

DIGITAL TRANSFORMATION A TSO POINT OF VIEW

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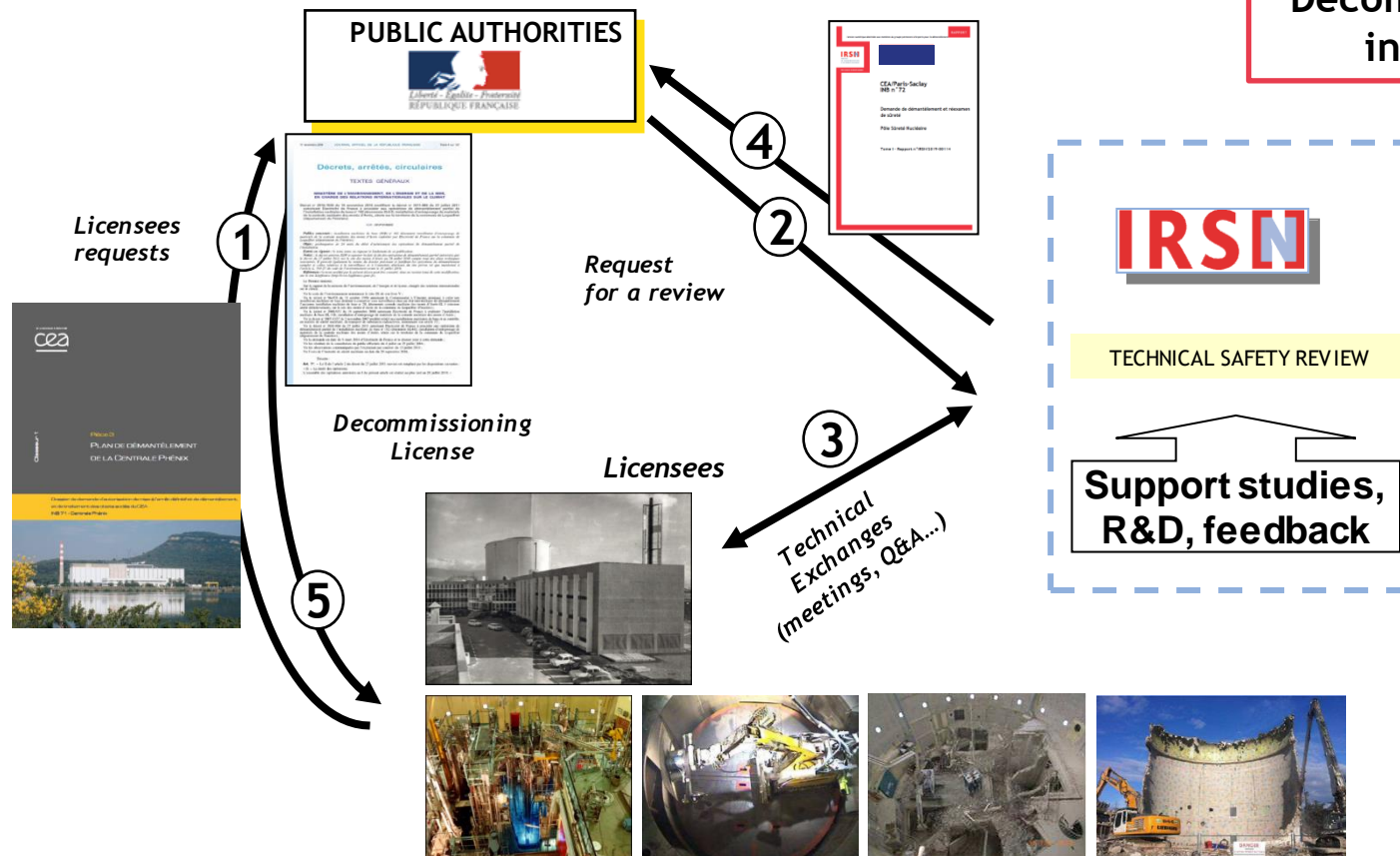
29 mars 2021

