Autoriteit Nucleaire Veiligheid en Stralingsbescherming

Licensing of Advanced Nuclear Reactors

Nuclear innovation conference

Joran de Jong

Joran de Jong

Coordinating advisor - Licensing of new nuclear installations

Content

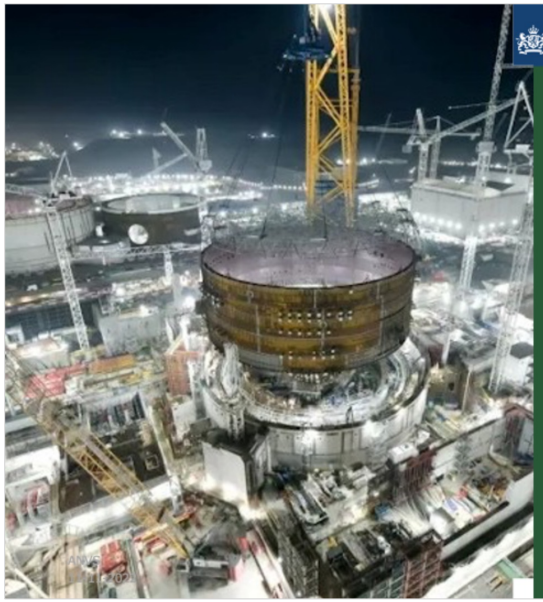
1. Introduction ANVS
2. Coalition ambitions
3. Regulatory framework
4. (Pre)Licensing Process
5. International collaboration
6. Program development

Authority for Nuclear Safety and Radiation Protection

Dutch regulatory body

~ 170 people

- Main tasks include:
  - Policy & law advisement
  - Authorisation (Licensing)
  - Oversight & enforcement
  - Emergency preparedness
  - International collaboration
  - Public communication
  - Research and development



New build

"[this cabinet puts in motion] ... the necessary steps for the construction of two new NPPs."

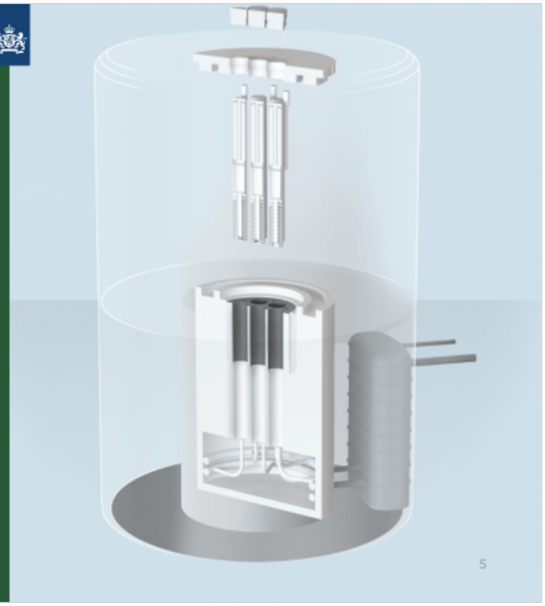
LTO Borssele

"[...] Therefore NPP Borssele will operate for a longer time, of course with respect to its safety."

Nuclear ambitions of the Dutch government

SMRs & AMRs

"[..] means will be allocated in support of realization of SMRs [to gain knowledge on supply chain, control and oversight]"

