

Recommendations for the selection of in situ measurement techniques for radiological characterization in D&D processes

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Context and Methodology



• Inventory

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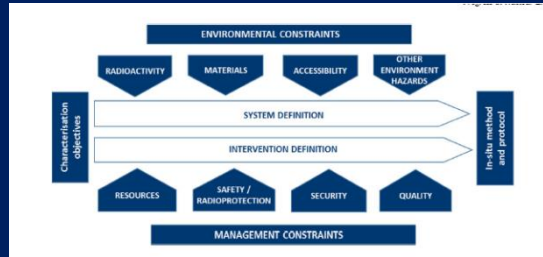
Appendix A: Radiation protection basics.....

D 5.1

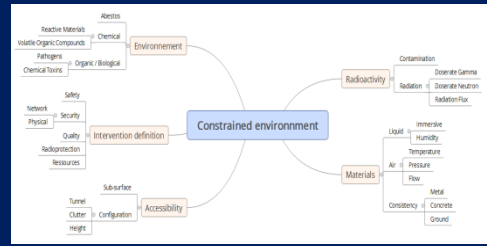
2018



• Constraints



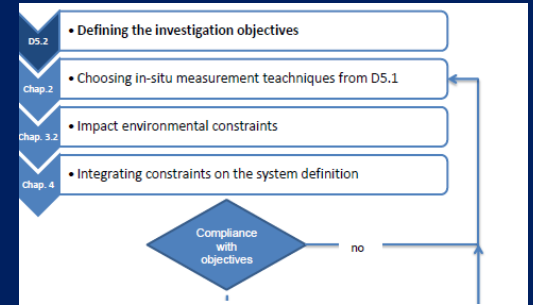
D 5.2



2019



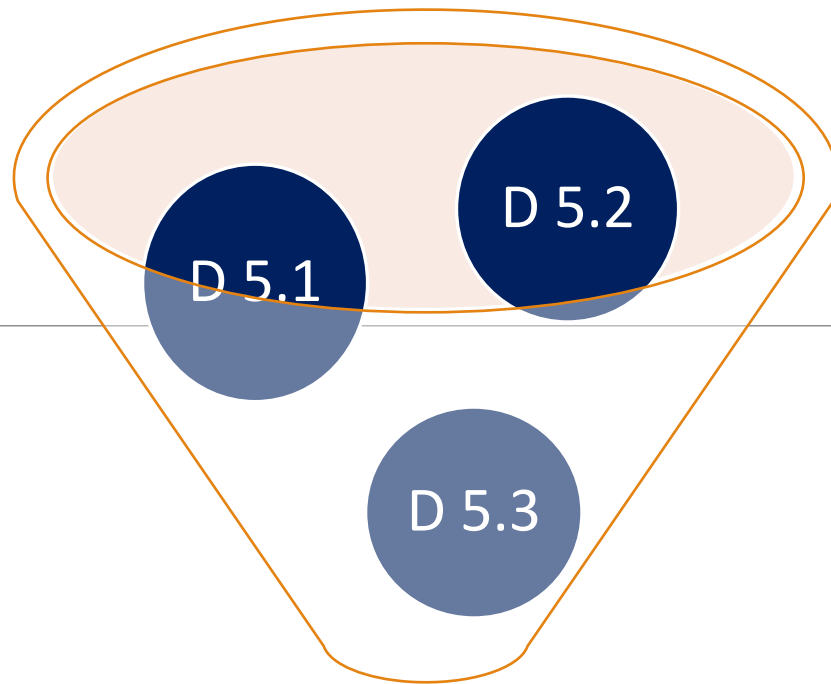
• Recommendation



D 5.3

Environmental constraint	Radiation		Materials							Accessibility					
			Air		Liquid	Others									
	Contamination	Gamma Dose rate	Neutron Dose rate	Pressure	Temperature	Flow	Immersive	Humidity	Metal	Concrete	Confined/Tunnel	Height	Cut-off	Subsurface	
Environmental radiation measurements	1	3	3	3	0*	0*	0	NA	0*	1	2	1	0	2	3
Surface contamination measurements	3	1	1	1	0	0	1	NA	2	1	2	0	0	2	NA
Gamma spectrometry	1	3	1	2	0	1	0	1	2	1	1	2	2	2	3
Neutron measurements	0	3	3	2	0	1	0	3	2	0	2	1-3**	1-3**	1-3**	3
Radiation cameras	0-1**	2	1	2	0	1	0	NA	0	0	0	1-3**	1-3**	1-3**	3

