FOSH – Forsmark Safety Enhancement Project

Post-Fukushima actions at Forsmark NPP

NKS January 12-13, 2016

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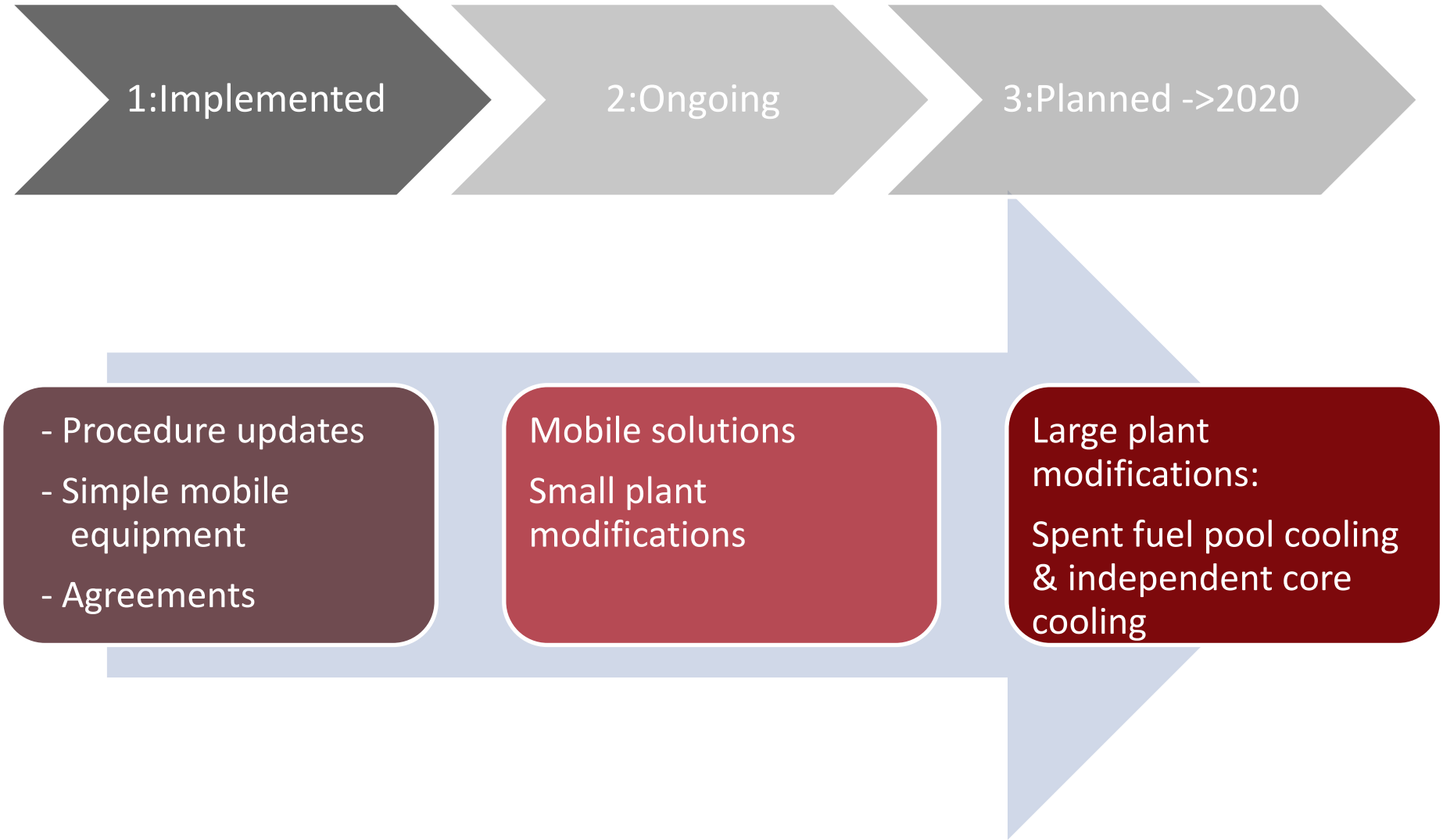
Sekretessklass: Open (S1)

FOSH – Three step strategy



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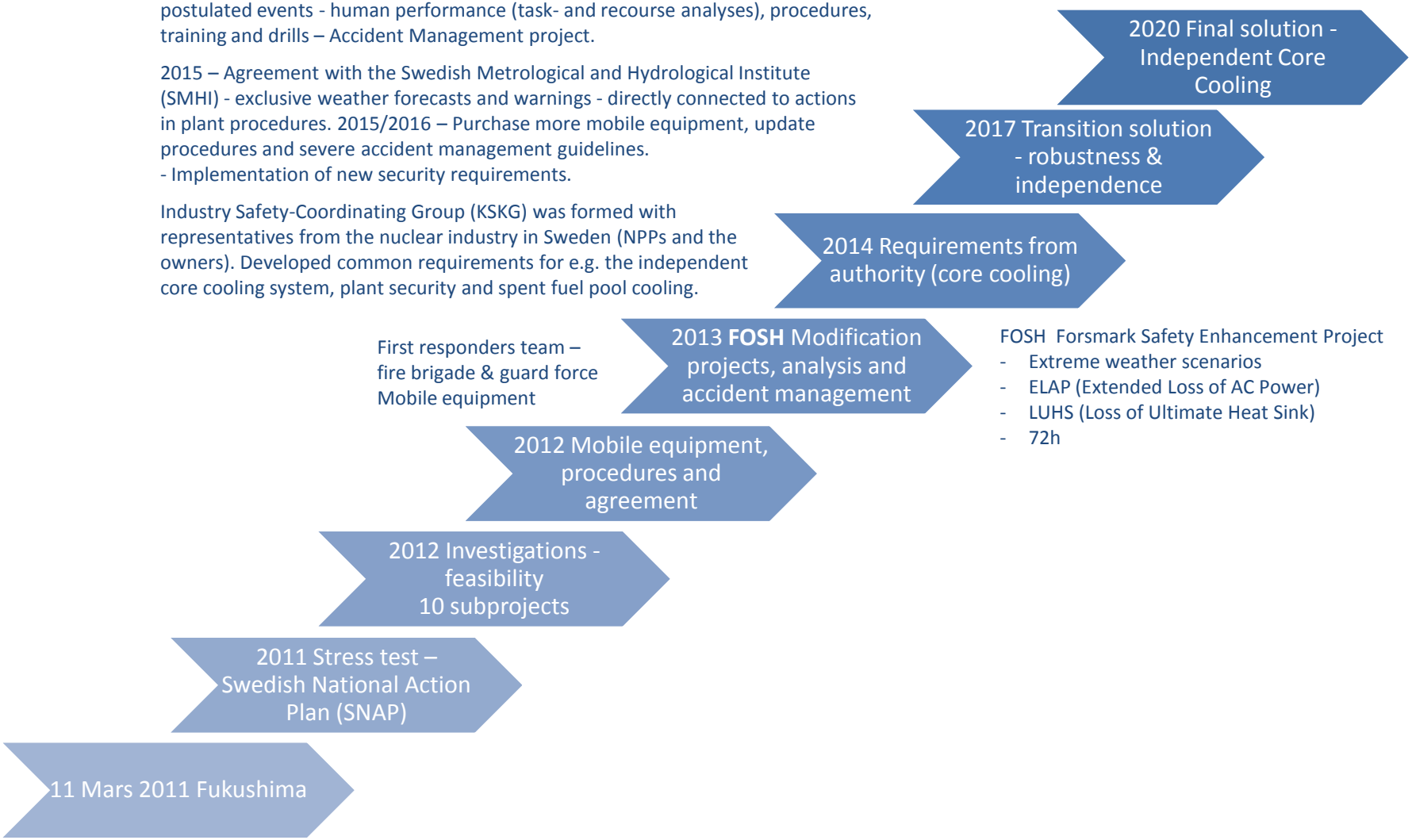
Post Fukushima Activities