Content of the presentation

- **The role of IRSN as a Technical support organization of a regulatory body**
- **Why using simulation tools from a TSOs perspectives?**
- **IRSN approach to develop the use of Digital simulation tools and preliminary findings from examples**
- **Summary and discussion**

➤ A structured process for review

~ 40 facilities
under
Decommissioning
in France



Approach for the safety review for decommissioning

Review of the overall Decommissioning Strategy and related Waste Management implemented by French Operators (complex projects, multi-facility sites, multi-sites)

- Identify Safety priorities
- Waste management plans and discharges
- Technical feasibility of dismantling sequence and scenarios
- Organizational aspects implemented by operators

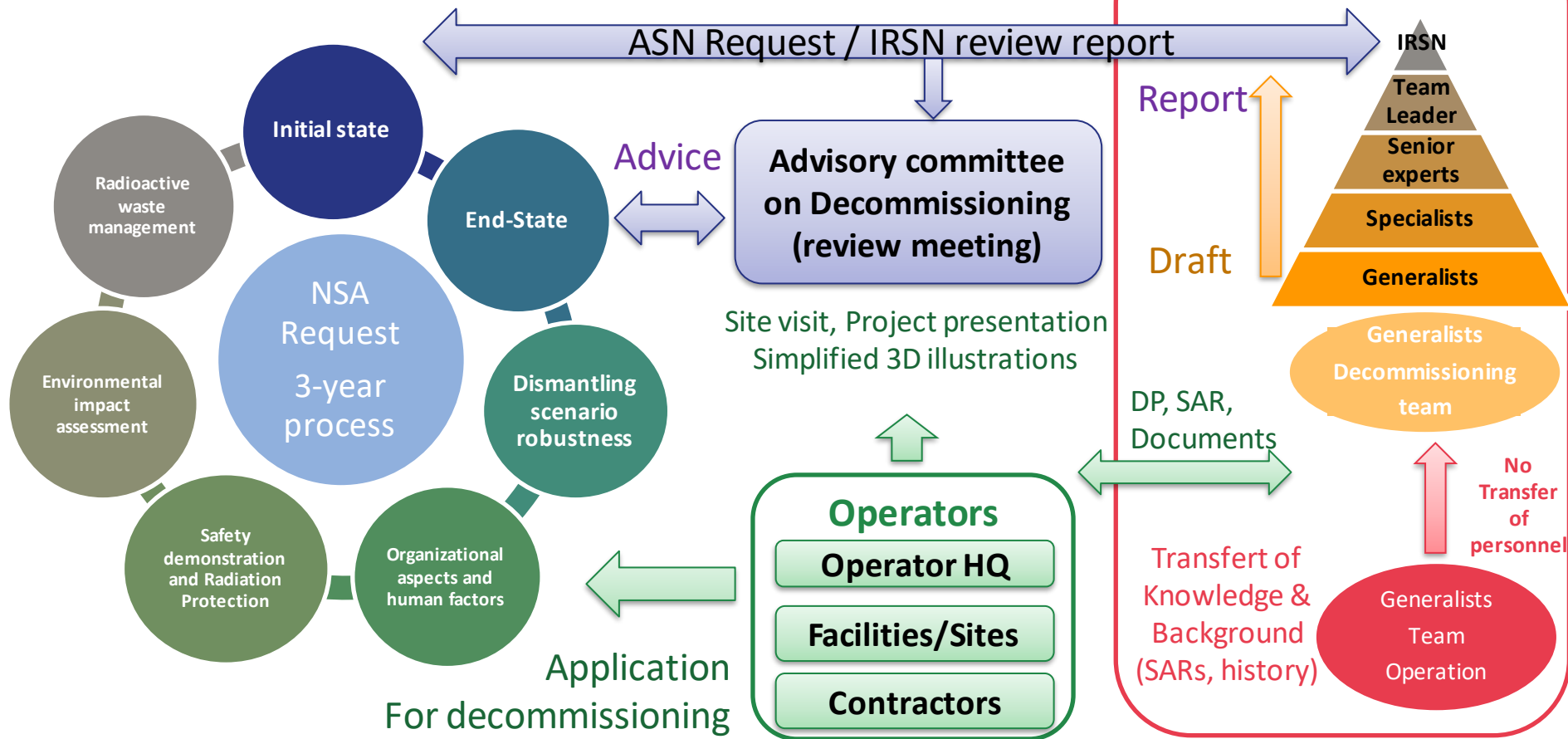
Review of the safety provisions of each nuclear facility undertaking decommissioning