2020



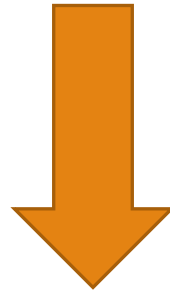
Easy to share

Usefull

Used

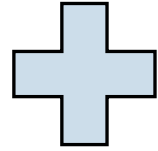
Radiological characterization under D&D processes

- Precise list of radionuclides (nature / location / concentration)
- Essential component **for intervention scenarios**
- **In-situ measurement** is a **KEY** element. Non-destructive assay (NDA) discussed here

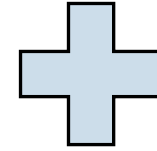


**How to choose the right NDA technique,
and then the right Detector ?**

WP 5.1



WP 5.2



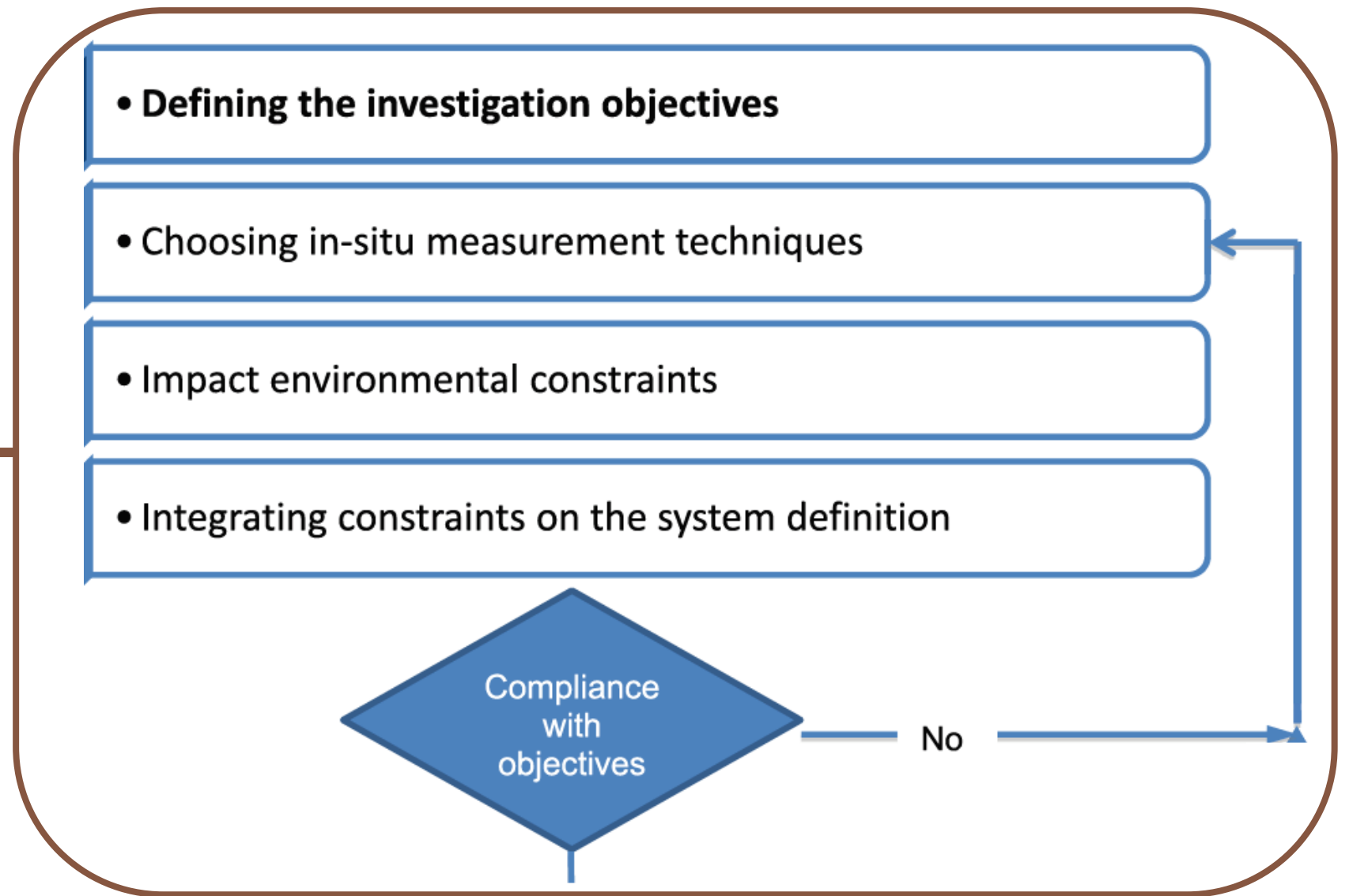
WP 5.3

Decision Helping Tool

Tool's objectives

- **Recommends detectors type**
- **Uses Database** from WP5
- **Online**, easy to access
- Easy to understand / Easy to use
- Allows flexibility for expert users
- **Easy to add** new detectors / areas