Up to 2017 – An organisation that can handle the installed modifications during postulated events - human performance (task- and recourse analyses), procedures, training and drills – Accident Management project.

2015 – Agreement with the Swedish Metrological and Hydrological Institute (SMHI) - exclusive weather forecasts and warnings - directly connected to actions in plant procedures. 2015/2016 – Purchase more mobile equipment, update procedures and severe accident management guidelines.
- Implementation of new security requirements.

Industry Safety-Coordinating Group (KSKG) was formed with representatives from the nuclear industry in Sweden (NPPs and the owners). Developed common requirements for e.g. the independent core cooling system, plant security and spent fuel pool cooling.



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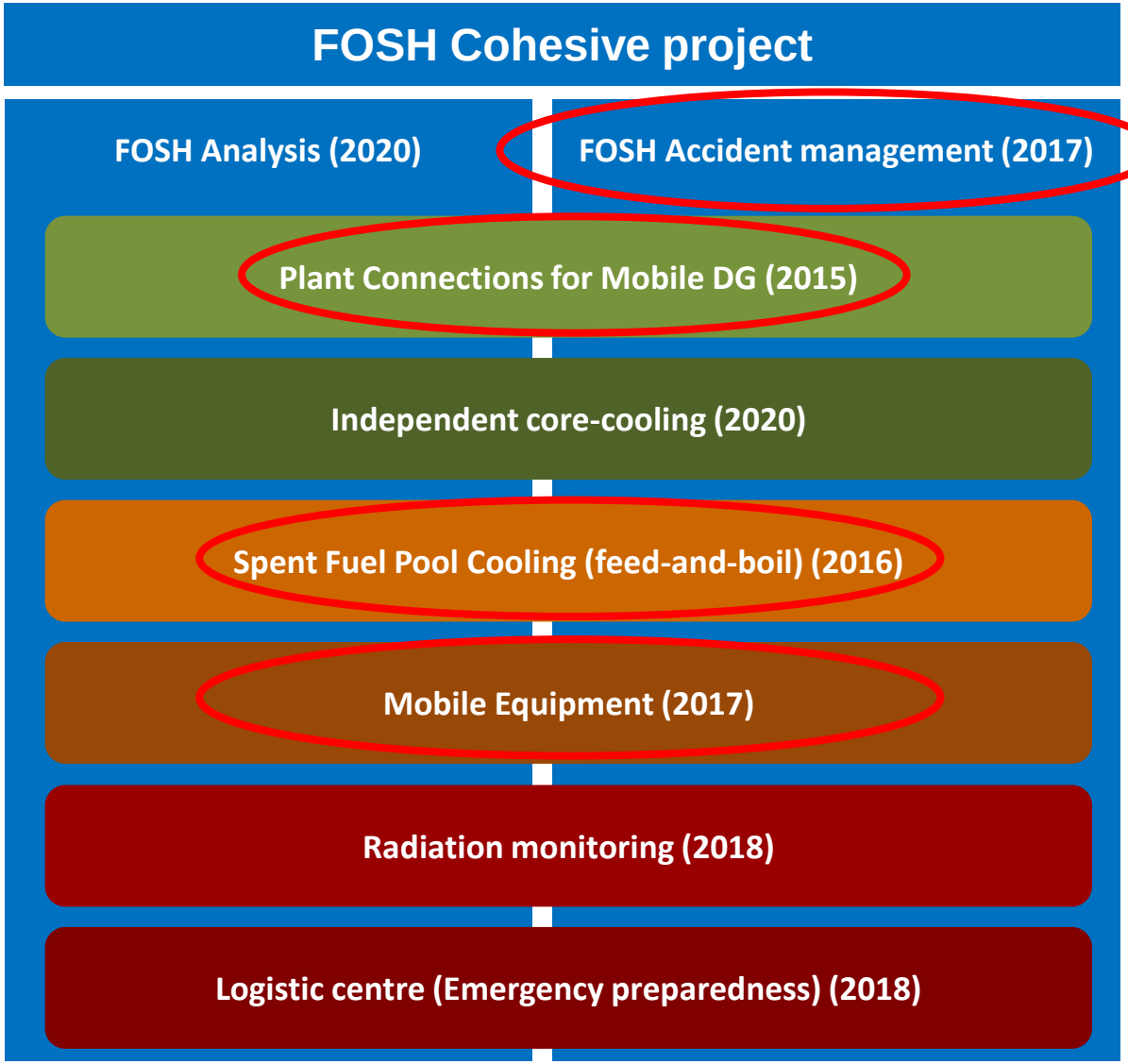
FOSH – Forsmark Safety Enhancement Project



- FOSH = will fulfill post-Fukushima requirements
- FOSH = both plant modifications and organizational improvements
- ELAP+LUHS+weather scenarios up to 72 h
- Safe state after 72h