- Decommissioning plan, safety report, Environmental impact assessment and supporting documents

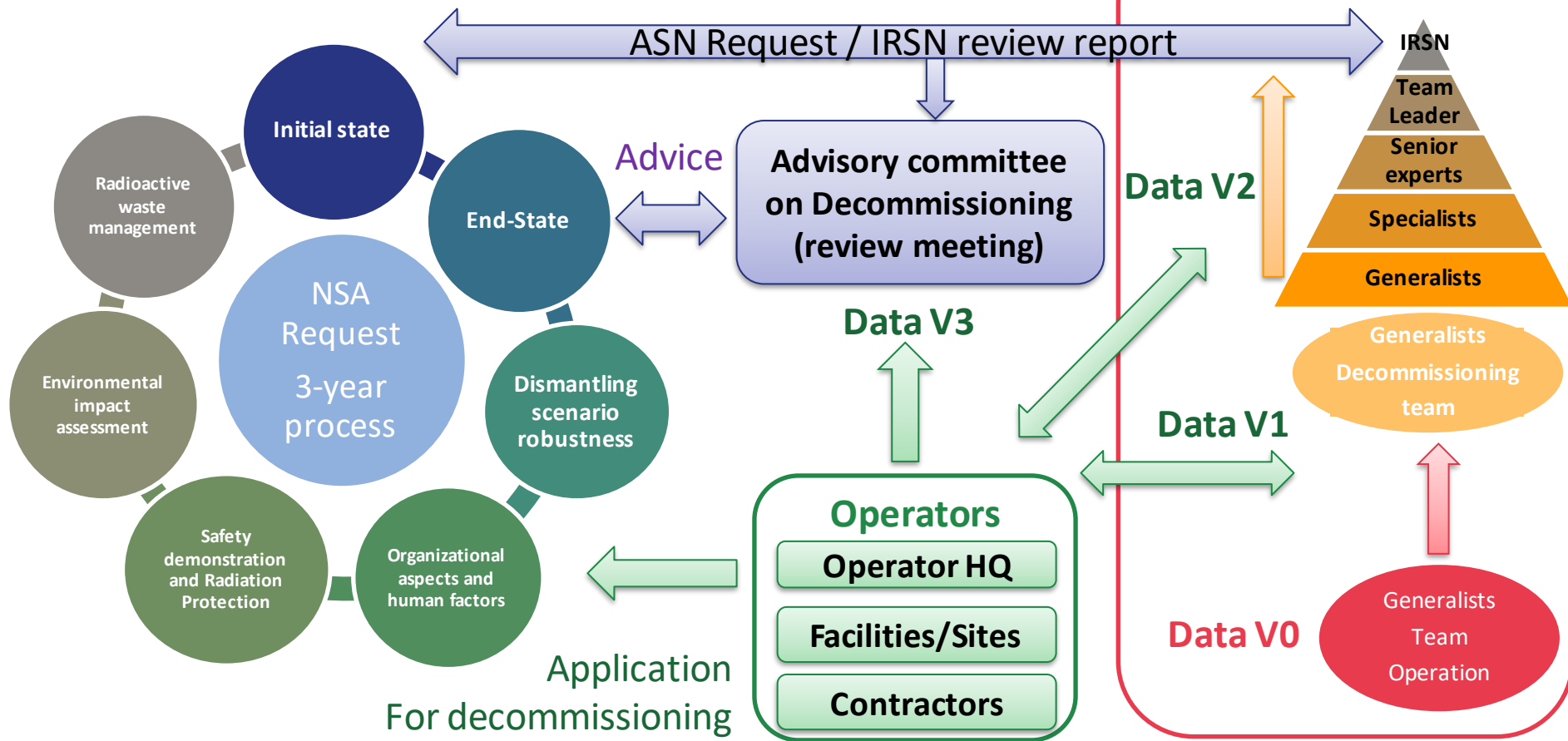
Periodic Safety review during decommissioning

