





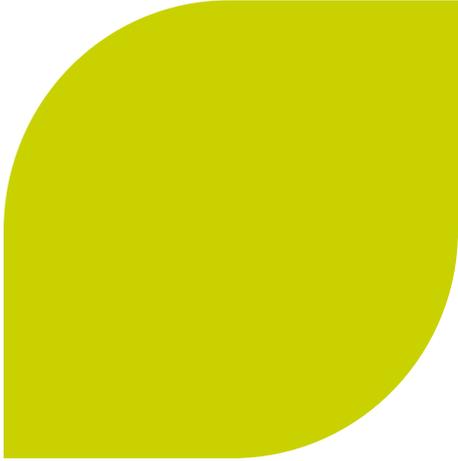
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EPR™ Decommissioning by Design

Ian R. Terry

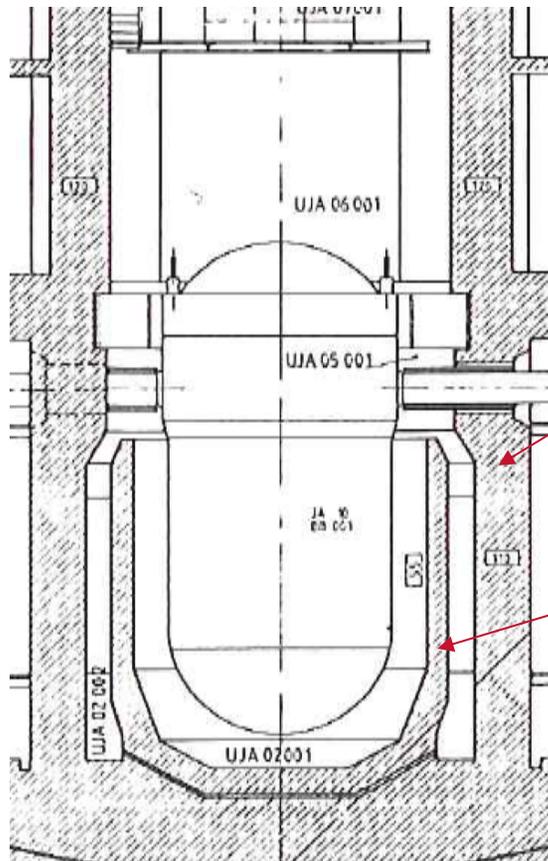
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Cambridge UK, 19th November 2010



EPR™ Decommissioning by design



Load bearing shield

Reactor shield

Decommissioning

KONVOI series

AREVA NP

EPR™ Decommissioning by design



Recommendations of the IAEA in 1997

**Design and Construction of Nuclear Power Plants to facilitate
Decommissioning**

Technical Reports Series no. 382 1997

EPR™ Basic Design time period

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European Utility Requirements for LWR nuclear power plants

<http://www.europeanutilityrequirements.org>

EPR™ Decommissioning by design



Decommissioning is already today important in design assessment before awarding a construction contract

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For consideration:

- ▶ **Costs**
- ▶ **Strategy**
- ▶ **Radiation protection**
- ▶ **Waste minimisation**
- ▶ **Layout aspects**
- ▶ **Documentation**

All these points concern either directly or indirectly radiation protection. !

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Documentation:

According to IAEA prescription

- ▶ **Documentation of details during construction of the plant**
- ▶ **Record keeping of irregularities during plant operation**

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Strategy:

- ▶ Immediate dismantling
- ▶ Deferred dismantling

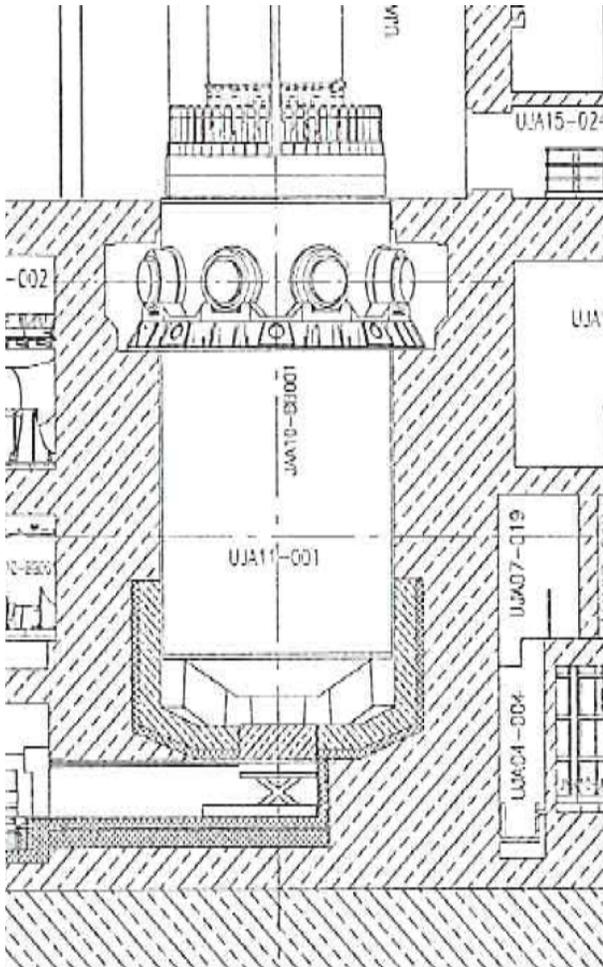
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Costs:

- ▶ **With today's design of large commercial plants very little difference between the strategies**
- ▶ **(Approx. 300 € per installed electrical kW, 2007)**
- ▶ **Immediate dismantling is politically generally desired**
- ▶ **Dose (Decont. ?)**

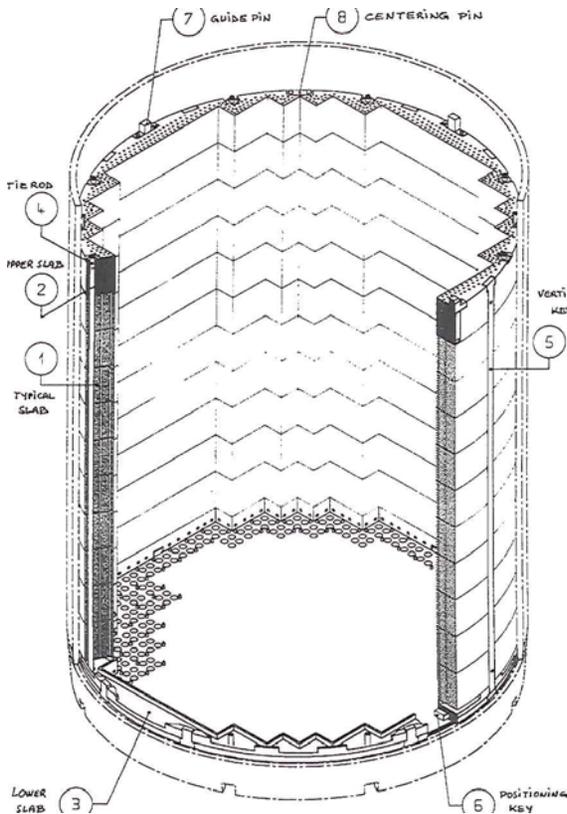
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What the EPR™ does not have:

- ▶ A modular reactor shield
- ▶ Instead a monolith structure selected

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What the EPR™ does have:

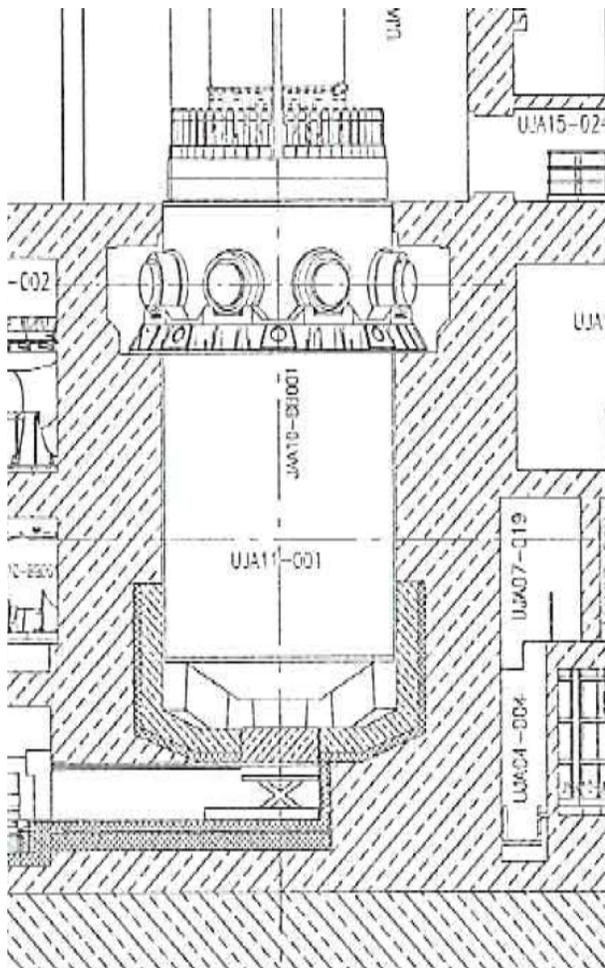
▶ A neutron shield within the RPV

This “Heavy Reflector“ is removable in parts

These are moved under water to minimise dose

Serves to minimise the activation in the surrounding concrete

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Inventory in concrete* (estimate)

Some nuclides

Nuclide	First 50 cm	Whole shield
H3	7E12 Bq	8E12 Bq
Fe55	6E11	7E11
Eu152	1E11	2E11
Total	1.0E13	1.1E13

* after 6 years

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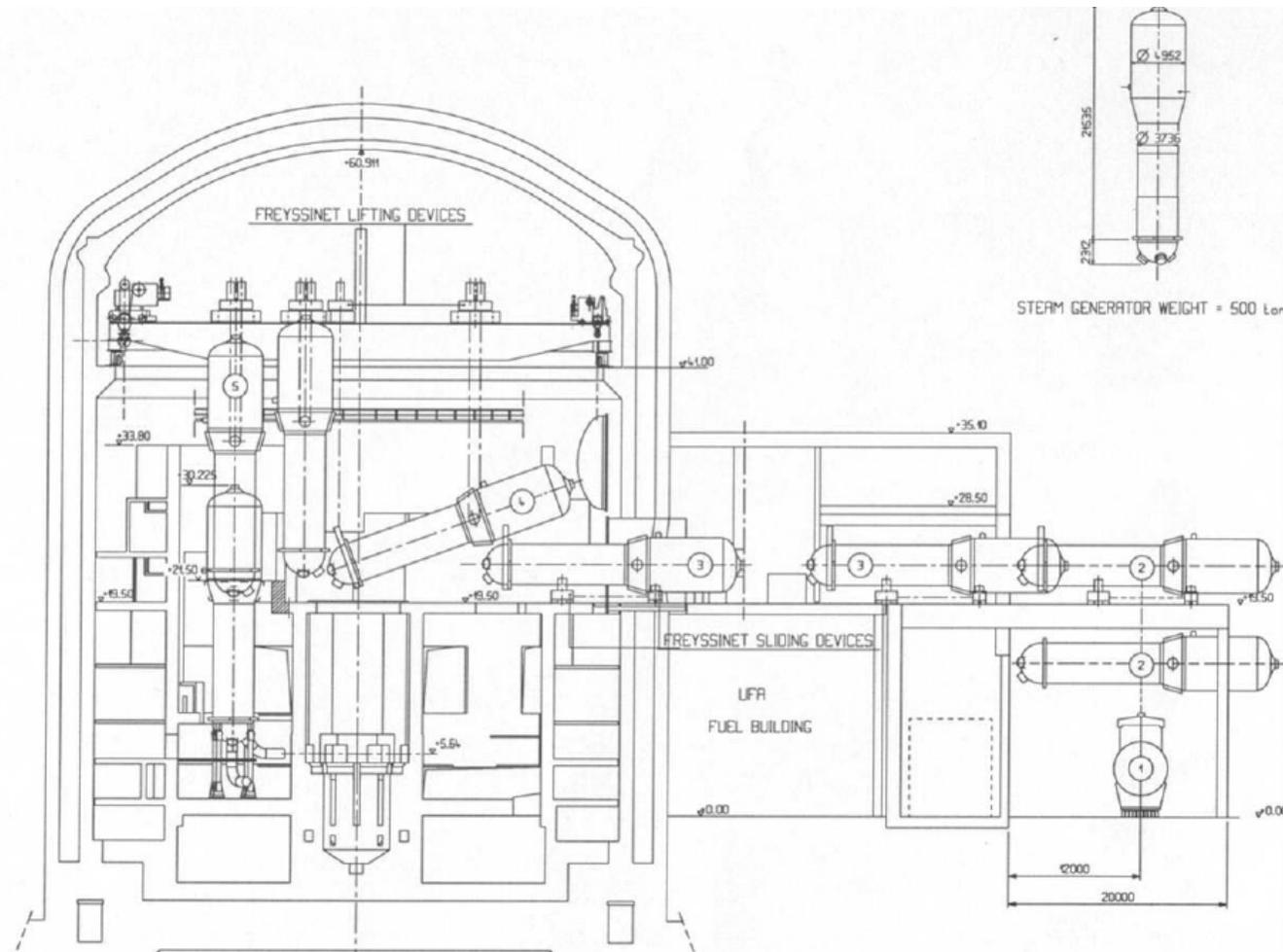