Transition solution - 2017

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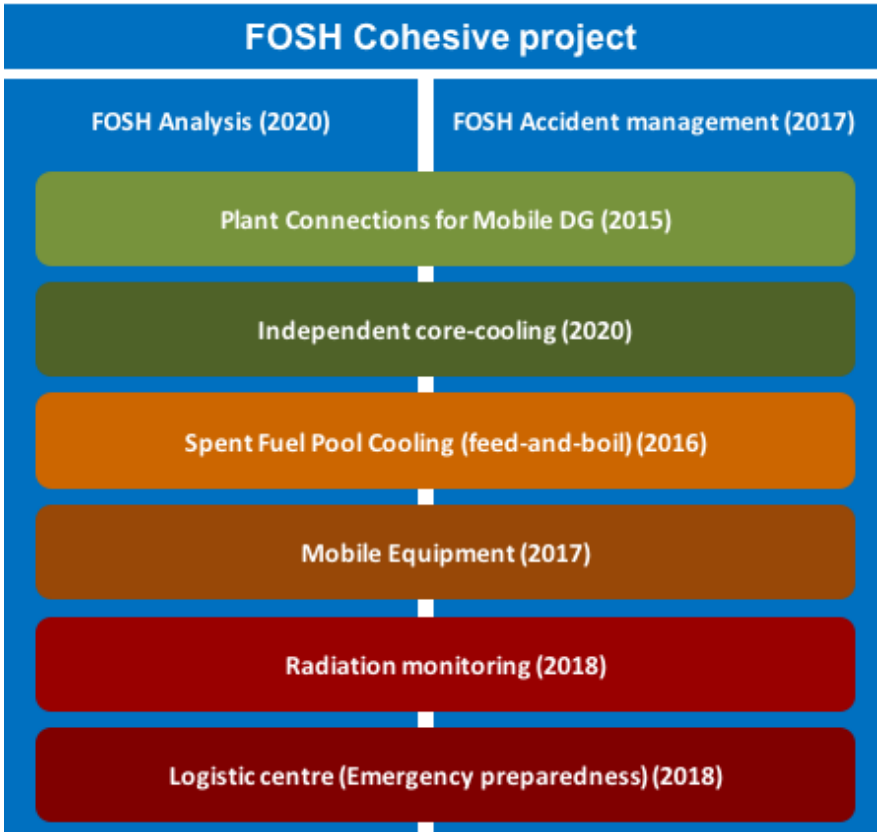
FOSH – Accident management project

Education & Training | Procedures & Routines | Exercise & Drills | Human Performance | Radiation Protection



The Accident Management project is responsible for the overall implementation and function of all FOSH-projects (Up to 2017, not independent core cooling)

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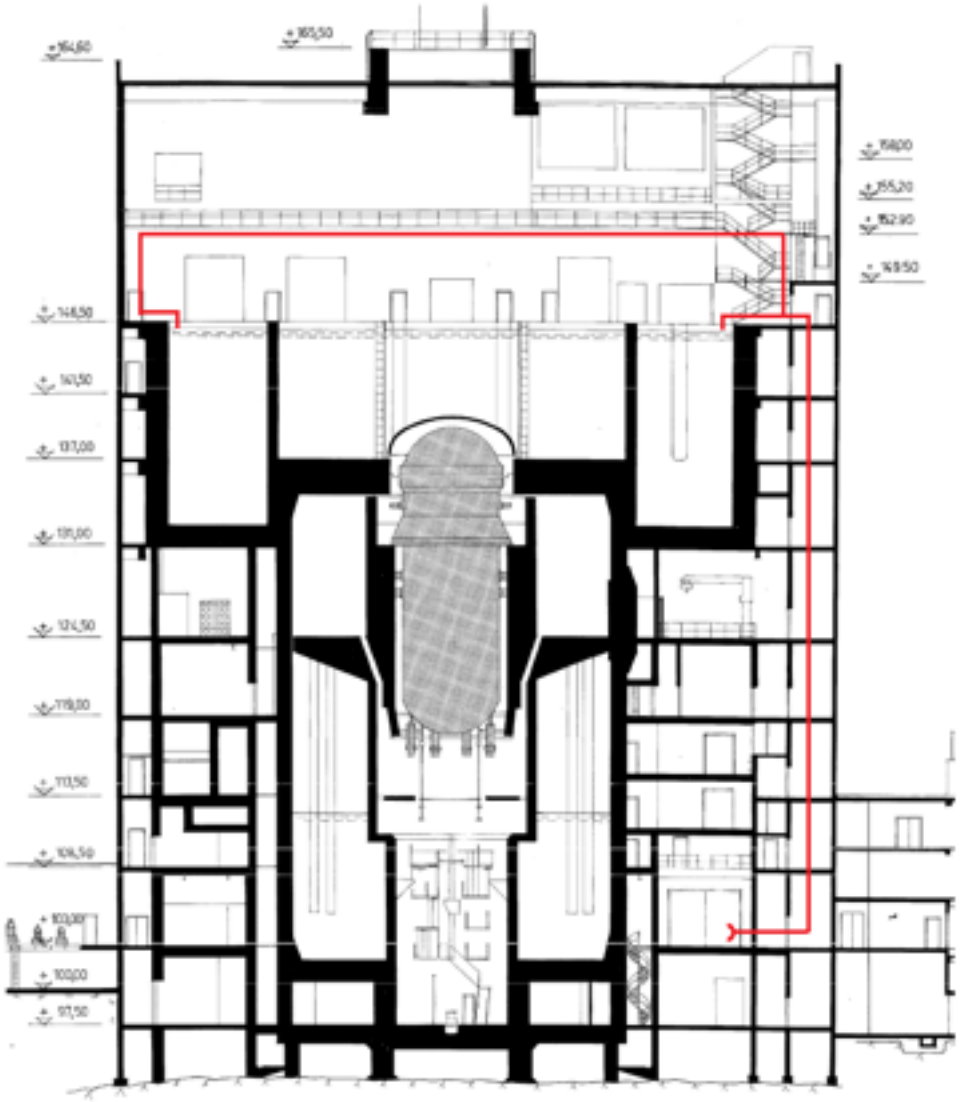
Spent Fuel Pool Cooling



The project target

- Water level above fuel top
- Level control

Technical solution

- Feed-and-boil-off – long grace times
  - New pipes and mobile pumps
  - Level measurement
  - Manual actions

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FOSH project – Mobile and temporary equipment

Mobile generators	Mobile cooling of existing DG at F12	Mobile equipment for extreme weather
Function Enough power to run ordinary start up diesel-sequence.	**Function** Makes it possible to cool existing emergency diesel generator with mobile pumps (LUHS).	**Function** Accident prevention or mitigation of the consequences of extreme weather scenarios. (*high/low temp, snow, ice storm, high sea level, organic materials in the intake*)
Equipment • 7 diesel generators (1350 kVA, 6,9/10,5 kV) • 4 external tanks (16-19 m³) – 24h • 11 trailers for transport • Cables	**Equipment** • Connections will be installed during outage 2014-2016 • Fire pumps, mobile pumps, etc. • Std. fire connections and hoses	**Equipment** Procurement during 2015/2016

