

Master Table of Contents

<u>Section</u>	<u>Title</u>	<u>Page</u>
CHAPTER 1		
THE FACILITY		
1.1	INTRODUCTION	1-1
1.2	SUMMARY AND CONCLUSIONS ON PRINCIPAL SAFETY CONSIDERATIONS.....	1-2
1.3	GENERAL DESCRIPTION OF THE FACILITY	1-8
1.4	SHARED FACILITIES AND EQUIPMENT.....	1-13
1.5	COMPARISON WITH SIMILAR FACILITIES.....	1-14
1.6	SUMMARY OF OPERATIONS	1-18
1.7	COMPLIANCE WITH THE NUCLEAR WASTE POLICY ACT OF 1982	1-19
1.8	FACILITY MODIFICATIONS AND HISTORY	1-20
1.9	REFERENCES	1-21
CHAPTER 2		
SITE CHARACTERISTICS		
2.1	GEOGRAPHY AND DEMOGRAPHY	2.1-1
2.2	NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES.....	2.2-1
2.3	METEOROLOGY.....	2.3-1
2.4	HYDROLOGY	2.4-1
2.5	GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING.....	2.5-1
2.6	REFERENCES	2.6-1
CHAPTER 3		
DESIGN OF STRUCTURES, SYSTEMS, AND COMPONENTS		
3.1	DESIGN CRITERIA	3-1
3.2	METEOROLOGICAL DAMAGE	3-19
3.3	WATER DAMAGE	3-22
3.4	SEISMIC DAMAGE	3-25
3.5	SYSTEMS AND COMPONENTS	3-45
3.5a	IRRADIATION FACILITY.....	3-57
3.5b	RADIOISOTPE PRODUCTION FACILITY	3-94
3.6	REFERENCES	3-107
CHAPTER 4		
IRRADIATION UNIT AND RADIOISOTOPE PRODUCTION FACILITY DESCRIPTION		
4a1	HETEROGENEOUS REACTOR DESCRIPTION	4a1-1
4a2	IRRADIATION FACILITY DESCRIPTION.....	4a2-1
4a2.1	SUMMARY DESCRIPTION	4a2-2
4a2.2	SUBCRITICAL ASSEMBLY	4a2-6

4a2.3	NEUTRON DRIVER	4a2-20
4a2.4	TARGET SOLUTION VESSEL AND LIGHT WATER POOL	4a2-26
4a2.5	IRRADIATION FACILITY BIOLOGICAL SHIELD	4a2-32
4a2.6	NUCLEAR DESIGN	4a2-37
4a2.7	THERMAL HYDRAULIC DESIGN	4a2-51
4a2.8	GAS MANAGEMENT SYSTEM.....	4a2-56
4a2.9	REFERENCES	4a2-62
4b	RADIOISOTOPE PRODUCTION FACILITY DESCRIPTION.....	4b-1
4b.1	FACILITY AND PROCESS DESCRIPTION	4b-2
4b.2	RADIOISOTOPE PRODUCTION FACILITY BIOLOGICAL SHIELD.....	4b-13
4b.3	RADIOISOTOPE EXTRACTION SYSTEM	4b-18
4b.4	SPECIAL NUCLEAR MATERIAL PROCESSING AND STORAGE	4b-27
4b.5	REFERENCES	4b-56

CHAPTER 5 COOLING SYSTEMS

5a1	HETEROGENEOUS REACTOR COOLING SYSTEMS.....	5a1-1
5a2	IRRADIATION UNIT COOLING SYSTEMS.....	5a2-1
5a2.1	SUMMARY DESCRIPTION	5a2-2
5a2.2	PRIMARY COOLING SYSTEM	5a2-4
5a2.3	SECONDARY COOLING SYSTEM.....	5a2-13
5a2.4	PRIMARY COOLANT CLEANUP	5a2-20
5a2.5	PRIMARY COOLANT MAKEUP WATER SYSTEM	5a2-22
5a2.6	NITROGEN-16 CONTROL	5a2-25
5a2.7	AUXILIARY SYSTEMS USING PRIMARY COOLANT	5a2-26
5a2.8	REFERENCES	5a2-27
5b	RADIOISOTOPE PRODUCTION FACILITY COOLING SYSTEMS.....	5b-1