**Design measures for the dismantling
of large components.**

- ▶ **Steam generators**
- ▶ **Pressuriser**
- ▶ **Reactor pressure vessel**

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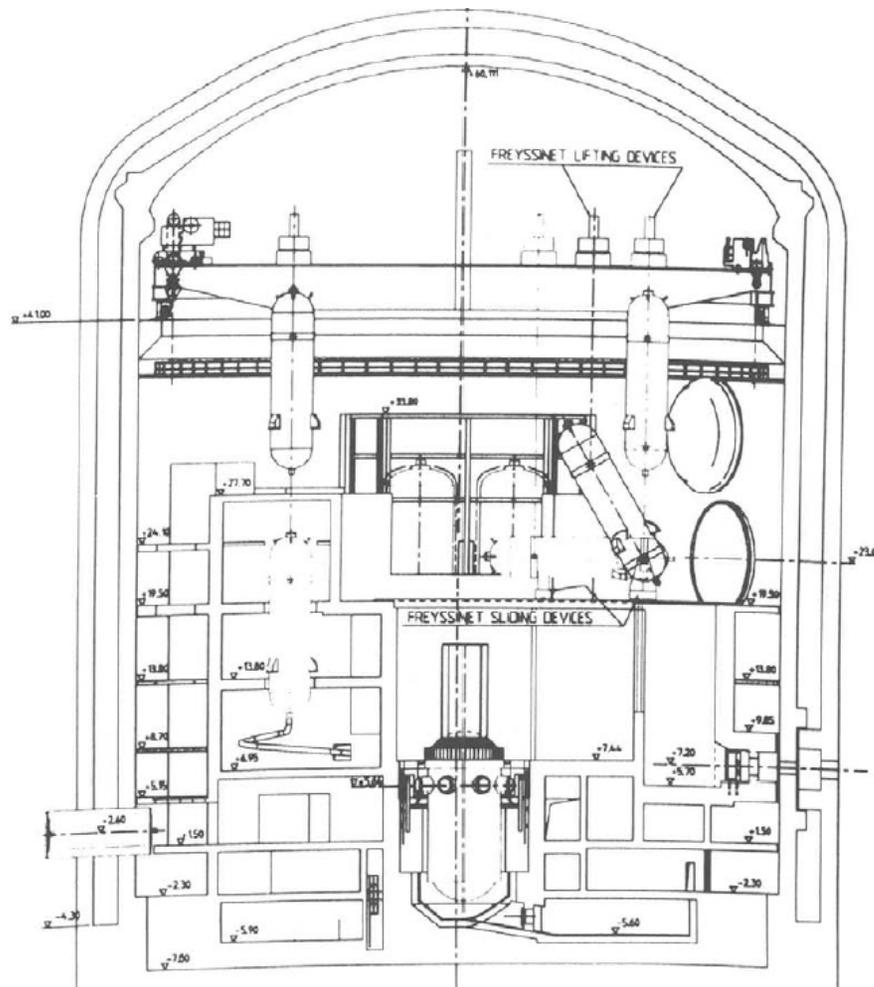
Steam generator: Removal in one piece