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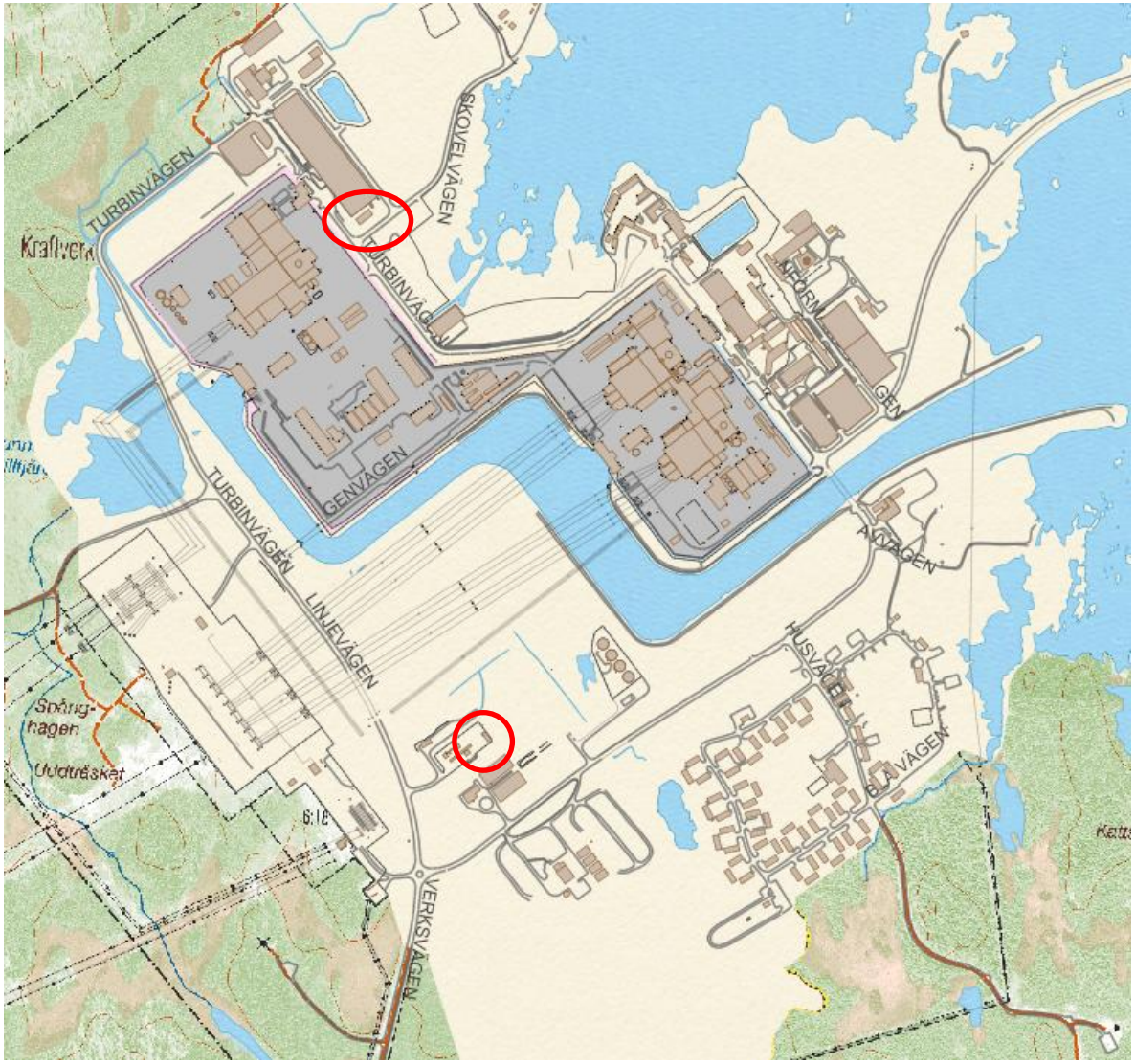
Mobile equipment – storage



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Mobile equipment 2012/13 - Gunnarsbo

On-site, Gunnarsbo

- 5x Diesel generators 30 kVA
- 4x Lighting with built-in diesel generator
- 8x Lighting of with external generator
- 10x Diesel generators 5 kVA
- 3x Diesel driven heaters 80 kW
- 12x Electric heaters 9 kW
- 6x Petrol driven air compressors
- 6x 30 m air hoses
- 5x Electric distribution boards 400/220 V
- 45x 25 m 400 V (32 A) cables
- 45x 25 m 220 V cables
- 30x Jerry cans 20 l

At the units

- 50x LED battery powered lights

External rescue company – 2013

A rescue company based in Östhammar but operates throughout Sweden.

- 13 persons on-call with 1 hour response time.
- Mobile equipment on-site.

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External rescue company - mobile equipment

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External rescue company - mobile equipment

