



SANDA/D5.5 (WP5/Task 1)

Report on assessment of nuclear data

CEA, CIEMAT, UPM, SCK, KIT


Spokeperson: D. Bernard
February 5, 2024



3 documents for the time being:



February 2023


 HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME OF THE EUROPEAN ATOMIC ENERGY COMMUNITY HORIZON 2020				
Nuclear Fission and Radiation Protection 2018 (NFRP-2018-4)				
Project acronym:	SANDA			
Project full title:	Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities			
Grant Agreement no.:	H2020 Grant Agreement number: 847552			
Workpackage N°:	WP5			
Identification N°:	D5.5			
Type of document:	Deliverable			
Title:	Report on assessment of nuclear data needs			
Dissemination Level:	PU			
Reference:				
Status:	VERSION 1			
Comments:				
	Name	Partner	Date	Signature
Prepared by:	All	1	24-02-2023	p.o.
WP leader:	R. Jacqmin	1	xx-02-2023	
IP Co-ordinator:	E. González	1	xx-02-2023	

To be finalized

LWR-UOx depleted keff + PIE:
 S/U+ Pu xs χ^2 re-estimation 26 nrj-groups (shared with D5.2/Nuria) to be added + sections CEA(JHR), KIT(HLW) + UKEA (Fusion) ?



May 2023

 HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME OF THE EUROPEAN ATOMIC ENERGY COMMUNITY HORIZON 2020				
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Project acronym:	SANDA			
Project full title:	Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities			
Grant Agreement no.:	H2020 Grant Agreement number: 847552			
Workpackage:	WP5			
Identification N°:				
Type of document:	Non-contractual report			
Title:	Target Accuracy Requirements on the MYRRHA k_{eff}			
Dissemination Level:	PU			
Reference:	ER-1270 / SCK CEN/55264898			
Status:	VERSION 1.0			
Actual Delivery date:	11 May 2023			
Comments:				
	Name	Partner	Date	Signature
Prepared by:	P. Romojaro	SCK CEN	11-05-2023	
WP leader:	R. Jacqmin	CEA		
IP Co-ordinator:	E. González	CIEMAT		


Finalized

MYRRHA keff
 7 nrj-groups TAR exercice
 2 sets of cost factors



POLITECNICA

February 2024

UPM report 20240108		
 POLITECNICA	UPM contribution to Deliverable 5.5 of SANDA project	Date: 08/01/2024
	UPM contribution to D5.5: Report on assessment of nuclear data needs	Pags: 22 Version: 1
SUMMARY		
This report contains the UPM contribution to Deliverable 5.5 of the EC SANDA project, Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities (H2020 Grant Agreement number 847552).		
MODIFICATIONS TO PREVIOUS VERSION		
Written by:	Reviewed by:	Approved by:
Nuria García-Herranz Oscar Cabellos Antonio Jiménez-Carrascosa	Oscar Cabellos	

Finalized

ESFR + ASTRID
 keff + Doppler + void/coolant
 7 nrj-groups S/U TAR exercice
 3 sets of cost factors

HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME OF THE EUROPEAN ATOMIC ENERGY COMMUNITY

Nuclear Fission and Radiation Protection 2018 (NFRP-2018-4)

Project acronym: SANDA
 Project full title: Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities
 Grant Agreement no.: H2020 Grant Agreement number: 847552

Workpackage N°: WP6
 Identification N°: DS.8
 Type of document: Deliverable
 Title: Report on assessment of nuclear data needs
 Dissemination Level: PU
 Reference: VERSION 1
 Status: VERSION 1
 Comments:

Prepared by:	Name	Partner	Date	Signature
	All	1	24-02-2023	p.o.
WP leader:	R. Jacqmin	1	xx-02-2023	
IP Co-ordinator:	E. González	1	xx-02-2023	

HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME OF THE EUROPEAN ATOMIC ENERGY COMMUNITY

Nuclear Fission and Radiation Protection 2018 (NFRP-2018-4)

Project acronym: SANDA
 Project full title: Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities
 Grant Agreement no.: H2020 Grant Agreement number: 847552

Workpackage: WP6
 Identification N°: DS.8
 Type of document: Non-contractual report
 Title: Target Accuracy Requirements on the MYRRHA LWR
 Dissemination Level: PU
 Reference: ER-1270 / SCK CEN/85264888
 Status: VERSION 1.0
 Actual Delivery date: 11 May 2023
 Comments:

Prepared by:	Name	Partner	Date	Signature
	P. Ronegato	SCK CEN	11-05-2023	
WP leader:	R. Jacqmin	CEA		
IP Co-ordinator:	E. González	CIEMAT		

LPM report 20240108

LPM contribution to Deliverable 5.5 of SANDA project
 LPM1 contribution to DS-5 Report on assessment of nuclear data needs

Date: 08/01/2024
 Page: 22
 Version: 1

SUMMARY

This report contains the LPM contribution to Deliverable 5.5 of the EC SANDA project, Solving Challenges in Nuclear Data for the Safety of European Nuclear facilities (H2020 Grant Agreement number: 847552).

MODIFICATIONS TO PREVIOUS VERSION

Written by:	Reviewed by:	Approved by:
Alvaro Garcia Hernandez Oscar Caballero Antonio Jimenez Carrascosa	Oscar Caballero	

Table 5. List of isotopes, reactions and energy ranges (E) requiring the major relative reduction of the uncertainty for Case A.