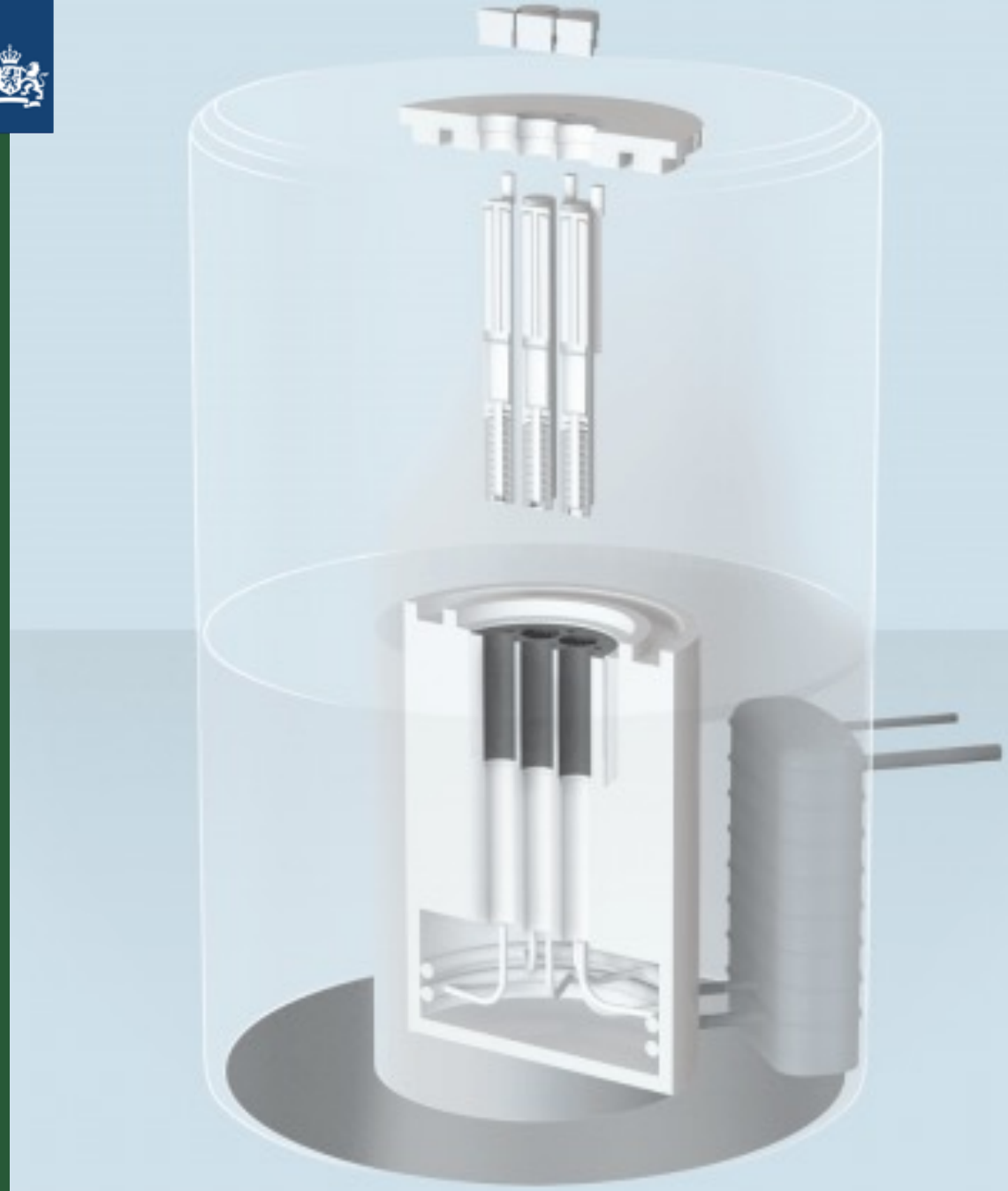


Research reactor PALLAS under construction

License to construct granted March 2023

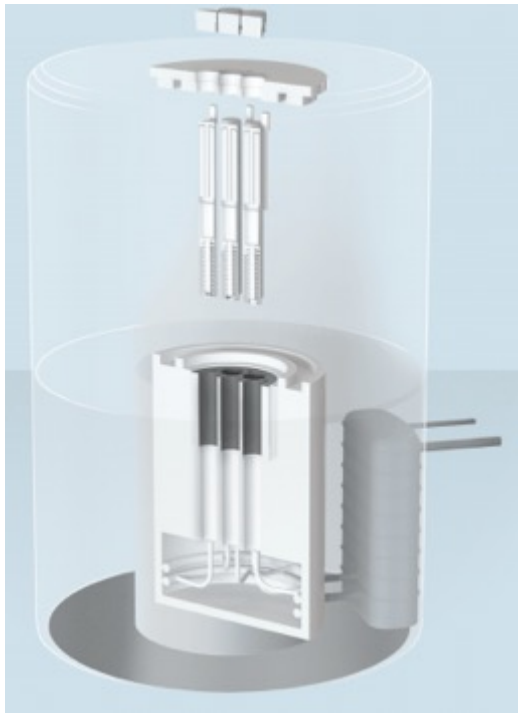
SMRs & AMRs

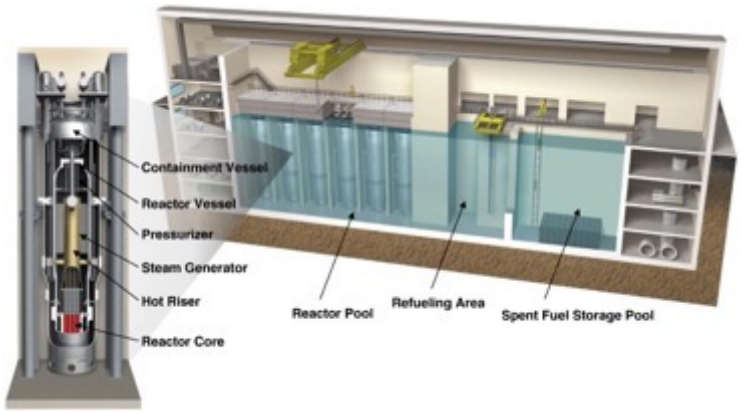
"[..] means will be allocated in support of realization of SMRs [to gain knowledge on supply chain, control and oversight]"