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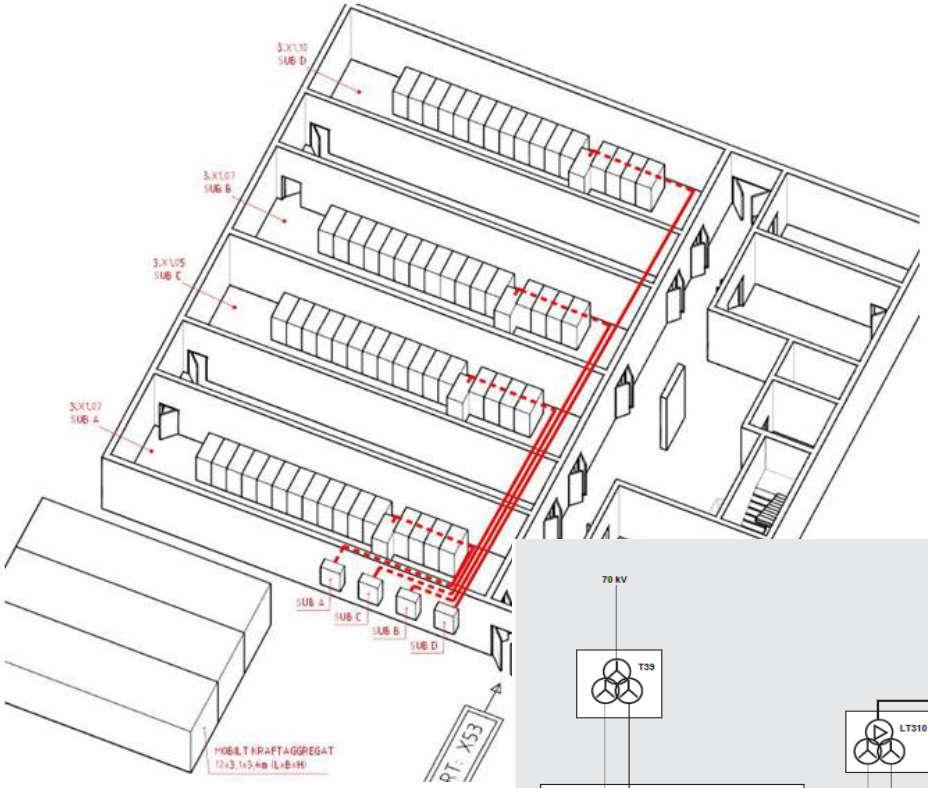
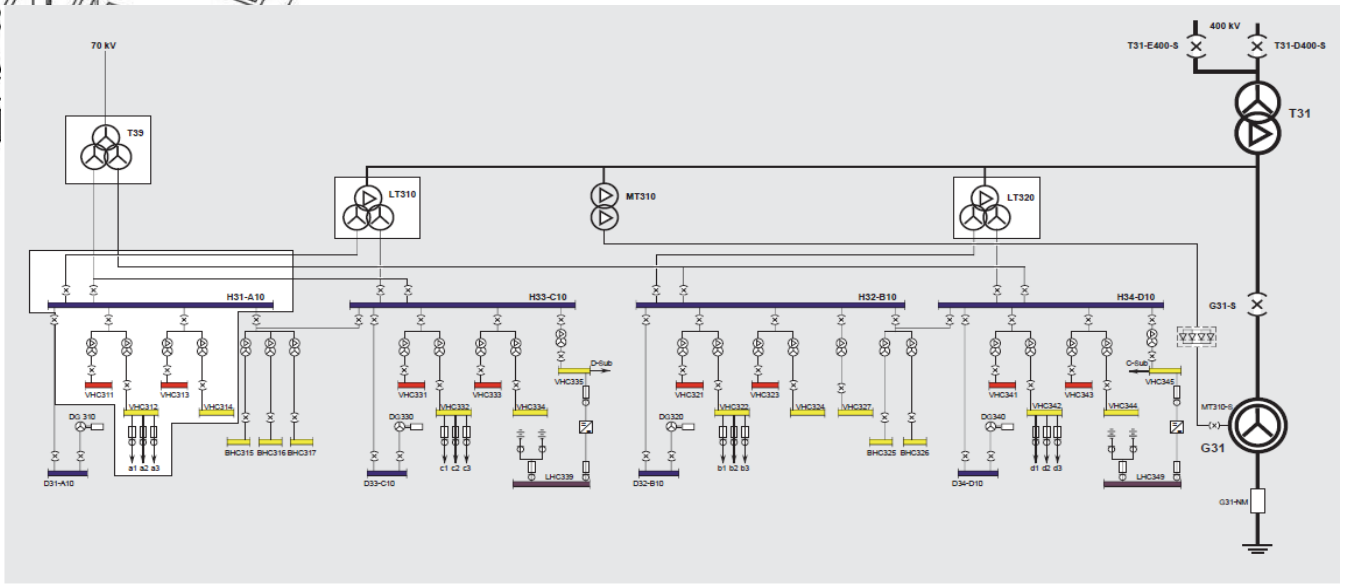
Mobile equipment – Diesel generators & connection points

Connections to the plant – modifications during outage 2015





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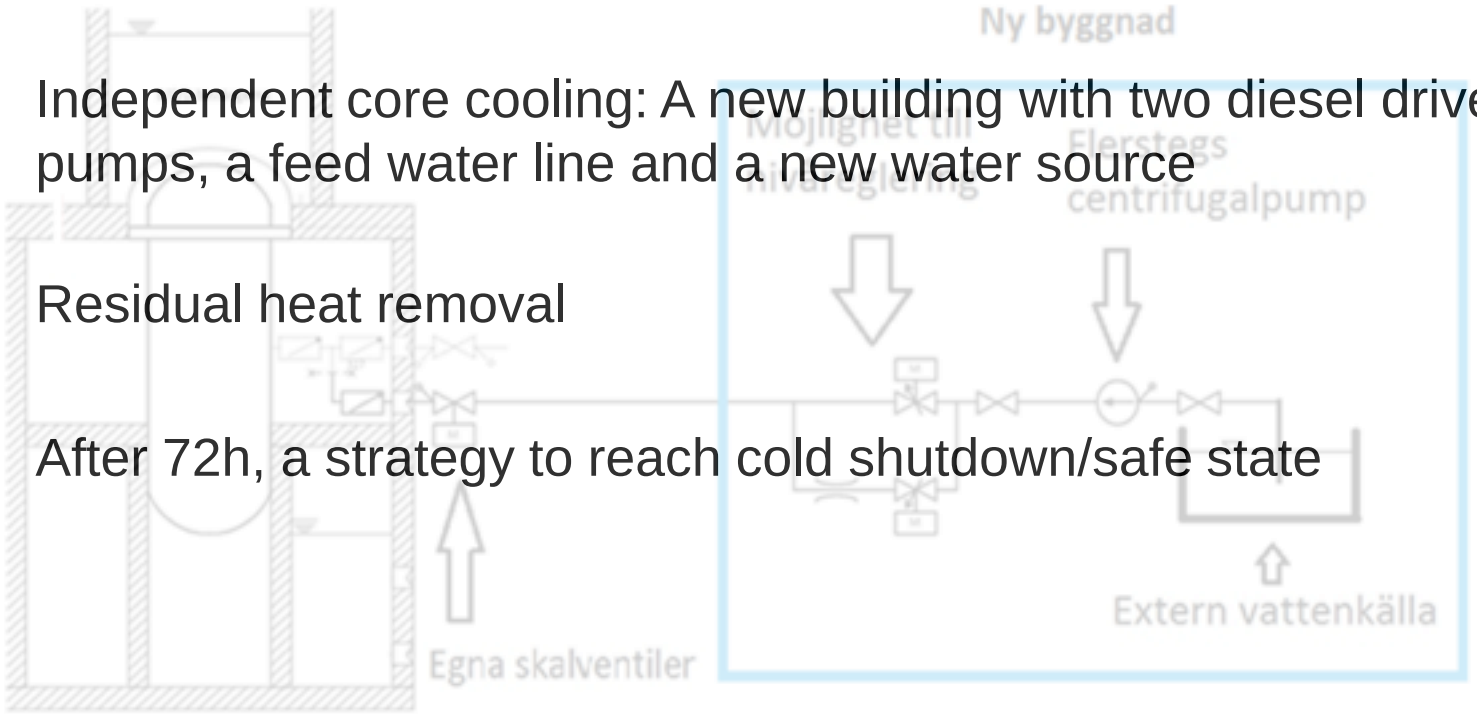
Independent Core Cooling – Final solution

- The new independent system will consist of three main parts:
  - Independent core cooling: A new building with two diesel driven pumps, a feed water line and a new water source
  - Residual heat removal
  - After 72h, a strategy to reach cold shutdown/safe state