Nuclide	Reaction	E (eV)	TAR UNCERTAINTY %	INITIAL UNCERTAINTY %	DIFFERENCE %
²⁴⁰ Pu	(n,f)	2.04E+03 - 6.74E+04	5.4	26.2	20.8
		6.74E+04 - 4.98E+05	3.8	12.8	9.0
		4.98E+05 - 2.23E+06	2.3	8.8	6.5
	(n,γ)	6.74E+04 - 4.98E+05	5.8	11.4	5.7
²³⁹ Pu	(n,f)	2.26E+01 - 2.04E+03	13.1	17.8	4.7
	(n,γ)	2.04E+03 - 6.74E+04	3.9	7.6	3.6
²³⁹ Pu	(n,γ)	2.26E+01 - 2.04E+03	3.0	6.1	3.1
²³⁸ U	(n,γ)	4.98E+05 - 2.23E+06	2.4	4.9	2.5
²³⁹ Pu	(n,γ)	2.04E+03 - 6.74E+04	1.4	3.6	2.2
²³⁸ U	(n,γ)	6.74E+04 - 4.98E+05	1.5	3.3	1.7
²³⁹ Pu	(n,f)	2.26E+01 - 2.04E+03	1.8	3.4	1.5
²³⁸ U	(n,f)	2.23E+06 - 2.00E+07	1.6	3.1	1.5

JEFF-4.0t1/²³⁹Pu capture cross section trend:

$$^{239}\text{Pu}(n_{[0.1-0.54]\text{eV}},\gamma) \sim (+3.7 \pm 1.4)\%$$

$$^{241}\text{Pu}(n_{[0.1-0.54]\text{eV}},\gamma) \sim (+1.0 \pm 3.1)\%$$

Table 14. Summary and conclusion of current ND uncertainties and uncertainty reduction requirements

Reaction	Above Threshold Fertile 2.23 10 ⁶ eV 1.96 10 ⁷ eV	Above Threshold Inelastic 4.98 10 ⁶ eV 2.23 10 ⁶ eV	Continuum to URR 6.74 10 ⁶ eV 4.98 10 ⁶ eV	URR 2.03 10 ⁹ eV 6.74 10 ⁶ eV	RRR 2.26 10 ¹ eV 2.03 10 ³ eV	EPITHERMAL 5.4 10 ¹ eV 2.26 10 ¹ eV	THERMAL 1.0 10 ⁵ eV 5.40 10 ¹ eV	HRPL entry number for the reaction (https://oced-nea.org/dbdata/hprl/)
U-238 (n, gamma)	IG=1	IG=2	IG=3	IG=4	IG=5	IG=6	IG=7	
U-238 (n, inelastic)	0.9% - 1.3%	0.9% - 1.5%	5.8% - 8.4%	-	-	-	-	18H (2%)
Pu-239 (n, inelastic)	-	4.4% - 7.0%	-	-	-	-	-	32H
Pu-239 (n, gamma)	-	-	-	0.8% - 1.5%	2.2% - 2.6%	-	-	(3%RRR, 3% URR)
Pu-239 (n, fission)	-	0.3% - 0.4%*	0.2% - 0.3%*	0.2% - 0.3%*	0.6% - 0.7%	-	-	*Below standards uncertainties
Pu-240 (n, fission)	-	1.1% - 1.8%	2.0% - 6.8%	2.3% - 6.8%	-	-	-	37H (2-3% SFR)
Pb-206 (n, inelastic)	1.1% - 1.6%	1.0% - 1.5%	-	-	-	-	-	41H (5% LFR)
Pb-207 (n, inelastic)	-	1.0% - 1.5%	-	-	-	-	-	42H (5% LFR)
Fe-56 (n, elastic)	-	-	4.8% - 7.2%	3.9% - 4.1%	-	-	-	
Fe-56 (n, inelastic)	-	1.2% - 1.8%	-	-	-	-	-	
Na-23 (n, elastic)	-	-	2.6% - 3.1%	3.9% - 4.0%	-	-	-	
Na-23 (n, inelastic)	2.0% - 2.4%	1.3% - 2.0%	-	-	-	-	-	
O-16 (n, elasticP1)	-	5.2% - 6.5%	-	-	-	-	-	
U-238 (n, elasticP1)	-	3.2% - 3.6%	3.8% - 4.9%	-	-	-	-	

- Updated entries in HPRL with tighter uncertainty reduction are:
 - U-238 (n, inelastic): ALFRED - coolant density reactivity / ESFR - keff
 - Pu-239 (n, gamma): ALFRED - keff
 - Pu-240 (n, fission): ESFR - keff
 - Pb-206 (n, inelastic): ALFRED - coolant density reactivity
 - Pb-207 (n, inelastic): ALFRED - coolant density reactivity
 - Fe-56 (n, inelastic): ALFRED - coolant density reactivity + JSFR - keff
 - Na-23 (n, inelastic): ESFR - Full void reactivity
- New entries in HPRL:
 - Pu-239 (n,inelastic) : ALFRED - Doppler reactivity
 - Fe-56 (n,elastic) : ESFR - Doppler reactivity
 - Na-23 (n,elastic) in JSFR -SVR

Conclusion

3 available documents (1 to be finalized → this month) for 3 different concepts.

Quasi identical methodology (TAR of χ^2):

- Clear trends for LWR depletion studies with JEFF
- 7 updated HPRL entries with tighter uncertainty reduction (thanks to ND correlations)
- 3 potential new HPRL entries !