- Conformity checks and re-assessment
- Taking into account at each level the best available techniques and the available experience

Review process for nuclear facility under decommissioning



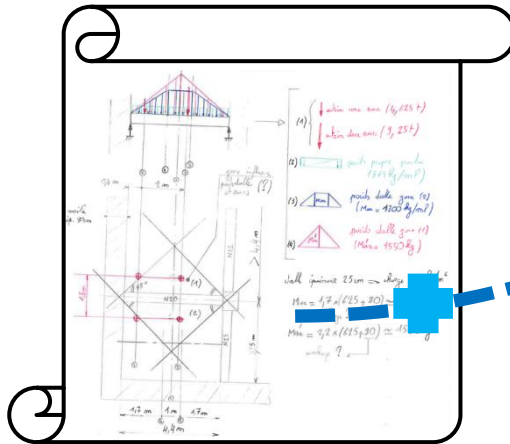
Review process for nuclear facility under decommissioning



Digital transformation

- Why using simulation tool from a TSOs perspectives?

Before
Paper
sheet



Excel spreadsheet showing a detailed table of data, likely related to the bridge structure. The table has multiple columns and rows, with some cells highlighted in yellow. The data appears to be organized into sections, possibly representing different parts of the bridge or different types of loads.

Yesterday
"EXCEL"
table

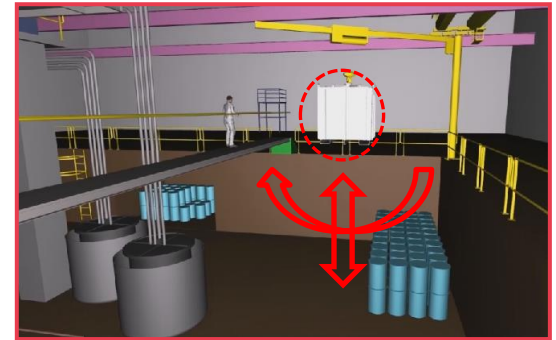
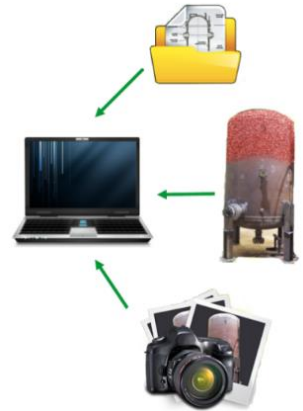
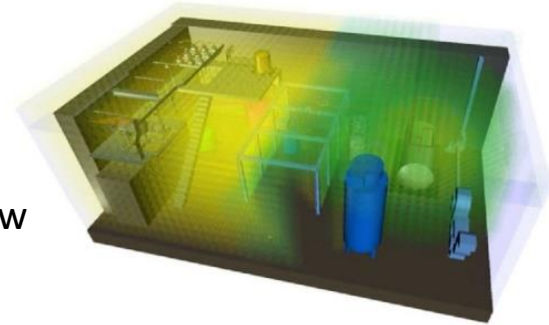


Today
Simulation
tool

Why using simulation tool from a TSOs perspectives?