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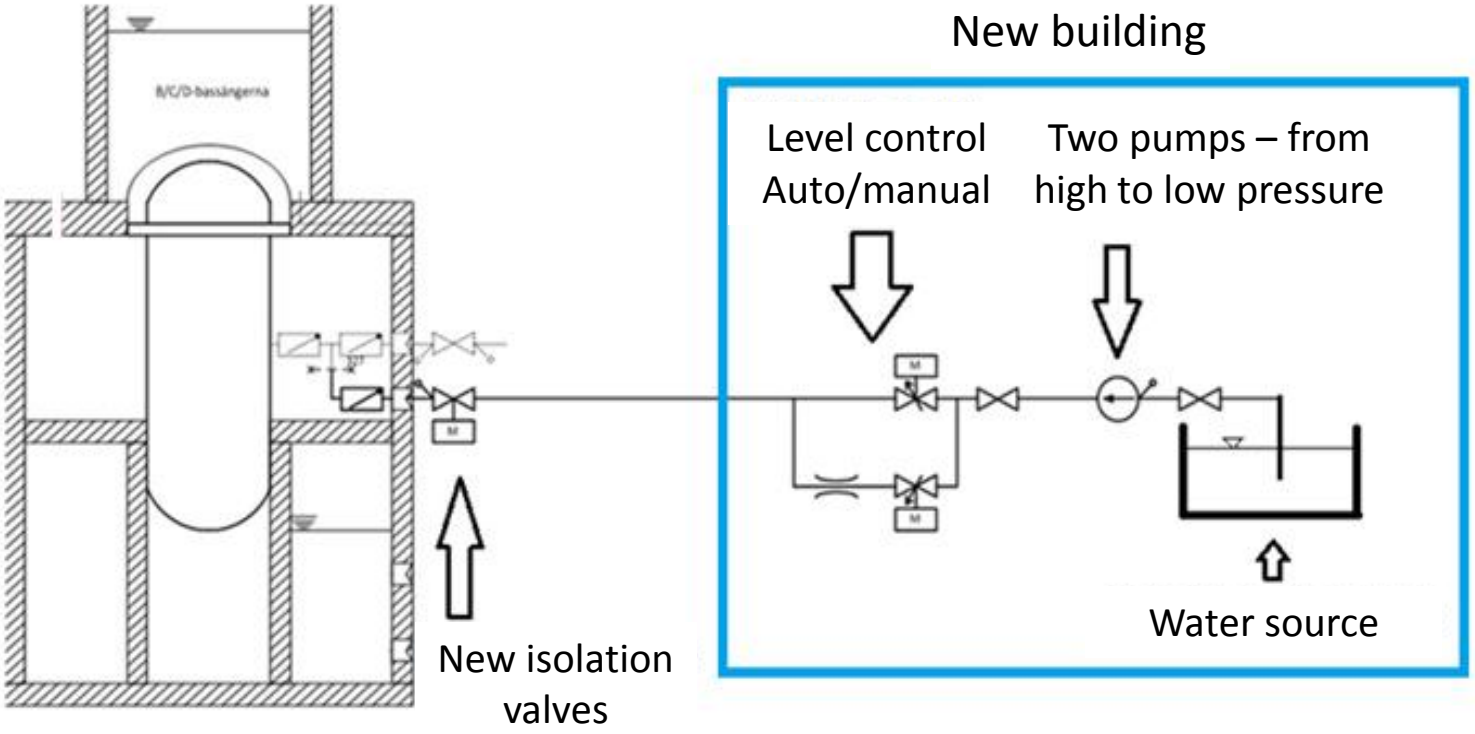
Independent Core Cooling



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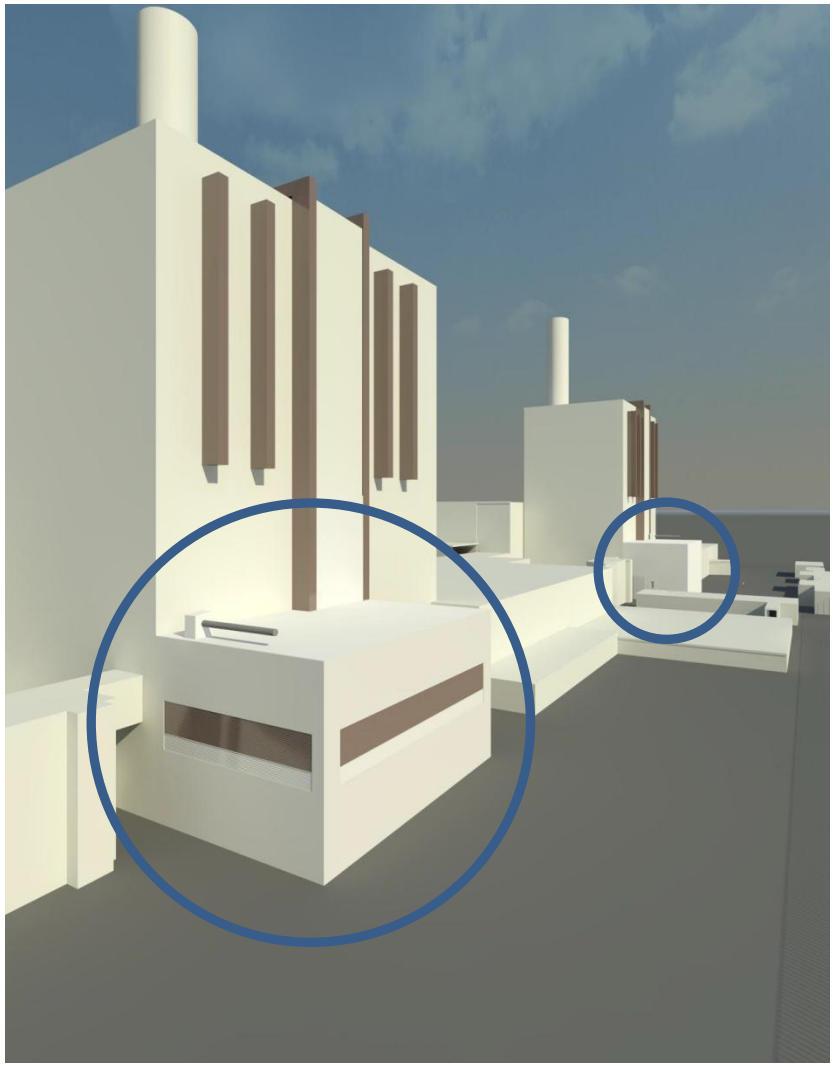
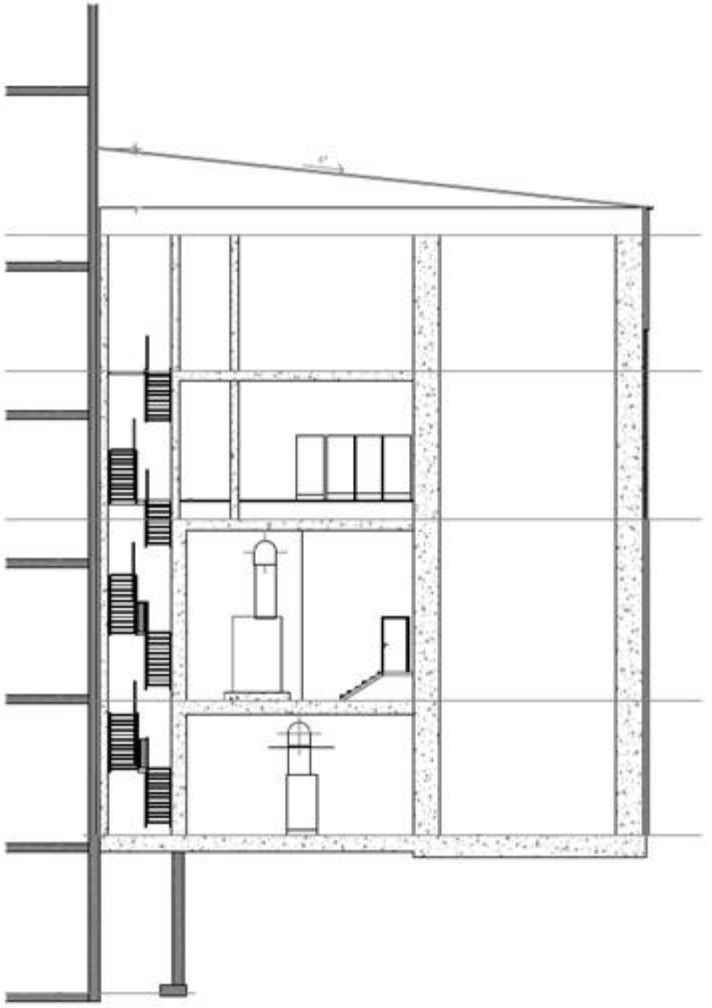
New buildings





