

CONTENTS

1. INTRODUCTION.....	1
2. SAFETY RELATED PHYSICS VALIDATION DATA AND NEEDS FOR ADVANCED GAS-COOLED REACTOR DESIGNS.....	2
2.1 PHYSICS VALIDATION DATA NEEDS FOR ADVANCED GCRS.....	2
2.2 SUMMARY OF VALIDATION DATA BASE (PRIOR TO CRP).....	7
2.3 PLANNING OF PROTEUS EXPERIMENTS TO PROVIDE VALIDATION DATA..	13
3. EARLY PROBLEM ANALYSIS.....	17
3.1 PROTEUS.....	17
3.2 VHTRC.....	30
4. PROTEUS CRITICAL EXPERIMENT FACILITY.....	46
4.1 HISTORY OF THE FACILITY AND RECONFIGURATION FOR THE HTR EXPERIMENTS.....	46
4.2 HTR-PROTEUS FACILITY DESCRIPTION.....	47
5. PROTEUS EXPERIMENT PLANS.....	58
6. PROTEUS MEASUREMENT TECHNIQUES.....	63
6.1 CRITICAL LOADINGS.....	63
6.2 REACTIVITY MEASUREMENTS.....	65
6.3 KINETIC PARAMETER (β/Λ).....	86
6.4 REACTION-RATE MEASUREMENTS.....	90
6.5 GRAPHITE ABSORPTION MEASUREMENTS.....	99
7. PROTEUS EXPERIMENTAL RESULTS.....	105
7.1. INTRODUCTION.....	105
7.2 CRITICAL BALANCE.....	106
7.3 INTEGRAL AND DIFFERENTIAL CONTROL ROD WORTHS.....	127
7.4 SHUTDOWN ROD WORTHS.....	133
7.5 KINETIC PARAMETER ($\beta_{\text{eff}}/\Lambda$).....	137
7.6 OTHER INTEGRAL PARAMETERS.....	143
8. COMPARISON OF MEASUREMENTS WITH CALCULATIONS.....	145
8.1 INTRODUCTION.....	145
8.2 CRITICAL BALANCES INCLUDING STREAMING.....	145
8.3 REACTION RATE RATIOS AND DISTRIBUTIONS.....	151
8.4 CONTROL ROD WORTHS.....	154
8.5 WATER INGRESS EFFECTS.....	162
8.6 REACTIVITY OF SMALL SAMPLES.....	168
8.7 KINETIC PARAMETER.....	181
9. SUMMARY AND CONCLUSIONS.....	189
9.1 LEU-HTR PROTEUS PROGRAM.	189
9.2 BENCHMARK CALCULATIONS.....	190
9.3 PROTEUS EXPERIMENTAL PROCEDURES.....	191
9.4 COMPARISON OF MEASUREMENTS WITH CALCULATIONS.....	194

APPENDIX A. ASSIGNMENT OF RESEARCHERS FROM PARTICIPATING INSTITUTES TO THE PROTEUS TEAM.....	197
APPENDIX B. EXTERNAL PUBLICATIONS MADE IN CONNECTION WITH HTR PROTEUS.....	200
APPENDIX C. QUALITY ASSURANCE PLAN FOR THE HTR-PROTEUS EXPERIMENTS.....	203