➔ IRSN main reasons to use a software tool

- To understand & to exchange
 - Internally & externally, during a review
- To reflect, to assess & to analyze
 - Deepening of issues highlighted during a review
 - Dedicated study to support an assessment
- To explain & to train
 - Specificities of the decommissioning tasks
 - New comers in the field of decommissioning
- With an overall goal
 - To be more effective during a review
 - exchanges for understanding
 - reflections on the important issues
 - relevance of the conclusions



Decommissioning tasks simulation

➔ DEM-Plus selected by IRSN

- Input data
 - Working areas, equipment (3D models)
 - Additional means (3D models)
 - Corresponding characteristics
- Works (set of tasks) description
 - Reference phasing-scenarios
 - Alternative phasing-scenarios
- Simulation results (indicative)
 - Feasibility / accessibility*
 - Set of tasks durations*
 - Collective & individual ext. γ doses
 - Atmospheric contamination (apart)
 - Radioactive waste amounts
 - Decommissioning works costs*



IRSN approach to develop the use of Digital simulation software

■ Phase 1: Selection process for tool simulation (2016-2018)

- Selection of DEM-Plus software
- Training of IRSN engineers (5 engineers)
- Acquisition of a license of DEM-Plus including hardware solutions (oculus)

■ Phase 2: “home made” test cases conducted by IRSN (2018-2019)

- First step: Gradual test cases to understand the use of the 3D models, data collection process and optimization of dismantling scenarios
- Second step: development of an example in the frame of a review to support a request from the authority

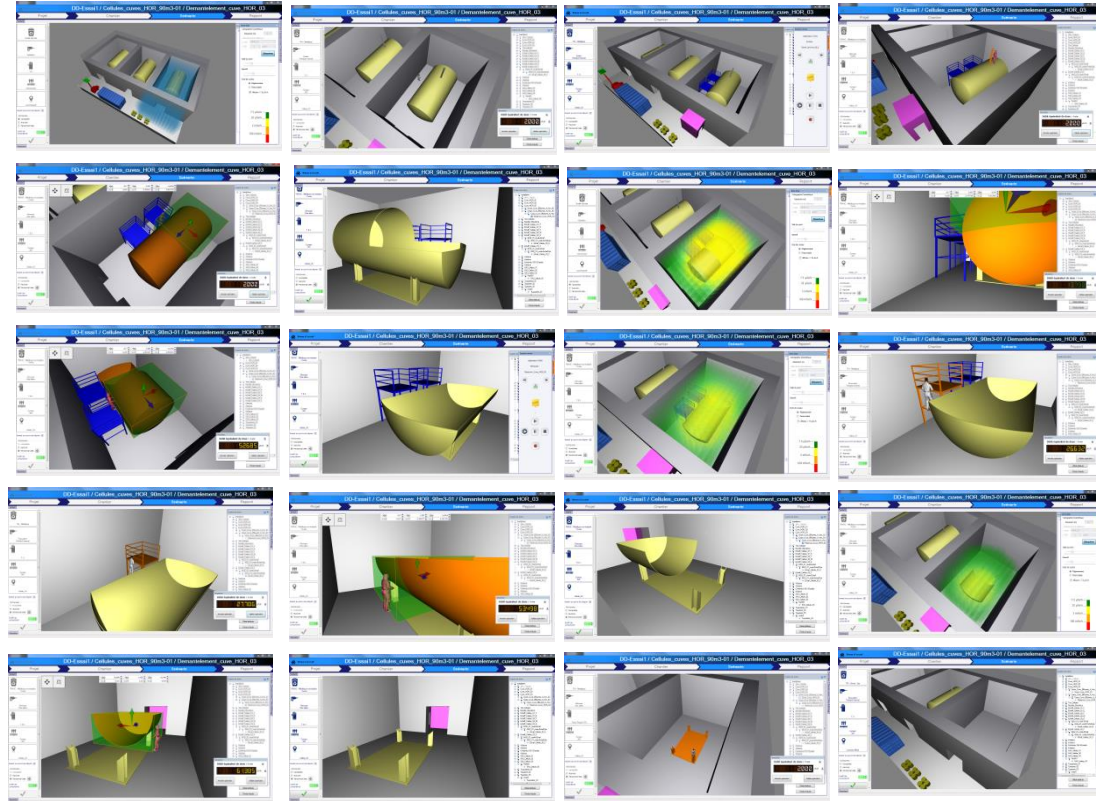
■ Phase 3: Involvement in the PLEAIDES project EC H2020 (2019-2023)