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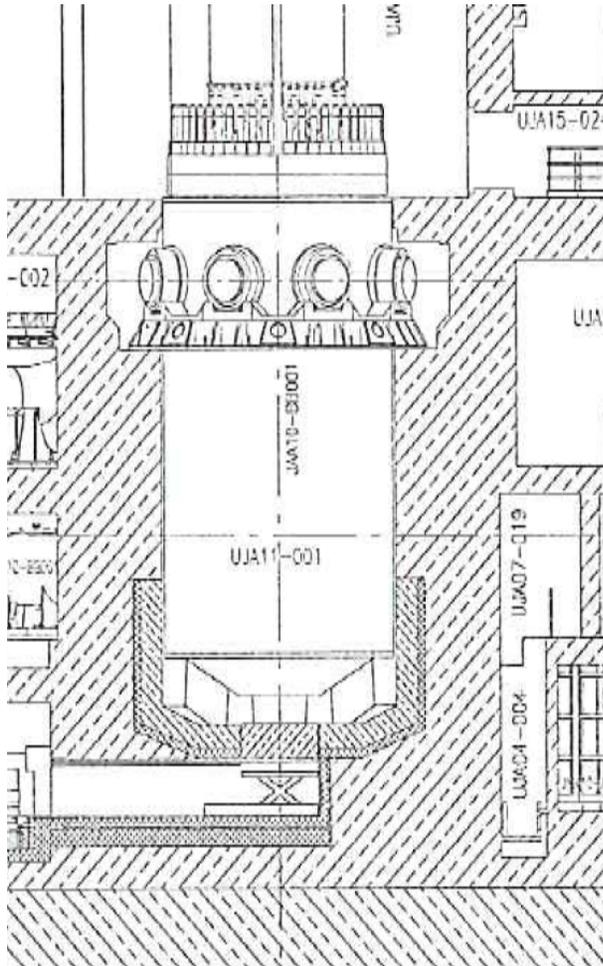
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Pressuriser: removal directly upwards



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Reactor pressure vessel: alternatives

- ▶ Removal in one piece
- Or
- ▶ Dismantling under water *in situ*

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Material limitation in components

- ▶ **Reduction in Co59 in steel alloys close to core**
- ▶ **Minimisation of Stellite® in valves**
- ▶ **Avoidance of Ag and Sb in bearings und gaskets**

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Accessibility to large components

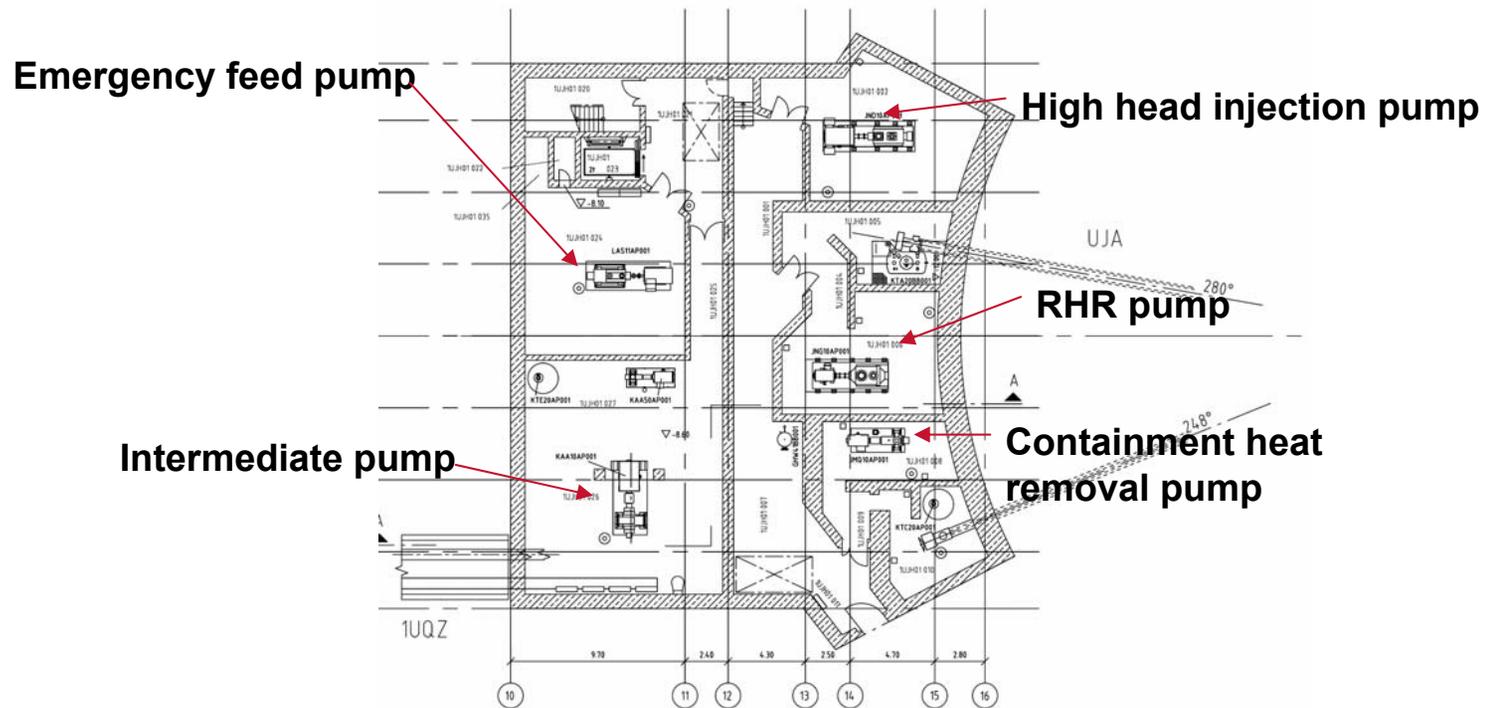
- ▶ Clearance always > 50 cm
- ▶ Separation “hot” and “cold”

