ALARA Approach - Dismantling Pit 7

Building 147 - Decladding

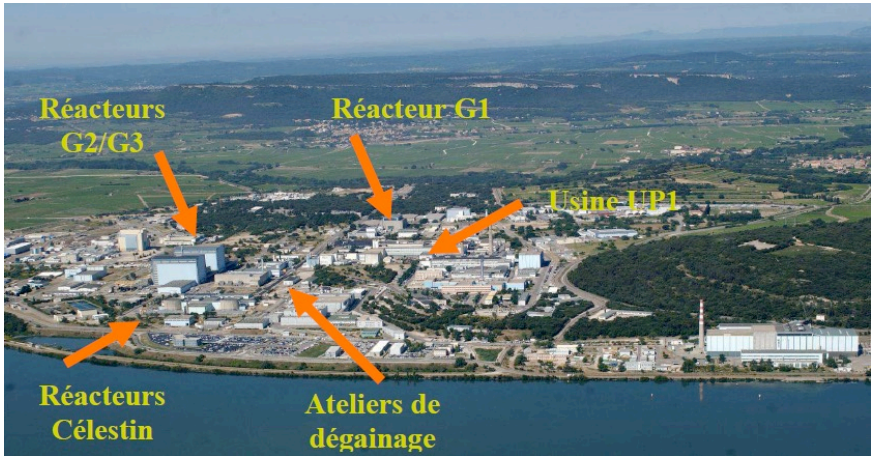
F. PETITOT / C. DURAIN

11/03/2019

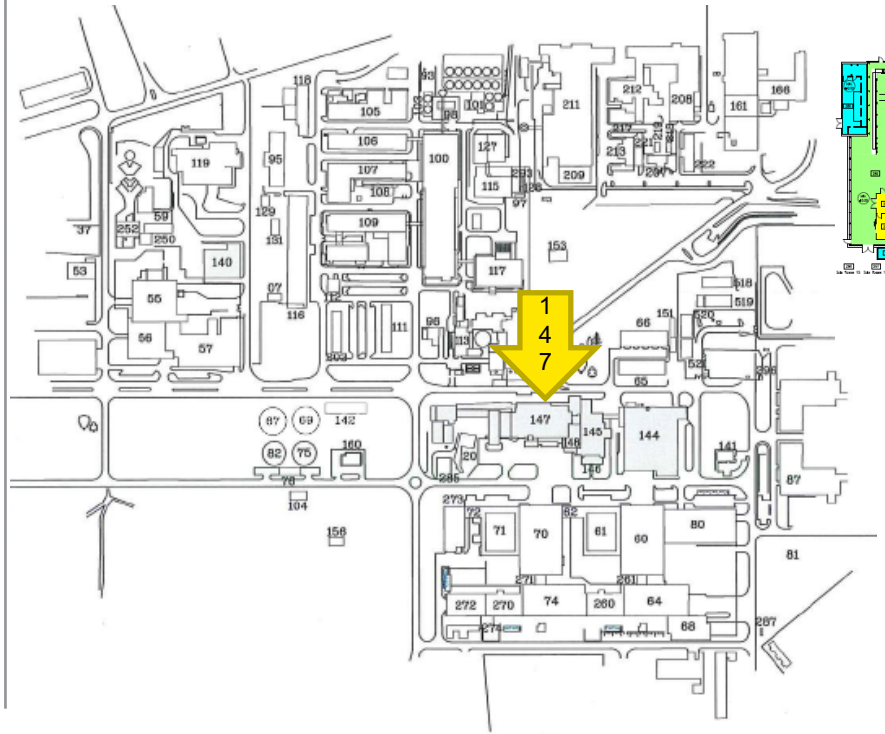
Location of the operations

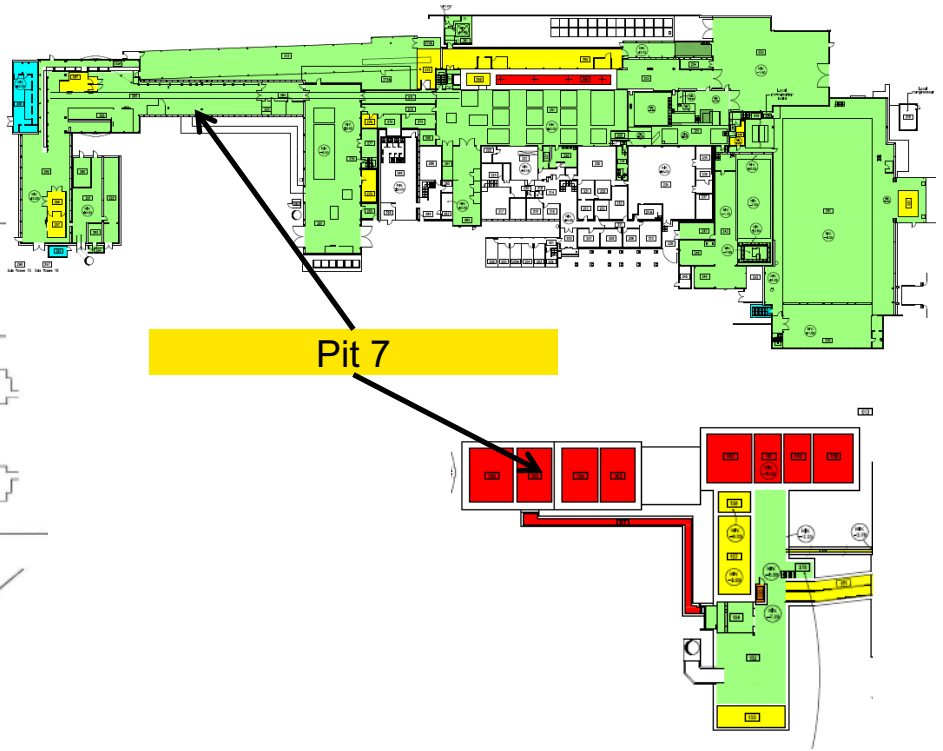
Marcoule Center

Decladding workshops



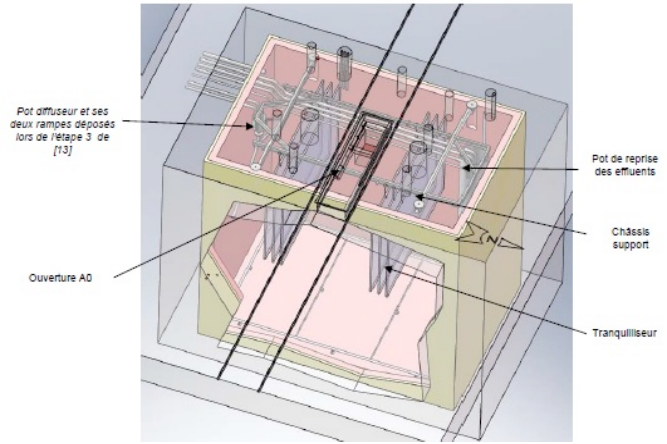
Building 147 decladding workshops





Pit 7

- Pit 7 was designed to hold liquids during the operational period, and to enable the decanting and storage of graphite from EDF spent fuels and zeolites from cooling pool treatment.
- Height: 7.38 m
- Length: 6.55 m
- Width: 4.55 m
- Usable volume: 176 m^3
- Covered by a 1m thick concrete ceiling slab