CHAPTER 6 ENGINEERED SAFETY FEATURES

6a1	HETEROGENEOUS REACTOR ENGINEERED SAFETY FEATURES.....	6a1-1
6a2	IRRADIATION FACILITY ENGINEERED SAFETY FEATURES	6a2-1
6a2.1	SUMMARY DESCRIPTION	6a2-2
6a2.2	IRRADIATION FACILITY ENGINEERED SAFETY FEATURES DETAILED DESCRIPTION.....	6a2-4
6a2.3	EMERGENCY COOLING SYSTEM	6a2-10
6a2.4	IRRADIATION FACILITY ENGINEERED SAFETY FEATURES TECHNICAL SPECIFICATIONS.....	6a2-11
6a2.5	REFERENCES	6a2-12
6b	RADIOISOTOPE PRODUCTION FACILITY ENGINEERED SAFETY FEATURES.....	6b-1
6b.1	SUMMARY DESCRIPTION ENGINEERED SAFETY FEATURES	6b-1
6b.2	RADIOISOTOPE PRODUCTION FACILITY ENGINEERED SAFETY FEATURES.....	6b-3
6b.3	NUCLEAR CRITICALITY CONTROL	6b-11
6b.4	REFERENCES	6b-23

**CHAPTER 7
INSTRUMENTATION AND CONTROL SYSTEMS**

7a1	HETEROGENEOUS REACTOR INSTRUMENT & CONTROL SYSTEMS.....	7a1-1
7a2	IRRADIATION FACILITY INSTRUMENT & CONTROL SYSTEMS	7a2-1
7a2.1	SUMMARY DESCRIPTION.....	7a2-1
7a2.2	DESIGN OF INSTRUMENTATION AND CONTROL SYSTEMS	7a2-3
7a2.3	TSV PROCESS CONTROL DESCRIPTION	7a2-31
7a2.4	TSV REACTIVITY PROTECTION SYSTEM	7a2-33
7a2.5	ENGINEERED SAFETY FEATURES ACTUATION SYSTEM	7a2-37
7a2.6	CONTROL CONSOLE AND DISPLAY INFORMATION.....	7a2-40
7a2.7	RADIATION MONITORING SYSTEMS.....	7a2-43
7a2.8	REFERENCES	7a2-47
7b	RADIOISOTOPE PRODUCTION FACILITY INSTRUMENT & CONTROL SYSTEM	7b-1
7b.1	SUMMARY DESCRIPTION.....	7b-1
7b.2	DESIGN OF INSTRUMENTATION AND CONTROL SYSTEMS	7b-2
7b.3	PRODUCTION FACILITY PROCESS CONTROL SYSTEMS	7b-29
7b.4	ENGINEERED SAFETY FEATURE AND ALARMING.....	7b-31
7b.5	CONTROL CONSOLE AND DISPLAY INSTRUMENTATION	7b-35
7b.6	RADIATION MONITORING SYSTEMS.....	7b-37
7b.7	REFERENCES	7b-38

**CHAPTER 8
ELECTRIC POWER SYSTEMS**

8a1	HETEROGENEOUS REACTOR ELECTRICAL POWER SYSTEMS	8a1-1
8a2	IRRADIATION UNIT ELECTRICAL POWER SYSTEMS	8a2-1
8a2.1	NORMAL ELECTRICAL POWER SYSTEMS	8a2-1
8a2.2	EMERGENCY ELECTRICAL POWER SYSTEMS.....	8a2-9
8a2.3	IRRADIATION FACILITY ELECTRICAL POWER SYSTEMS TECHNICAL SPECIFICATIONS	8a2-15
8a2.4	REFERENCES	8a2-16
8b	RADIOISOTOPE PRODUCTION FACILITY ELECTRICAL POWER SYSTEMS	8b-1
8b.1	NORMAL ELECTRICAL POWER SYSTEMS	8b-1
8b.2	EMERGENCY ELECTRICAL POWER SYSTEMS.....	8b-2
8b.3	RADIOISOTOPE PRODUCTION FACILITY ELECTRICAL POWER SYSTEMS TECHNICAL SPECIFICATIONS.....	8b-3