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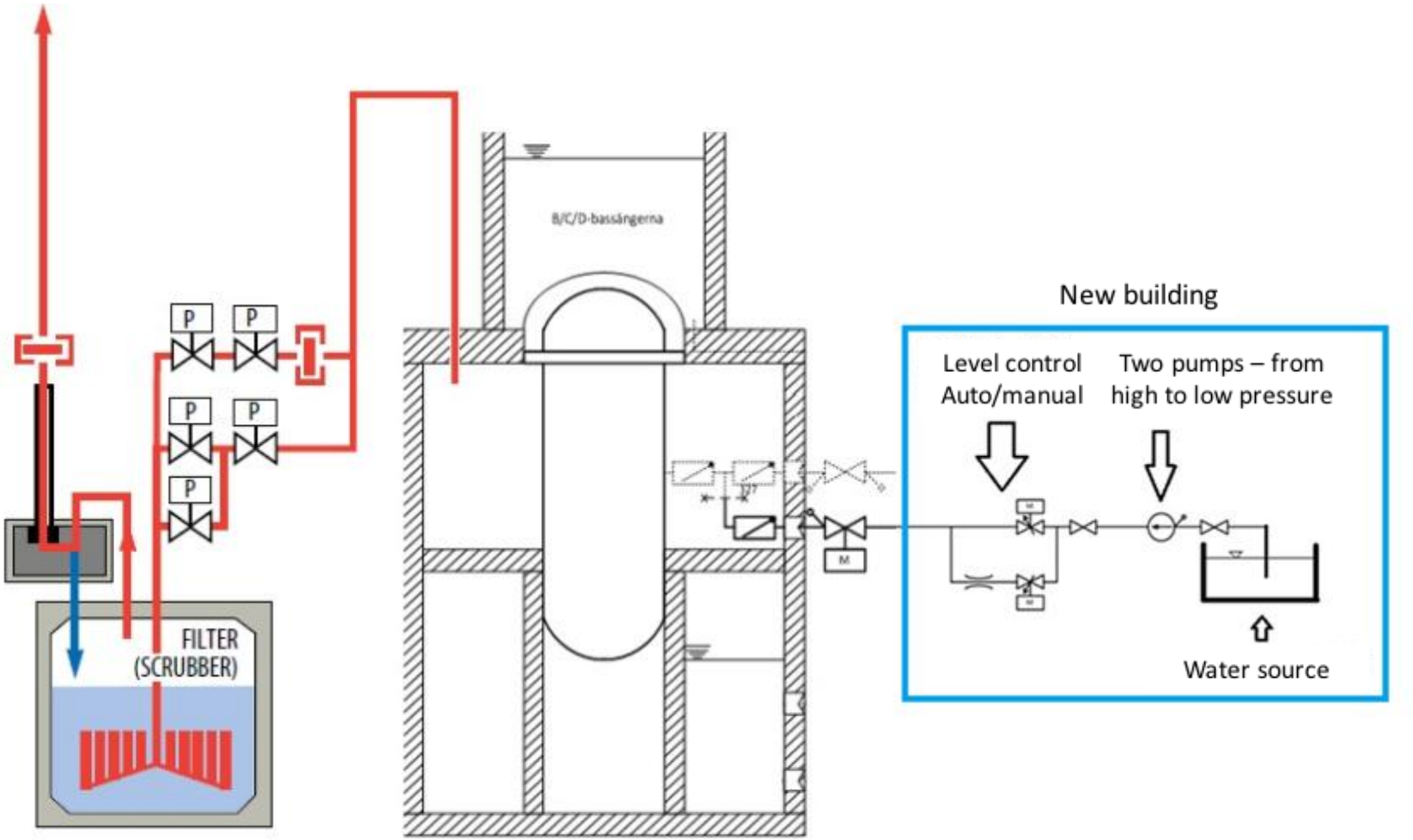
Residual heat removal