- Design of the PLEAIDES platform to ensure that safety concerns are captured (input data)
- Running test cases (NPP, RR, FCF) including transfer of 3D models, data and dismantling scenarios with the objectives of addressing optimization of dismantling scenarios

IRSN approach to develop the use of Digital simulation software

Phase 2 – Step 1: “home made” test cases conducted by IRSN (2018-2019)

- First step: Gradual test cases to understand the use of the 3D models, data collection process and optimization of dismantling scenarios
 - ✓ Detailed models and advanced scenarios
 - ✓ Detailed models and simplified scenarios
 - ✓ Simplified models and simplified scenarios

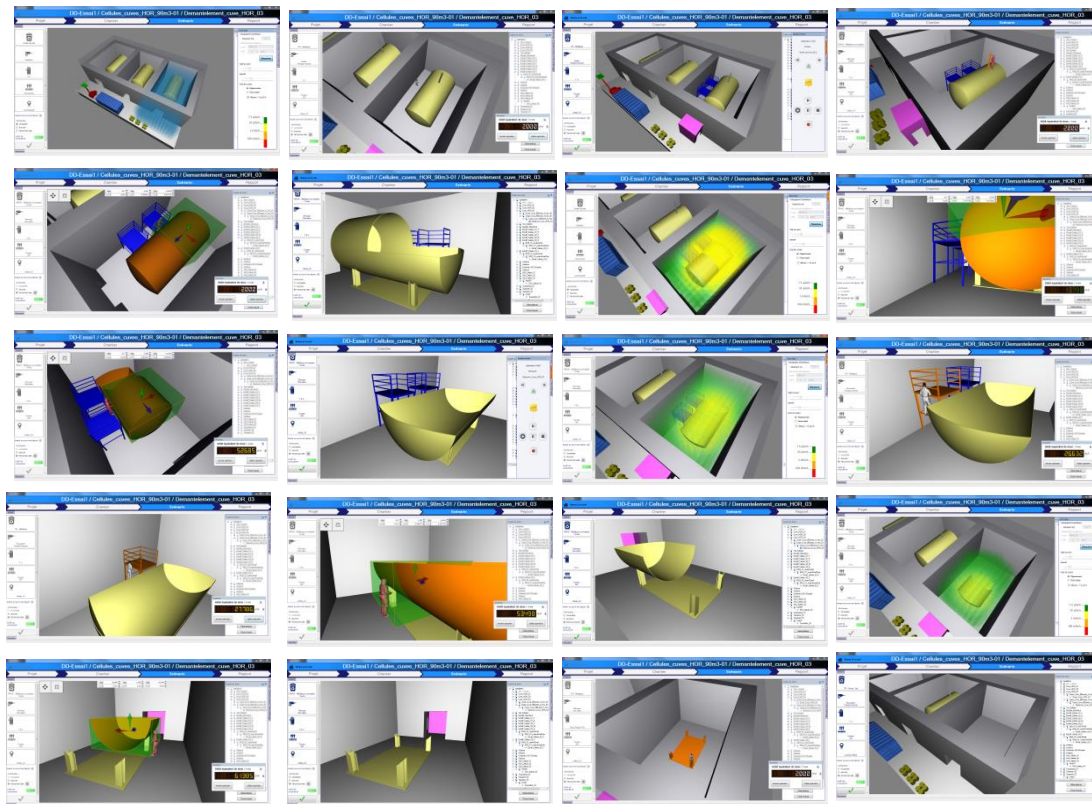
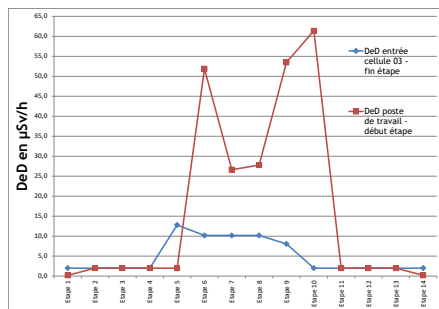