**CHAPTER 9
AUXILIARY SYSTEMS**

9a1	HETEROGENEOUS REACTOR AUXILIARY SYSTEMS	9a1-1
9a2	IRRADIATION FACILITY AUXILIARY SYSTEMS	9a2-1
9a2.1	HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS.....	9a2-1
9a2.2	HANDLING & STORAGE OF TARGET SOLUTION	9a2-13
9a2.3	FIRE PROTECTION SYSTEMS AND PROGRAMS	9a2-16

9a2.4	COMMUNICATIONS SYSTEMS	9a2-46
9a2.5	POSSESSION & USE OF BYPRODUCT, SOURCE AND SPECIAL NUCLEAR MATERIAL.....	9a2-48
9a2.6	COVER GAS CONTROL IN CLOSED PRIMARY COOLANT SYSTEMS	9a2-50
9a2.7	OTHER AUXILIARY SYSTEMS	9a2-51
9a2.8	IRRADIATION FACILITY AUXILIARY SYSTEMS TECHNICAL SPECIFICATIONS.....	9a2-60
9a2.9	REFERENCES	9a2-61
9b	RADIOISOTOPE PRODUCTION FACILITY AUXILIARY SYSTEMS	9b-1
9b.1	HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS.....	9b-1
9b.2	HANDLING & STORAGE OF TARGET SOLUTION	9b-2
9b.3	FIRE PROTECTION SYSTEMS AND PROGRAMS	9b-6
9b.4	COMMUNICATION SYSTEMS	9b-7
9b.5	POSSESSION AND USE OF BYPRODUCT, SOURCE AND SPECIAL NUCLEAR MATERIAL.....	9b-8
9b.6	COVER GAS CONTROL IN CLOSED PRIMARY COOLANT SYSTEMS	9b-15
9b.7	OTHER AUXILIARY SYSTEMS	9b-25
9b.8	RADIOISOTOPE PRODUCTION FACILITY AUXILIARY SYSTEMS TECHNICAL SPECIFICATIONS	9b-53
9b.6	REFERENCES	9b-54

**CHAPTER 10
EXPERIMENTAL FACILITIES**

10.1	SUMMARY DESCRIPTION.....	10-1
------	--------------------------	------

**CHAPTER 11
RADIATION PROTECTION PROGRAM AND WASTE MANAGEMENT**

11.1	RADIATION PROTECTION.....	11-1
11.2	RADIOACTIVE WASTE MANAGEMENT.....	11-42
11.3	RESPIRATORY PROTECTION PROGRAM.....	11-57
11.4	RADIATION PROTECTION PROGRAM AND WASTE MANAGEMENT TECHNICAL SPECIFICATIONS	11-59
11.5	REFERENCES	11-60

**CHAPTER 12
CONDUCT OF OPERATIONS**

12.1	ORGANIZATION	12-1
12.2	REVIEW AND AUDIT ACTIVITIES.....	12-5
12.3	PROCEDURES	12-7
12.4	REQUIRED ACTIONS.....	12-8
12.5	REPORTS	12-9
12.6	RECORDS.....	12-10
12.7	EMERGENCY PLANNING	12-11
12.8	SECURITY PLANNING	12-12
12.9	QUALITY ASSURANCE	12-13
12.10	OPERATOR TRAINING AND REQUALIFICATION	12-14

12.10a	REACTOR OPERATOR TRAINING AND REQUALIFICATION.....	12-14
12.10b	PRODUCTION FACILITY OPERATOR TRAINING AND REQUALIFICATION	12-15
12.11	STARTUP PLAN.....	12-16
12.12	VACATED	12-17
12.13	MATERIAL CONTROL AND ACCOUNTABILITY PROGRAM.....	12-18
12.14	REFERENCES	12-19
APPENDIX 12A	EMERGENCY PLAN.....	12A-1
APPENDIX 12B	SECURITY PLAN.....	12B-1
APPENDIX 12C	QUALITY ASSURANCE PROGRAM DESCRIPTION	12C-1
APPENDIX 12D	CONDUCT OF OPERATIONS PROGRAM DESCRIPTION	12D-1