Tool's purpose



Tool's presentation



Decision Helping Tool

In situ Measurements

START

PHASE OF THE D&D PROGRAM

1

INITIAL



+ info

2

INTERMEDIATE



+ info

3

FINAL



+ info



Return

Advance





NEEDS



CRITICALITY
CONTROL

+ info



RADIOACTIVE LEVEL OF
EXISTING WASTE

+ info



LOCALIZATION
OF NUCLEAR
MATERIAL

+ info



VERIFICATION OF
RADIOLOGICAL
SPECTRUM

+ info



SITE
CARTOGRAPHY

+ info

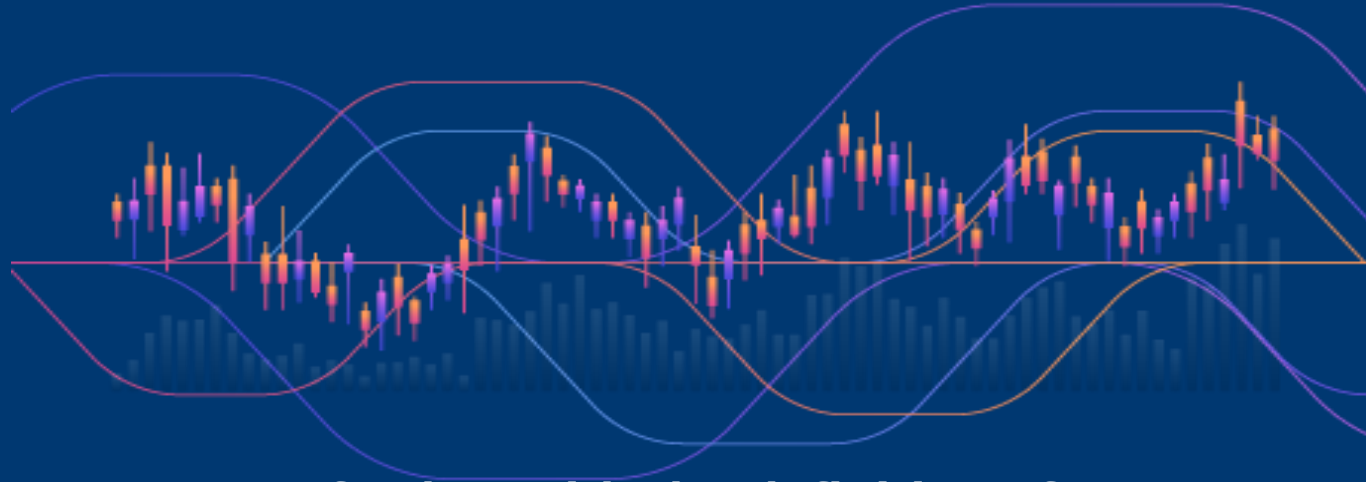


Return

Advance



RECOMMENDED IN SITU NDA TECHNIQUE



Go further with the definition of your

NOT
AVAILABLE
YET

CONSTRAINTS



INSTALLATION



< Return

Advance >



INSTALLATION



REACTOR

[+ info](#)



PLANT

[+ info](#)



ACCELERATOR

[+ info](#)



Return

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AREAS

	Outdoor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Technical galleries
Foundations-Structural Materials and apron		<input type="checkbox"/>	<input type="checkbox"/>	Traffic Corridor
	Waste storage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Technical area
	Changing room	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Equipment room
	Peripheral galleries	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Office
	Process control room	<input type="checkbox"/>	<input type="checkbox"/>	Decontamination room

RECOMMENDED DETECTORS

BF3 Gas-Filled proportional counters Neutron detector



+ STRENGTHS

- Reasonably light
- Good γ rejection
- Readily available than ^3He

- WEAKNESSES

- Sensitive to vibrations
- Toxic and corrosive
- Low neutron cross-section
- Limited filling pressure
- Pulse pile-up effect and gas degradation at intense radiation fields