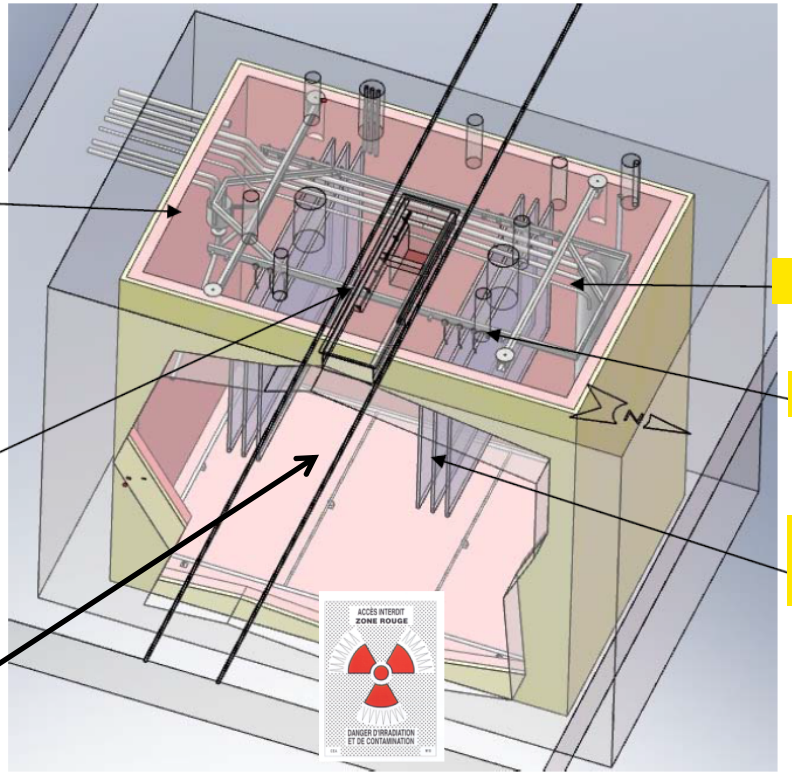


Worksite phases

Emptying and dismantling Pit 7 in the Decladding building

- Retrieval of the waste (sludge + graphite) present in the bottom of the pit
- Internal equipment rinsed
- A0 opening in the ceiling slab enlarged
- Dismantling and removal of the internal equipment
- Pumping system dismantled
- Final pit treatment (removal of polyester + concrete pit bottom and walls, and cleanup of black steel casing).

