

Selection and evaluation of decontamination and dismantling techniques for the decommissioning of large NPPs components

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Motivation

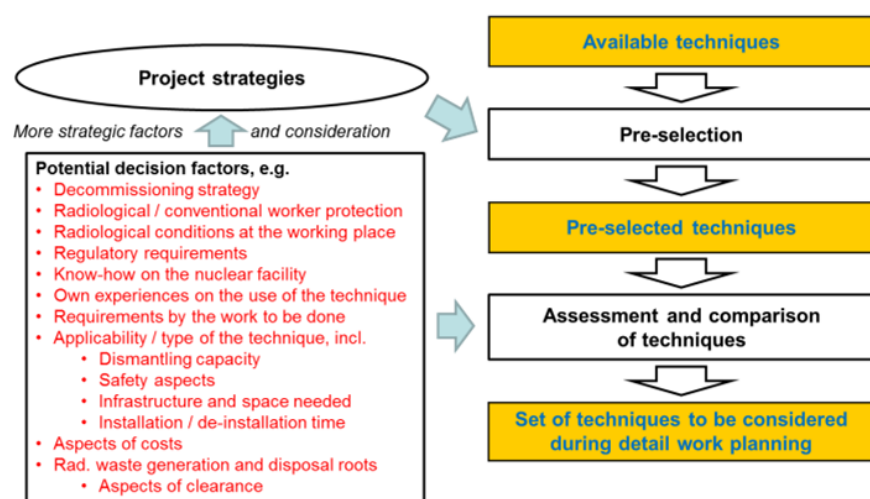
A wide variety of dismantling and decontamination (D&D) techniques is available.

Dismantling tasks of each large NPP component is unique with respect to

- technical challenges (space available, radiological conditions at work space),
- general strategic conditions.

Question: What systematics do operators apply to select D&D techniques?

Generic selection process¹⁾



Starting point is a list of all available techniques.

Pre-selection

According project strategies, i.e. sum of all considerations influencing the principle proceeding in decommissioning, led by

- general requirements, like
 - technical (not all techniques are suitable to dismantle all types of materials),
 - regulatory (qualification, i.e. has the technique been demonstrated to be suitable for the foreseen task in former projects, not necessarily at a nuclear installation), and
 - radiological (use of remote techniques in areas with high dose rates) aspects ,
- principles, e.g.
 - mechanical cutting techniques only,
 - to perform a decontamination of the system before dismantling.

Assessment of pre-selected techniques

Assessment of techniques using

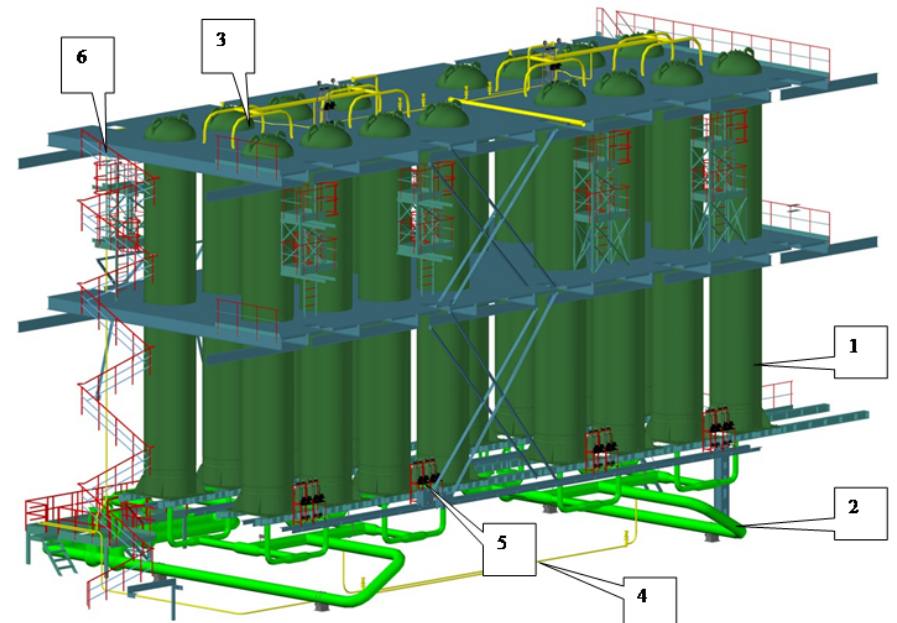
- qualitative (e.g. expert judgment, check lists),
- quantitative (e.g. HAZOP)

methods leading to a set of techniques to be considered during detailed work planning.

¹⁾Kaulard, J., Brendebach, B., Strub, E (GRS mbH), Strahlenschutzaspekte gängiger Abbau- und Dekontaminations-techniken, GRS – 270, ISBN 978-3-939355-46-5, 12/2010

Decommissioning of Ignalina NPP

Dismantling of emergency core cooling system:



1. Pressurized tanks, height: 14 m, mass: 47650 kg,
2. Large diameter pipework and fittings,
3. Nitrogen pipelines P=100 kgf/cm² and fittings,
4. Nitrogen pipelines P=6 kgf/cm² and fittings,
5. C&I frames,
6. Steel decks and stairs

List of available techniques

Flame cutting, plasma cutting, thermal lance, hydraulic shears, diamond wire saw, circular saw, abrasive disc cutting, band saw, reciprocating (sabre) saw, UHP water jetting, milling cutter explosives, vacuum extraction unit.

Possible D&D strategies and realization

- Passive safe storage (not realized)
- Intact disposal of equipment without decontamination (not realized)
- In-situ size reduction and disposal without decontamination (not realized)
- Ex-situ size reduction and decontamination (realized)
- In-situ size reduction and decontamination (not realized)

Assessment

- Expert judgment and weighted multi attribute decision analysis
- Quantitative assessment on basis of cost, waste management, schedule, manpower, ALARA, and conventional safety considerations

Results

- Flame cutting for large components
- "Tool-box" for smaller systems

Conclusion

Selection of D&D techniques follows a multi-step process

- reducing list of available techniques following on basis of general, strategic decisions and principle decisions,
- qualitative / quantitative analysis during of D&D tasks
 - leading to „tool-box“ of techniques,
 - allowing flexibility during detailed work planning for optimization of R&P, rad waste, costs etc.