CHAPTER 13 ACCIDENT ANALYSIS

13a1	HETEROGENEOUS REACTOR ACCIDENT ANALYSIS	13a1-1
13a2	IRRADIATION FACILITY ACCIDENT ANALYSIS.....	13a2-1
13a2.1	ACCIDENT-INITIATING EVENTS AND SCENARIOS	13a2-1
13a2.2	ACCIDENT ANALYSIS AND DETERMINATION OF CONSEQUENCES	13a2-36
13a3	SUMMARY AND CONCLUSIONS	13a3-1
13a4	REFERENCES	13a4-1
13b	RADIOISOTOPE PRODUCTION FACILITY ACCIDENT ANALYSES	13b-1
13b.1	RADIOISOTOPE PRODUCTION FACILITY ACCIDENT ANALYSIS METHODOLOGY	13b-1
13b.2	ANALYSES OF ACCIDENTS WITH RADIOLOGICAL CONSEQUENCES	13b-4
13b.3	ANALYSIS OF ACCIDENTS WITH HAZARDOUS CHEMICALS PRODUCED FROM LICENSED MATERIAL.....	13b-37
13b.4	REFERENCES	13b-51

CHAPTER 14 TECHNICAL SPECIFICATIONS

14a1	HETEROGENEOUS REACTOR TECHNICAL SPECIFICATIONS.....	14a1-1
14a2	IRRADIATION FACILITY TECHNICAL SPECIFICATIONS	14a2-1
14a2.1	INTRODUCTION	14a2-2
14a2.2	SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS	14a2-3
14a2.3	LIMITING CONDITIONS FOR OPERATION.....	14a2-4
14a2.4	SURVEILLANCE REQUIREMENTS	14a2-5
14a2.5	DESIGN FEATURES.....	14a2-6
14a2.6	ADMINISTRATIVE CONTROLS.....	14a2-7
14a2.7	REFERENCES	14a2-18
14b	TECHNICAL SPECIFICATIONS OF PROCESSES OUTSIDE THE IRRADIATION FACILITY.....	14b-1
14b.1	INTRODUCTION	14b-1
14b.2	SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS	14b-2
14b.3	LIMITING CONDITIONS FOR OPERATION.....	14b-3
14b.4	SURVEILLANCE REQUIREMENTS	14b-4

14b.5	DESIGN FEATURES	14b-5
14b.6	ADMINISTRATIVE CONTROLS.....	14b-6
14b.7	REFERENCES	14b-7

**CHAPTER 15
FINANCIAL QUALIFICATIONS**

15.1	FINANCIAL ABILITY TO CONSTRUCT THE SHINE FACILITY	15-1
15.2	FINANCIAL ABILITY TO OPERATE THE SHINE FACILITY	15-3
15.3	FINANCIAL ABILITY TO DECOMMISSION THE SHINE FACILITY	15-5
15.4	FOREIGN OWNERSHIP, CONTROL, OR DOMINATION	15-6
15.5	NUCLEAR INSURANCE AND INDEMNITY	15-7
15.6	REFERENCES.....	15-8

**CHAPTER 16
OTHER LICENSE CONSIDERATIONS**

16.1	PRIOR USE OF FACILITY COMPONENTS	16-1
16.2	MEDICAL USE OF THE FACILITY	16-2

**CHAPTER 17
DECOMMISSIONING AND POSSESSION-ONLY LICENSE AMENDMENTS**

17.1	DECOMMISSIONING.....	17-1
17.2	POSSESSION-ONLY LICENSE AMENDMENTS	17-2

**CHAPTER 18
HIGHLY ENRICHED TO LOW ENRICHED URANIUM CONVERSION**

18.1	HIGHLY ENRICHED TO LOW ENRICHED URANIUM CONVERSION.....	18-1
------	---	------

**CHAPTER 19
ENVIRONMENTAL REVIEW**

19.1	INTRODUCTION OF THE ENVIRONMENTAL REPORT	19.1-1
19.2	PROPOSED ACTION.....	19.2-1
19.3	DESCRIPTION OF THE AFFECTED ENVIRONMENT	19.3-1
19.4	IMPACTS OF PROPOSED CONSTRUCTION, OPERATIONS, AND DECOMMISSIONING.....	19.4-1
19.5	ALTERNATIVES.....	19.5-1
19.6	CONCLUSIONS	19.6-1
19.7	REFERENCES	19.7-1