Equipment present



Diffuser pot and spreading blades
4 Gy/h

Opening A0

Pit center
at mid-height
120 mGy/h

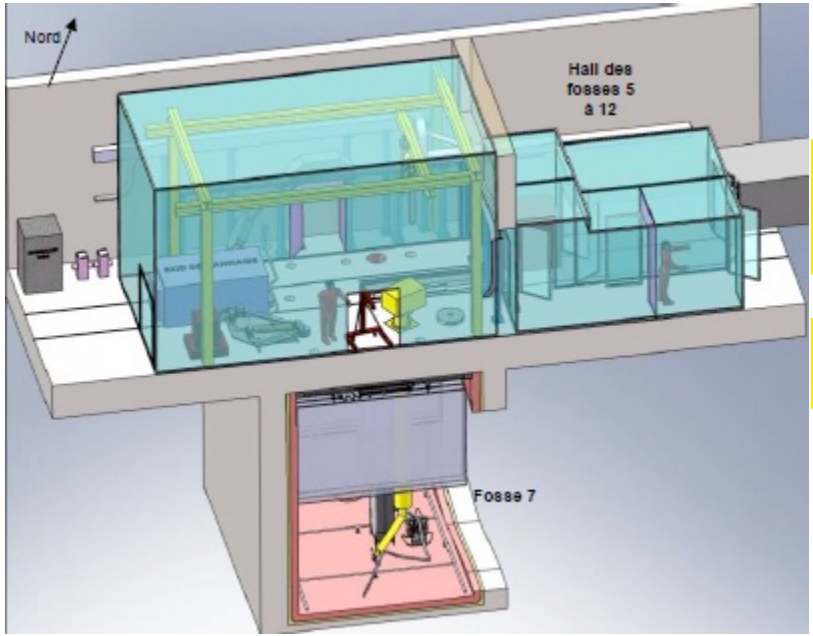
Effluent retrieval pot

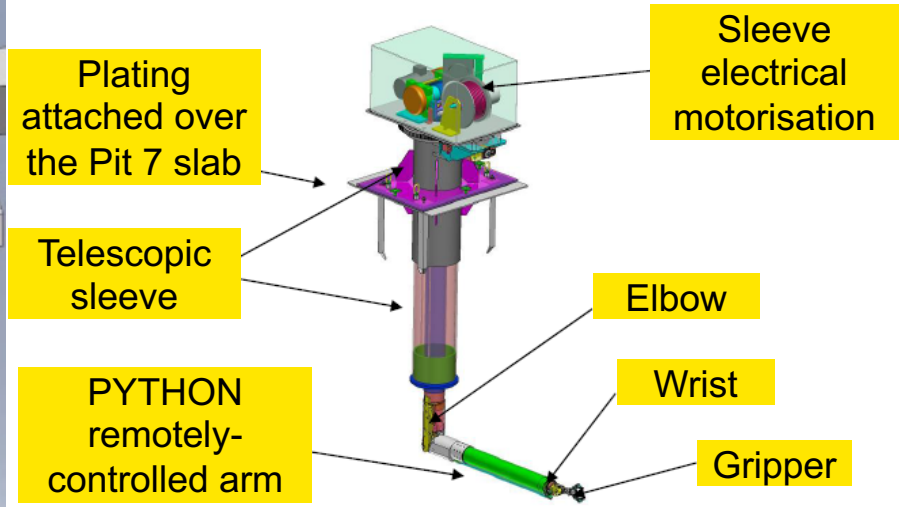
Support frame

Wave control plates
240 to 400 mGy/h

orano cea

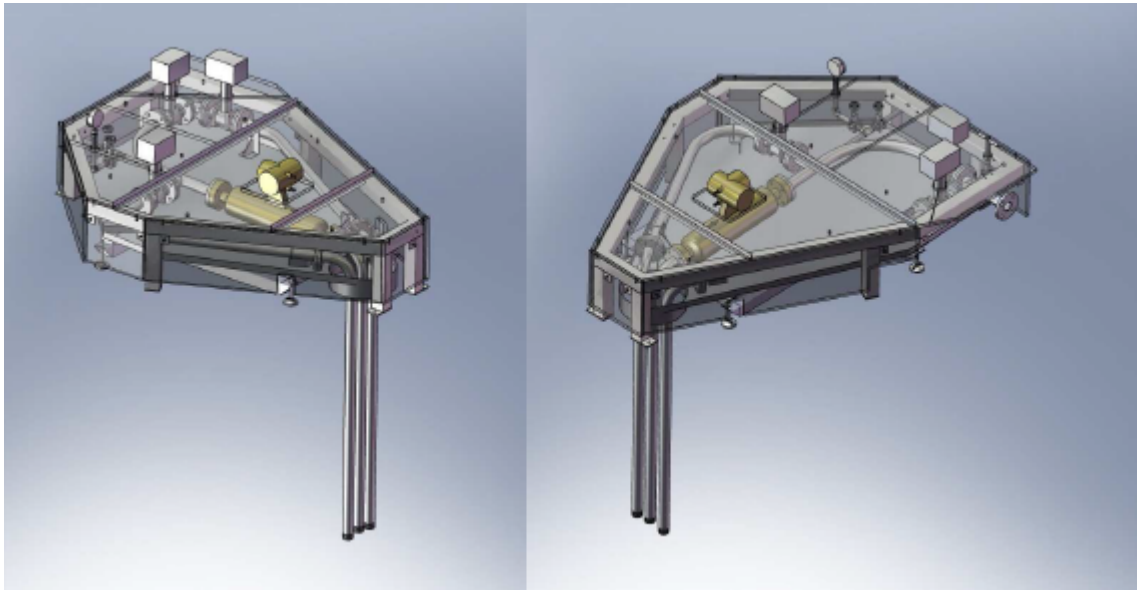
Worksite setup





Retrieval of waste from the bottom of the pit

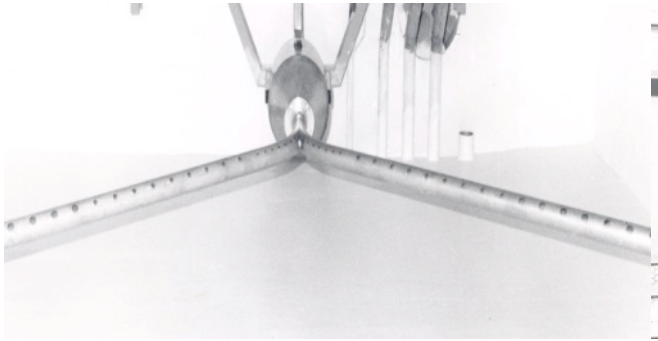
- Use of a pumping SKID:

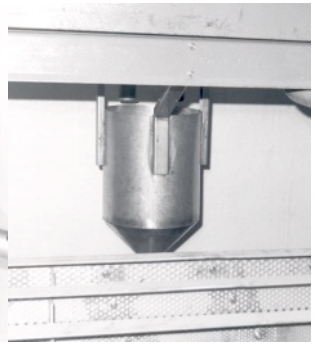


- The PYTHON arm enabled the suction nozzle to be positioned.