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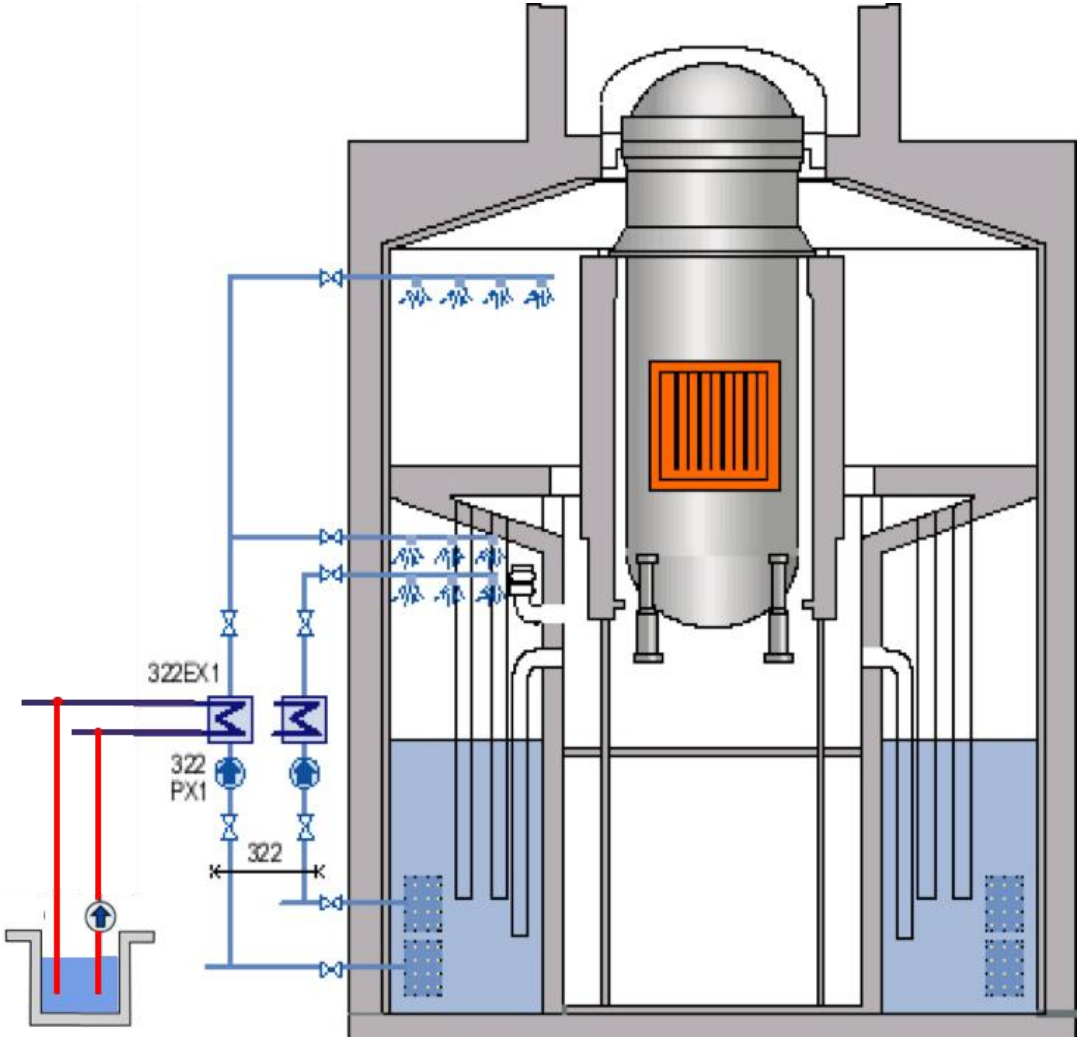
How to reach cold shut down condition/safe state?

Existing safety systems +
mobile equipment



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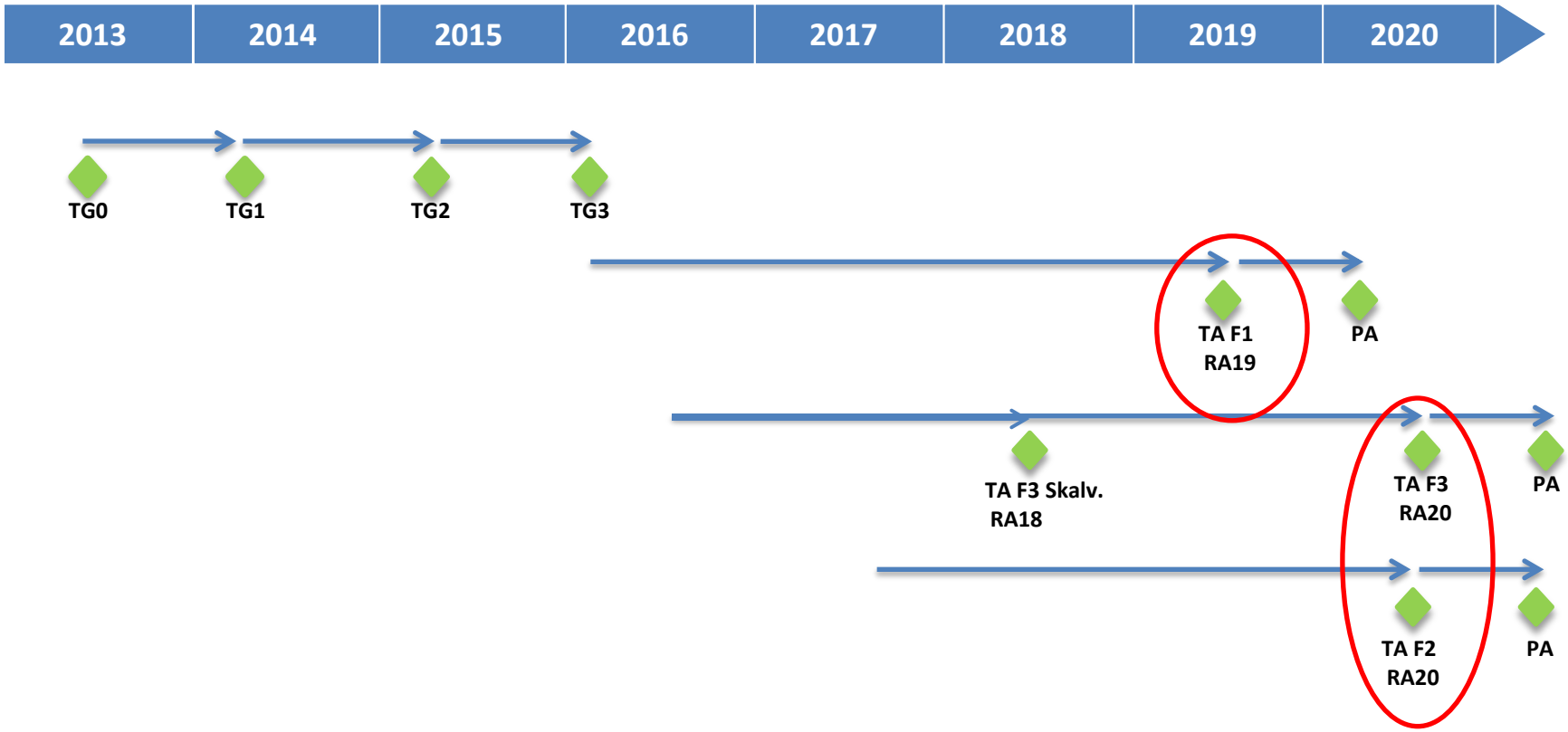
When will the independent core cooling be in place?



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Summary FOSH

- FOSH will fulfill all post-Fukushima requirements
- The injunction from the regulatory body SSM, stating the conditions for the independent core-cooling system, is divided into two parts:
  - Transition solution, in order to increase the robustness and to take actions that will make the plant more independent of the existing core cooling system (in operation 2017) – ***Accident management project***
  - Final solution with a new independent core cooling system (in operation 2020 at the latest) – ***Independent core cooling project***