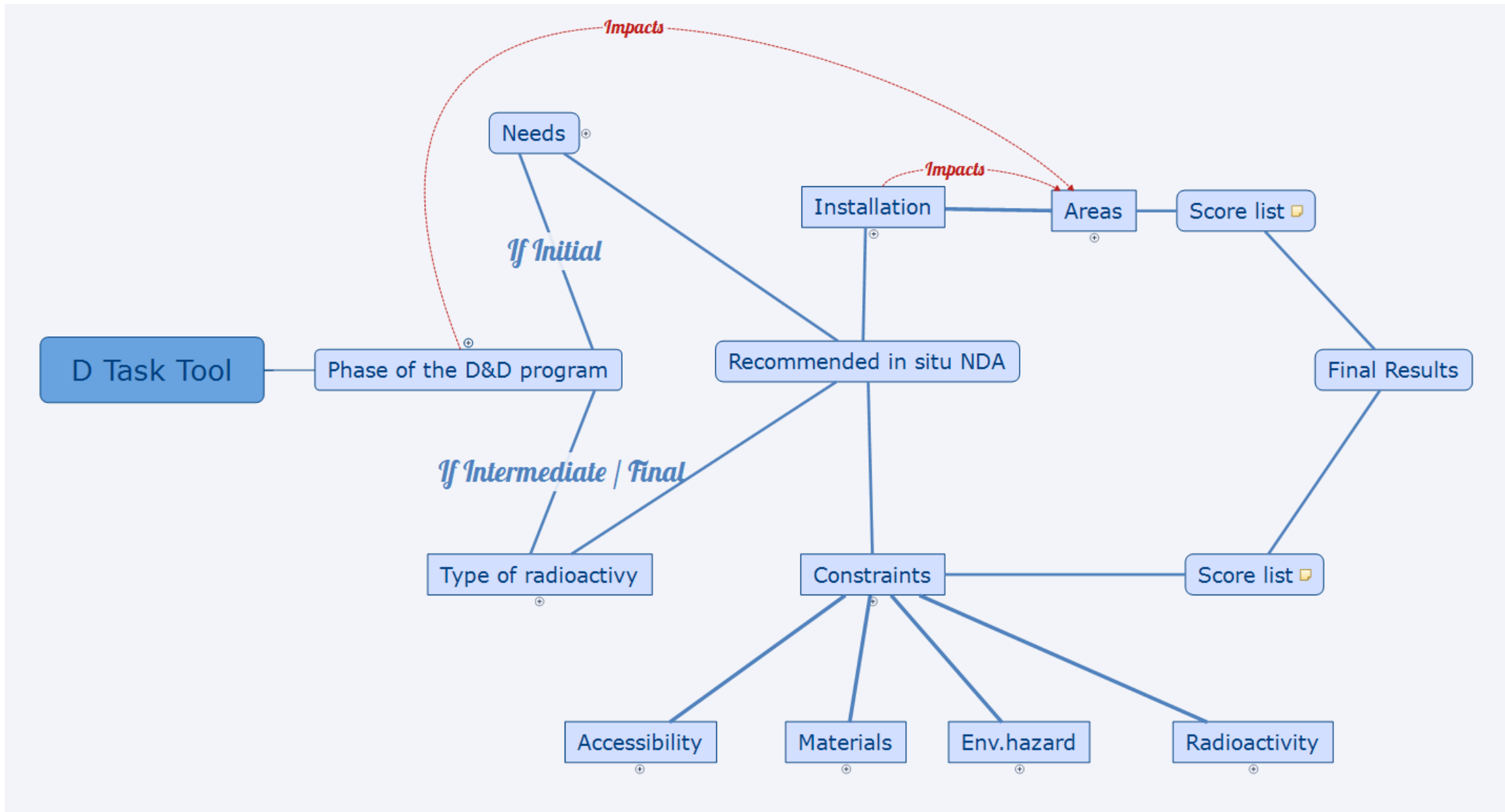
Where to Apply

- Almost all nuclear facility areas and equipment except the ones with high dose rates

More info at [\(link to study\)](#)



Return



	Initial Score	Immersive	Contamination	Gamma dose	Final Score
Applied Constraints		Yes	low	Very High	
	Detectors Points lost * Constraint Weight				
Detector 1	100	-10	-25	-3	62
Detector 2	100	-100	-10	-0	-10
Detector 3	100	-0	-0	-0	100
Detector 4	100	-15	-0	-35	50

THANK YOU