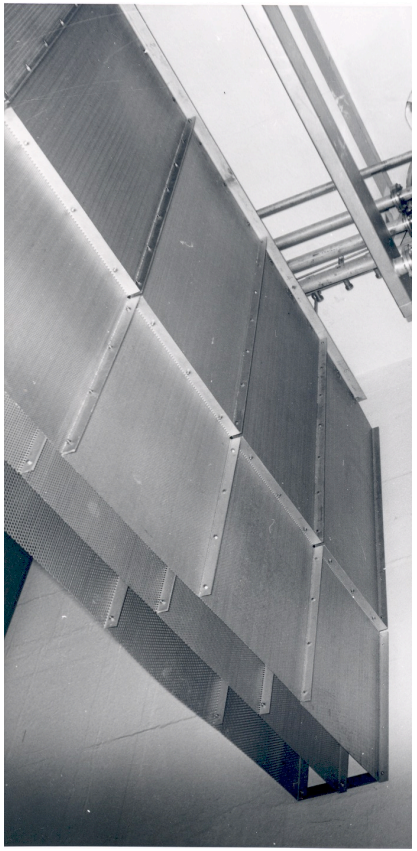
Rinsing the internal equipment

RETRIEVAL POT





DIFFUSER POT AND ITS SPREADING BLADES

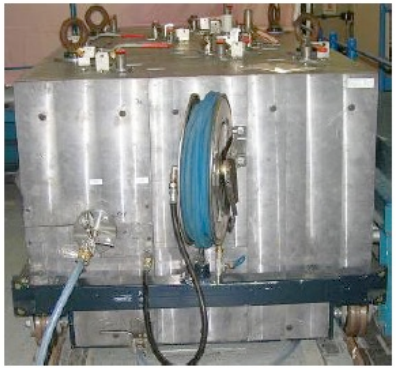


WAVE CONTROL PLATES

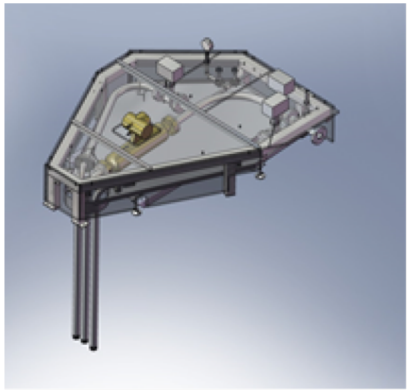
Dismantling the internal equipment and the pumping system

- **Dismantled items cut up using:**
  - **a Brokk 180 equipped with a grinder**
  - **A PYTHON arm equipped with a plasma torch**

- **Dismantling the pumping system:**
  - **Rinsing, then winnowing skid and pumping skid dismantled.**
  - **Removal of submerged pump and sludge retrieval pump.**