IRSN approach to develop the use of Digital simulation software

Outcomes of Phase 2 (2018-2019)

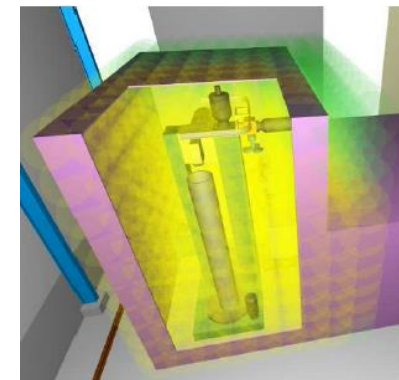
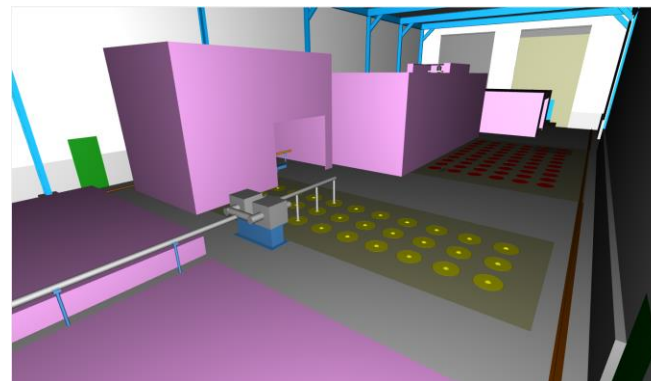
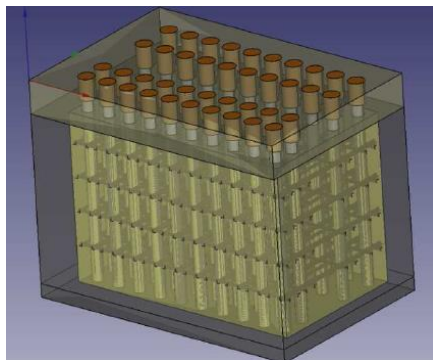
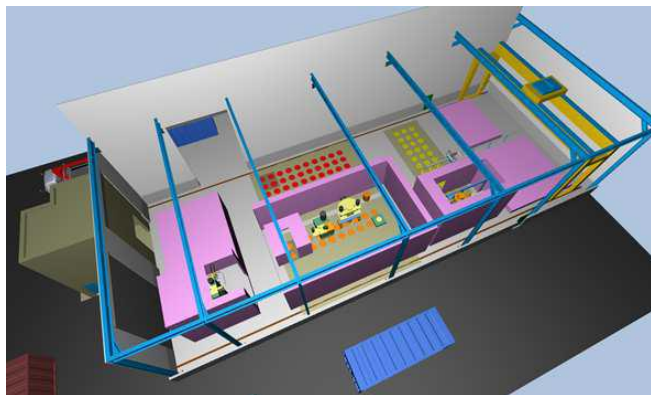
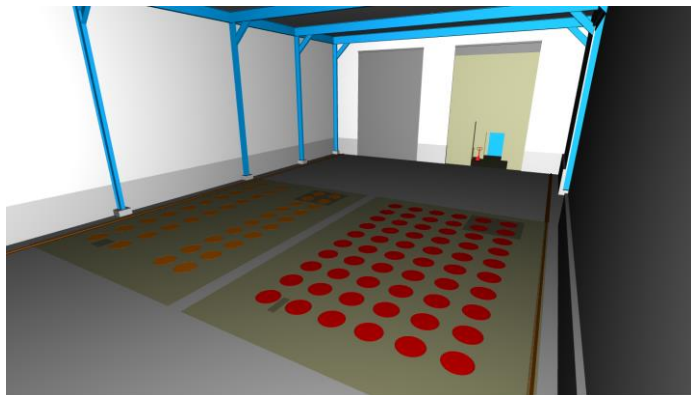
- 3D models and data set requirements linked to the objectives to be achieved
- Range of uses
 - ✓ Virtual visit and dose rate calculations (Data set 1 – DS1)
 - ✓ Simulation of scenarios (DS1 + DS2)
 - ✓ Simulation of scenarios and waste estimation (DS1+DS2+DS3)