Time reduction in radiation field

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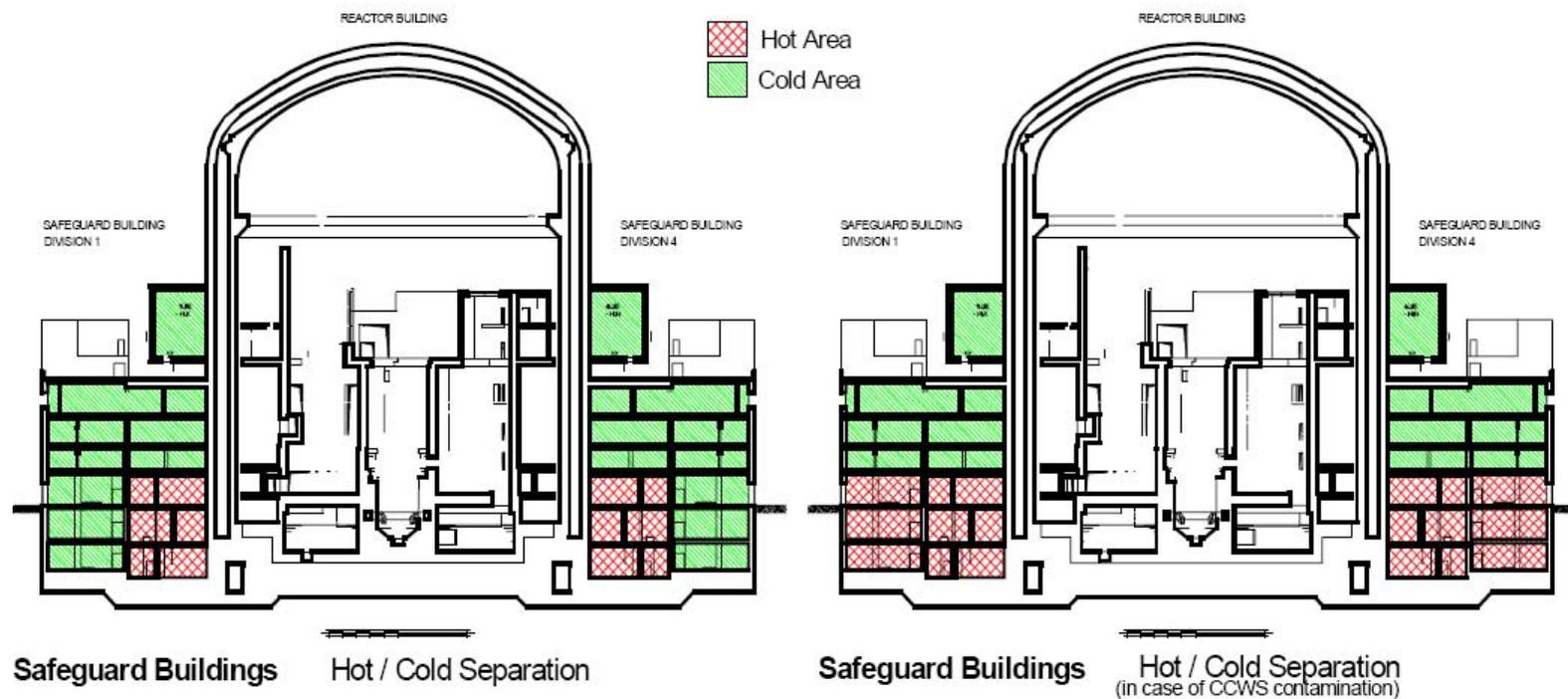
Accessibility in the Safeguards Building, for example