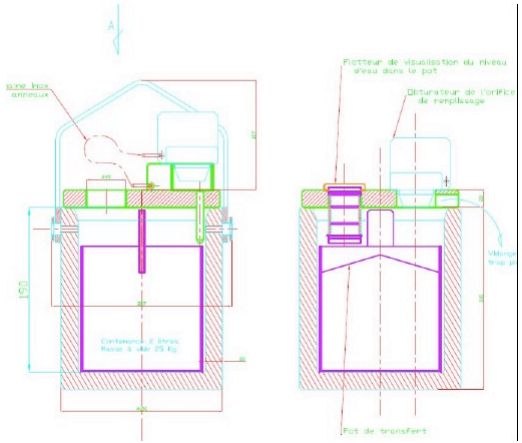


Skid de vannage se trouvant à l'Ouest du sas d'intervention



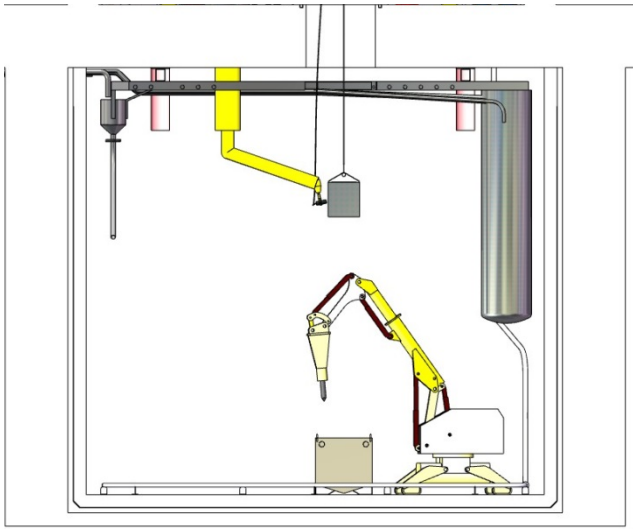
Removal of cut pieces (1/2)

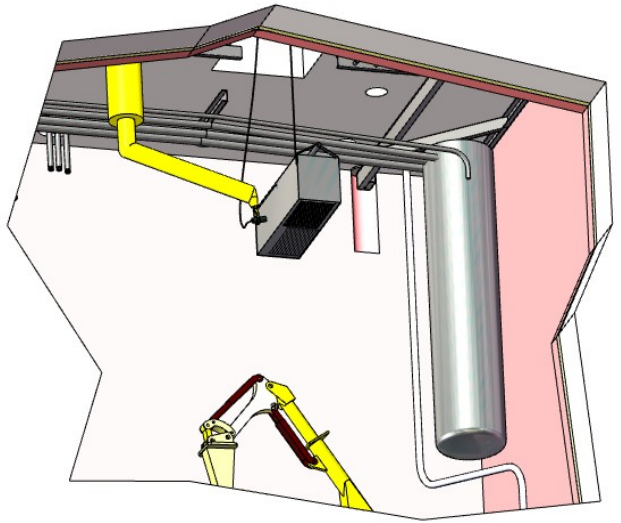
- The highly irradiating pieces were grouped in radiation-protected containers.
- These were lifted up through the pit ceiling and placed in a transfer cask, for containment in a special packaging or a suitable disposal site.



Removal of cut pieces (2/2)

- The other pieces were grouped in waste containers.
- An irradiation check was carried out by the PYTHON arm equipped with a measurement detector before their removal from the pit .





Final treatment of the pit

- Removal of the polyester lining and of the concrete tank walls until the black steel tank layer was reached (floor and walls).
- Surfaces chipped off by the Brokk inside the pit.
- Waste removed in suitable packaging.
- Complete radiological testing of the pit state.
- Brokk removed.
- Final cleanup carried out manually by operators.

The ALARA Approach

Operations carried out by STMI

- STMI carries out operations for AREVA (now ORANO), which is the prime contractor for the CEA (2010)
- STMI set out the ALARA approach associated with the operations (106 pages).
- Validated by the Order Giver after SPR validation.
- Operations planned to last 534 working days, i.e. 2 years
- Forecast collective dose: 114.4 man mSv
- Annual individual dose of 6.5 mSv

