dresden 150-ft Level (percent of total observations)	3-18



<u>Table</u>	<u>Title</u>	<u>Page</u>
3-9	Stability, Frequency, and Wind Speed	3-19
3-10	Characteristics of the Illinois River at Morris, Illinois	3-22
3-11	Characteristics of the Kankakee River at Wilmington, Illinois	3-23
3-12	Water Analysis - Morris Operation Well	3-26
3-13	Microscopic Particle Size Distribution - Morris Operation Well Water	3-27
3-14	Morris Operation Site Investigations	3-28
4-1	Spent Fuel Fission Product Activity (2 pages)	4-2
4-2	Analyses, Fuel Exposures, and Cooling Times	4-4
4-3	Codes, Guides, and Standards	4-29
5-1	Typical Isotope Concentrations in Basin Water	5-22
5-2	Central Alarm Station Monitoring of Fuel Storage Functions (4 pages)	5-26
7-1	Fission Product Activity (2 pgs)	7-2
7-2	Gamma Energy Spectrum (E) for Fuel in Storage - Volumetric Source (S_v)	7-4
7-3	Morris Operation Radiological Monitoring Program	7-14
8-1	List of Tornado-Generated Missiles	8-12
8-2	Velocities and Kinetic Energies of Missiles in Water when Entering Fuel Pool in a Vertical Position	8-13
8-3	Prompt Fission Gamma-Ray Spectra	8-20
8-4	Dose, mR, per Fission, at Basin Surface	8-21

FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1-1	General Location - Morris Operation	1-2
1-2	General Electric Tract and Vicinity	1-3



1-3	Principal Facilities - Site Area	1-4
1-4	Schematic - Morris Operation Basin Facilities	1-9
1-5a	Radwaste System	1-10
1-5b	Basin Filter Spent Resin System	1-11
1-6	Ventilation System	1-12
1-7	Basin Water Cleanup System	1-13
1-8	Basin Water Cooling System	1-14
1-9	Basin Water Heat Pump Cooling System - Simplified Schematic	1-15
1-10	Leak Detection, Empty-Out and Sampling System	1-16
1-11	Sewage Systems	1-16
3-1	Topographic Map - GE Tract and Vicinity	3-2
3-2	Contour Map - Morris Operation	3-3
3-3	Estimated Population Within a 5-Mile Radius of Morris Operation - 1990	3-5
3-4	Projected 2015 Population Within a Five Mile Radius of Morris Operation	3-5
3-5	Estimated 1990 Population Within a 5-50 Mile Radius of Morris Operation	3-6
3-6	Estimated 1990 Population Within a 5-50 Mile Radius of Morris Operation	3-6
3-7	DELETED	
3-8	Annual Wind Rose at 35-ft Level at DNPS Site	3-15
3-9	Major Regional Geologic Structures	3-30
3-10	Generalized Stratigraphic Column for the Morris Operation Site	3-32
3-11	Correlation of Angle Boring and Trench Data	3-34
3-12	Map of the U.S. Showing Zones of Approximate Equal Seismic Probability	3-36
4-1	Spectra Comparison - 0.10G Ground Acceleration: RG 1.60 versus EI Centro 1940 N-S	4-7



<u>Figure</u>	<u>Title</u>	<u>Page</u>
4-2	Spectra Comparison - 0.20G Ground Acceleration: RG 1.60 versus El Centro 1940 N-S	4-8
4-3	El Centro Accelerogram	4-9
4-4	Response Acceleration Spectrum - Morris Operation - Main Building, Ground Motion, Damping Ratio = 0.005	4-11
4-5	Response Acceleration Spectrum - Morris Operation - Main Building, Ground Motion, Damping Ratio = 0.010	4-11
4-6	Response Acceleration Spectrum - Morris Operation - Main Building, Ground Motion, Damping Ratio = 0.020	4-12
4-7	Hydrodynamic Constants for Rectangular and Cylindrical Tanks	4-12
4-8	Vertical and Horizontal Design Response Spectra for Nuclear Power Plants	4-15
5-1	Site Plan Showing Principal Facilities	5-2
5-5	Unloading Pit Doorway Guard	5-8
5-6	BWR Fuel Grapple	5-9
5-7	PWR Fuel Grapple	5-9
5-8	Morris Fuel Storage System	5-12
5-9	Typical Grid Assembly	5-13
5-10	Details of Storage Basket Lock Mechanism	5-14
5-11	Excavation at Morris Operation and Foundation Construction	5-16
5-12	Stainless Steel Basin Liners	5-18
5-15	Basin Filter Controls	5-21
7-1	History of Morris Operation Basin Water Activity	7-5
7-2	Radiation Monitor Location	7-11
7-3	TLD Sampling Locations	7-15
7-4	Monitoring Well Locations	7-16



<u>Figure</u>	<u>Title</u>	<u>Page</u>
7-5	Environmental Water Sample Locations	7-17
8-1	Event Diagram of Postulated Accidents	8-2
8-2	Kr-85 Activity as Function of Cooling Time for Different Fuel Exposures (Total Inventory in Fuel Rod)	8-5
8-3	Iodine, Krypton, and Xenon Decay	8-6
8-4	PWR Fuel Bundle Array at 2-inch Separation	8-16
8-5	Close-Packed Array of Four PWR Bundles	8-17
9-1	Morris Operation Relationship to GE Corporate Office	9-1
9-2	Morris Operation Organization Chart	9-3