

CONTENTS

1. INTRODUCTION	1
2. OBJECTIVE AND SCOPE	3
3. ACTIVITIES AND CONTRIBUTIONS OF PARTICIPATING INSTITUTES	4
3.1. Atomic Energy of Canada Limited.....	4
3.2. Nuclear Power Institute, China.....	4
3.3. University of West Bohemia, Czech Republic	4
3.4. CEA Cadarache, France.....	4
3.5. Bhabha Atomic Research Centre, India.....	4
3.6. Seoul National University, Republic of Korea	5
3.7. Hanyang University, Republic of Korea.....	5
3.8. Institute for High Energy Densities, Russian Federation.....	5
3.9. Institute of Physics and Power Engineering, Russian Federation.....	5
3.10. J.K. Fink (Argonne National Laboratory, USA).....	5
4. PROCEDURE FOR ASSESSMENT AND PEER REVIEW	6
4.1. Assessment guidelines	6
4.1.1. Collect data.....	6
4.1.2. Convert to ITS-90 temperature scale.....	6
4.1.3. Review data for consistency, reliability, and systematic errors.....	7
4.1.4. Review all available equations from other assessments.....	7
4.1.5. Statistical analysis of all data	7
4.1.6. Error analysis and uncertainties.....	8
4.1.7. Submit assessment for peer review	8
4.2. Temperature conversion	9
4.2.1. Comparison between ITS-27 and IPTS-48.....	9
4.2.2. Comparison between IPTS-48 and IPTS-68	10
4.2.3. Comparison between IPTS-68 and ITS-90.....	14
4.2.4. Conversion of the thermo-physical property values to the new temperature scale ITS-90.....	19
4.2.5. Graphic representation of temperature differences and derivatives	20
4.2.6. General recommendations	21
5. SUMMARY OF DATA USED IN ASSESSMENT.....	23
6. THERMO-PHYSICAL PROPERTIES OF MATERIALS.....	25
6.1. Fuel materials.....	25
6.1.1. Uranium dioxide (UO_2)	25
6.1.2. Thermal conductivity of irradiated UO_2	143
6.1.3. Thermal properties of $(U, Gd)O_2$	152
6.1.4. ThO_2 , $(Th_{1-y}U_y)O_2$ and $(Th_{1-y}Pu_y)O_2$ properties	182
6.2. Cladding and pressure tube materials	225
6.2.1. Zircaloy	225
6.2.2. Thermal conductivity of Zr-1%Nb	289
6.2.3. Thermal conductivity of Zr-2.5%Nb	293
6.3. Absorber materials and their oxides	296
6.3.1. Hafnium.....	296
6.3.2. Hafnium dioxide.....	307

6.4.	Structural materials	314
6.4.1.	Russian steels	314
6.4.2.	Thermal conductivity of alloy 600 and 800	324
6.5.	Zirconium	328
6.5.1.	Enthalpy and heat capacity	328
6.5.2.	Thermal conductivity	334
6.5.3.	Enthalpy of fusion	336
6.5.4.	Surface tension	340
6.5.5.	Viscosity	343
7.	THERMO-PHYSICAL PROPERTIES OF LIGHT AND HEAVY WATER	345
7.1.	Introduction.....	345
7.2.	Thermo-physical properties of light water.....	345
7.2.1.	The IAPWS formulation 1997 for the thermodynamic properties of water and steam for industrial use.....	346
7.2.2.	Transport properties	347
7.2.3.	Other properties.....	348
7.2.4.	Steam tables and software based on the IAPWS-IF97	349
7.3.	Thermo-physical properties of heavy water	351
7.3.1.	Thermodynamic properties.....	351
7.3.2.	Transport properties	351
7.3.3.	Other properties of heavy water	351
8.	THERMO-PHYSICAL PROPERTIES OF CORIUM UNDER SEVERE ACCIDENT CONDITIONS (CEA, CADARACHE).....	376
8.1.	Thermo-physical properties for severe accident analysis	376
8.1.1.	Experimental approach.....	376
8.1.2.	Database approach.....	377
8.1.3.	Theoretical approach	378
8.2.	Modelling of corium properties	378
8.2.1.	Density	378
8.2.2.	Thermal conductivity	381
8.2.3.	Viscosity	383
9.	THERPRO: ON-LINE NUCLEAR MATERIALS THERMO-PHYSICAL PROPERTIES DATABASE	388
9.1.	Introduction to THERPRO database.....	388
9.2.	Structure of THERPRO database	388
9.2.1.	Overall structure of database	388
9.2.2.	Structure of standard data set	391
9.2.3.	Data retrieval schemes.....	392
9.2.4.	User registration/authorization and database security	394
9.2.5.	THERPRO database management: data update and upgrade.....	395
	CONTRIBUTORS TO DRAFTING AND REVIEW	397