Criteria taken into account in the ALARA approach

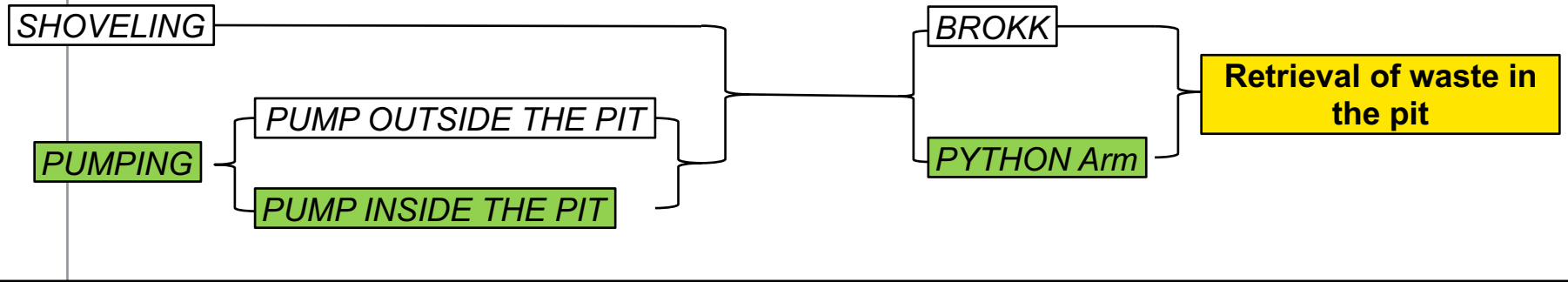
INTERMEDIARY SLUDGE RETRIEVAL	Option			
Criterion	**1**	**2**	**3**	**4**
Delivery time	5.8	5.5	5.0	4.8
Financial cost	5.5	5.0	6.0	5.5
Collective equivalent dose	4.0	6.0	4.0	6.0
Individual equivalent dose	4.0	6.0	4.0	6.0
Waste volume	6	6	6	6
Effluent volume	6	6	6	6
Technical difficulty	3.5	4.0	5.0	3.0
Security	6	3	6	3
Safety	6	3	6	3
TOTAL	46.8	44.5	48.0	43.3
AVERAGE	5.2	4.9	5.3	4.8
RANKING	**2**	**3**	**1**	**4**