Ambient dose rate evolution for each phase (before/end)



Example of development of 3D models and calculation to support IRSN review

■ Outcomes of Phase 2 – step 2 (2018-2019): Dismantling of a storage facility (review of the SAR)



Review of dismantling scenarios:

- Pits are dismantled during the last phases of the decommissioning project: scenario not detailed in the SAR
 - 6 pits are highly contaminated
 - IRSN considered one new option which is the prior decontamination of the 6 pits concerned at the beginning of the decommissioning project by remote tools
 - Results are addressed for the 2 options (with and without the prior decontamination of the 6 pits)
- ✓ **Finding:** Prior decontamination of the 6 pits at an early phase of the project could be considered

Dismantling without prior decontamination (6 pits highly contaminated)	Duration	Collective dose	Radioactive waste (%)	
Tasks	%	%	VLLW	LL-IL short lived
Preparatory works	2	1	/	/
Dismantling of supporting structures of pits	18	8	75	/
Dismantling of 94 pits slightly contaminated	53	27	3	/
Dismantling of 6 pits highly contaminated	4	52		100
Clean-up of First and second pits zones	10	5	13	/
Clean-up of the third pits zone	7	4	4	/
Final clean-up of the premise	6	4	5	/
	12 549 h	61 M.mSv	1 214 t	20 t

Dismantling with prior decontamination (6 pits highly contaminated)	Duration	Collective dose	Radioactive waste (%)	
Tasks	%	%	VLLW	LL-IL short lived
Preparatory works	2	2	/	/
Dismantling of supporting structures of pits	18	14	75	/
Dismantling of 94 pits slightly contaminated	53	51	3	/
Dismantling of 6 pits highly contaminated	4	11		100
Clean-up of First and second pits zones	10	5	13	/
Clean-up of the third pits zone	7	4	4	/
Final clean-up of the premise	6	4	5	/
	12 549 h	32 M.mSv	1 214 t	3 t

Summary - Discussion

■ IRSN approach: Use of 3D models and related data can support the regulatory review approach

- Optimization of dismantling scenario: robustness, feasibility
- Focus on particular tasks needed in deep review (detailed safety assessment)

■ IRSN is a technical support organization

- IRSN can not developed 3D models and collect data for them
 - 3D models and data are updated frequently (which data are to be kept and for how long?)
- 3D models and data will need to be shared between Regulators/TSOs and operators:
 - What are the barriers? (legal, technical, constraints of the industrial market, contractors)
- IRSN need to maintain a team of engineers able to use 3D models as needed (training):
 - Need still to confirm the benefits of the use of 3D models and data for generalists and specialists

■ Next phases for IRSN to consolidate the ongoing approach for the use of 3D models:

- Use of large 3D models developed in the frame of the PLEAIDES project: 3 kinds of facility (NPP, RR, Fuel Cycle Facility)
- Review of the relevance of data collected of “selected” dismantling scenario (optimization)