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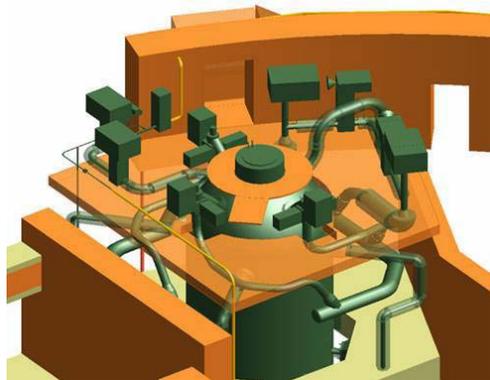
Component separation, example 1



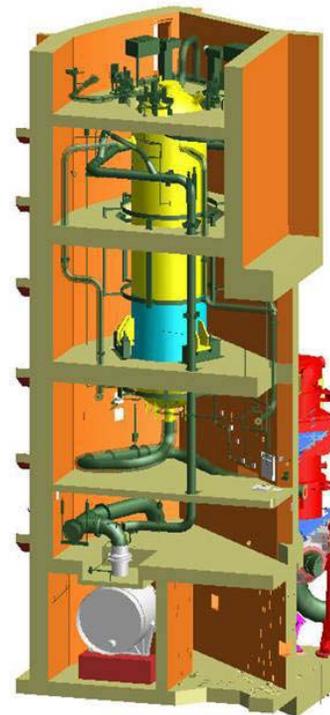
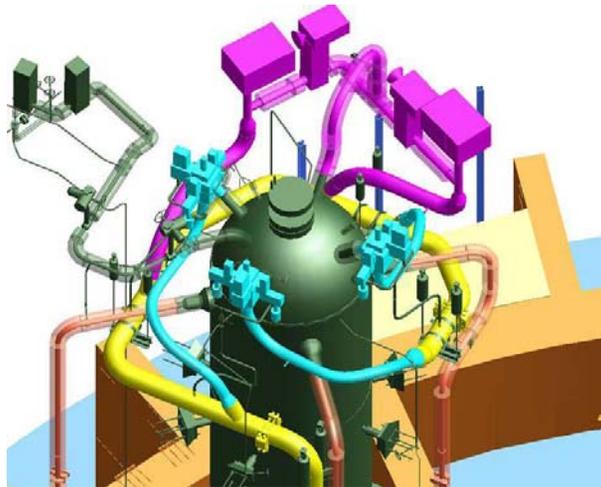
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Component separation, example 2



Access floor to pressuriser discharge valves



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Waste and Dose

- ▶ **Controlled area approx. 200,000 Tons
of this about 5,500 Tons in final repository
(low and intermediate level waste without heat generation)**

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Volume :

60 x

Or 20 x 20 x 20 m³



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DOSE ???

- ▶ **Choice of Strategy**
- ▶ **Decommissioning plan**

however 2 Sv attainable

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The EPR™ design is already suited to decommissioning



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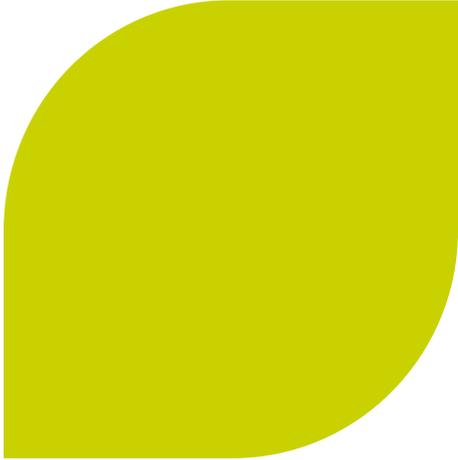


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End of presentation EPR™ Decommissioning by Design

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