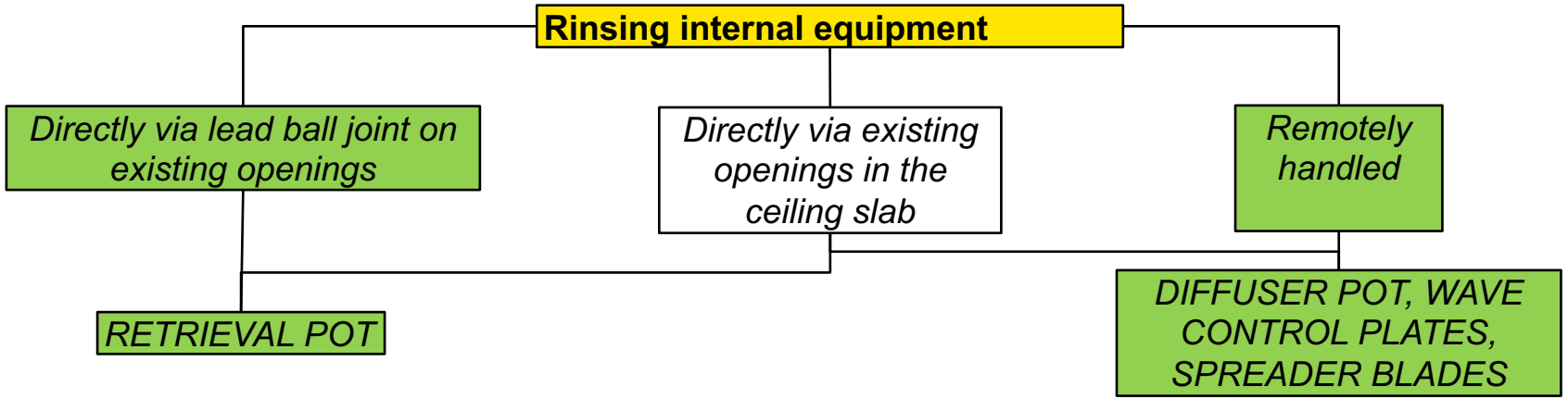
Model

Criterion max value: 6

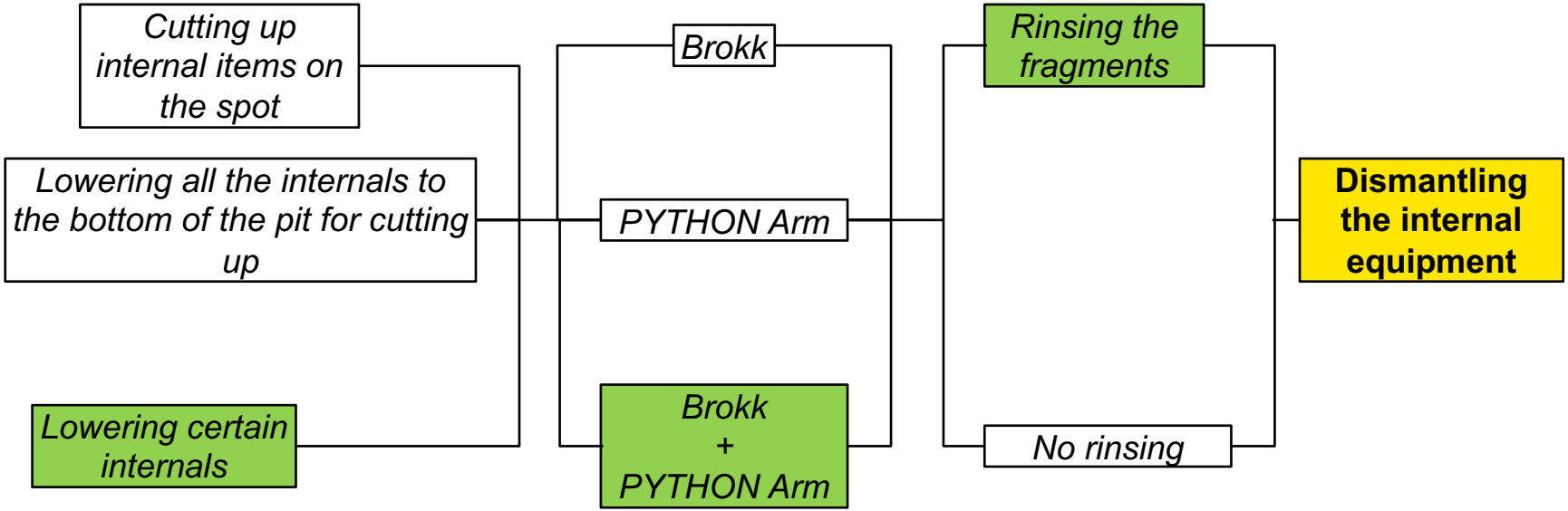
All criteria weighted at 1

Main variants studied (1/2)





Main variants studied (2/2)



Dose forecasts in 2010

Phase	Before optimization (man mSv)	After optimization (man mSv)	Dose gain (man mSv)
Retrieval of waste in the pit	64.8	45.2	19.6
Rinsing internal equipment	182.6	9.4	173.2
Dismantling internal equipment	80.0	33.0	47.0
Structure treatment	26.9	26.9	0
Totals	**354.3**	**114.4**	***239.8***

Evolution of the ALARA approach

- Since 2010, the ALARA approach has had 5 revisions (rev.7 → rev.12)
- 5 revisions of the forecast for the waste retrieval
- Discovery of highly irradiating waste (3 Gy/h) whose treatment has meant an increase in the forecast dose of 45 man mSv
- Premature wear on the aspiration pump leading to the need to change it 6 times, and meaning an increase in the forecast dose of 12.5 man mSv

Operational doses at the end of 2018

Phase	Forecast (man mSv) (Rev.7) 2010	Forecast (man mSv) (Rev.12) 2017	Actual (man mSv)	Dose gain (man mSv)
Retrieval of waste in the pit	45,.2	102.7	88.4 *Finished*	14.3
Rinsing internal equipment	9.4	9.4	2.4 *Finished*	7.0
Dismantling internal equipment	33.0	33.0	11.1 *Running*	
Structure treatment	26.8	26.8	*Left to do*	
Totaux	***114.4***	***171.9***	***101.9***	***21.3***

Conclusion

- **For this worksite:**
  - 7 revisions of the ALARA approach before the worksite began
  - 5 revisions since operations began (worksite started in 2010 and not yet finished)
- **On cleanup / dismantling worksites, the ALARA approach is applied continuously and dynamically.**
- **There is a systematic updating of the ALARA approach at each significant change in the worksite, to establish the new dose forecast.**
- **The objective is to guarantee the optimization of individual worker exposure.**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