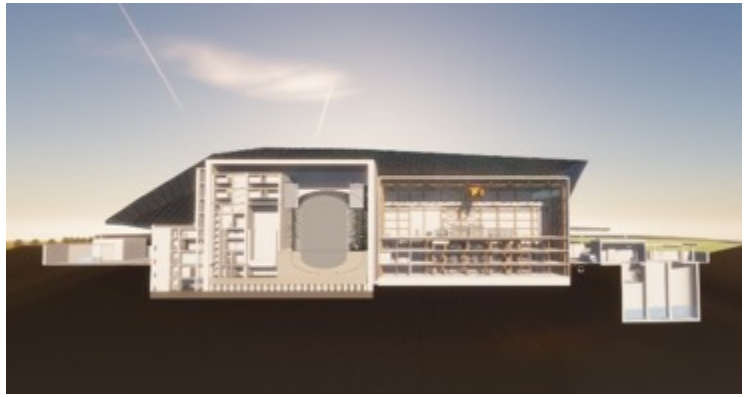


Small Modular Reactors

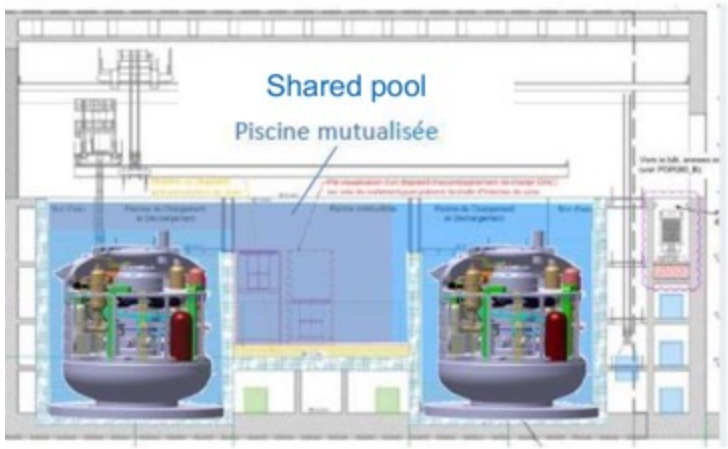
- Large variation SMR's designs;
- Smaller units, modular design
- At first: SMR's with 'conventional' light water technology;
- Later: more 'exotic' concepts (molten salt, lead cooled etc);

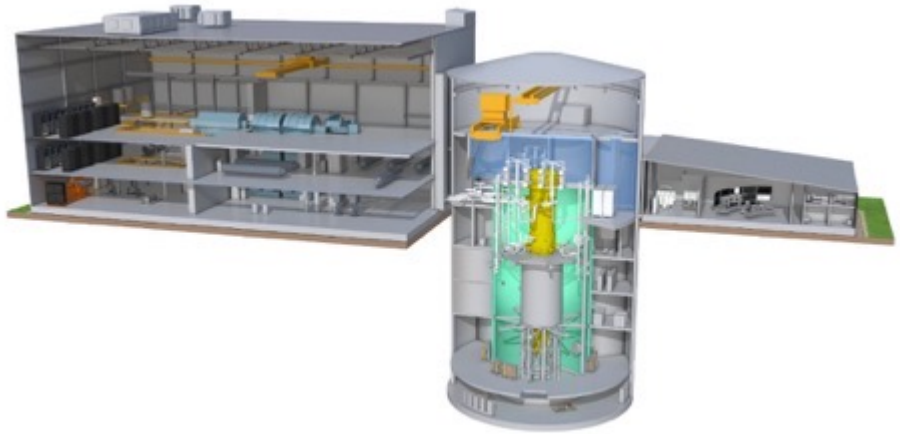






- Important changes:
  - Passive heat removal
  - Smaller inventory
  - Alternative fuel/cooling
  - Safety systems

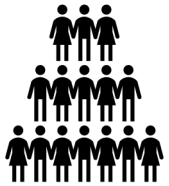




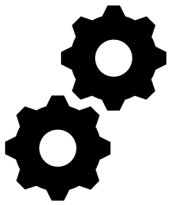
Regulatory challenges

- Regulatory Framework
  - Laws and regulations
  - ANVS guidelines (DSR)
  - Codes and Standards

- Adequate assessment personnel
  - Capacity
  - Knowledge
  - Experience

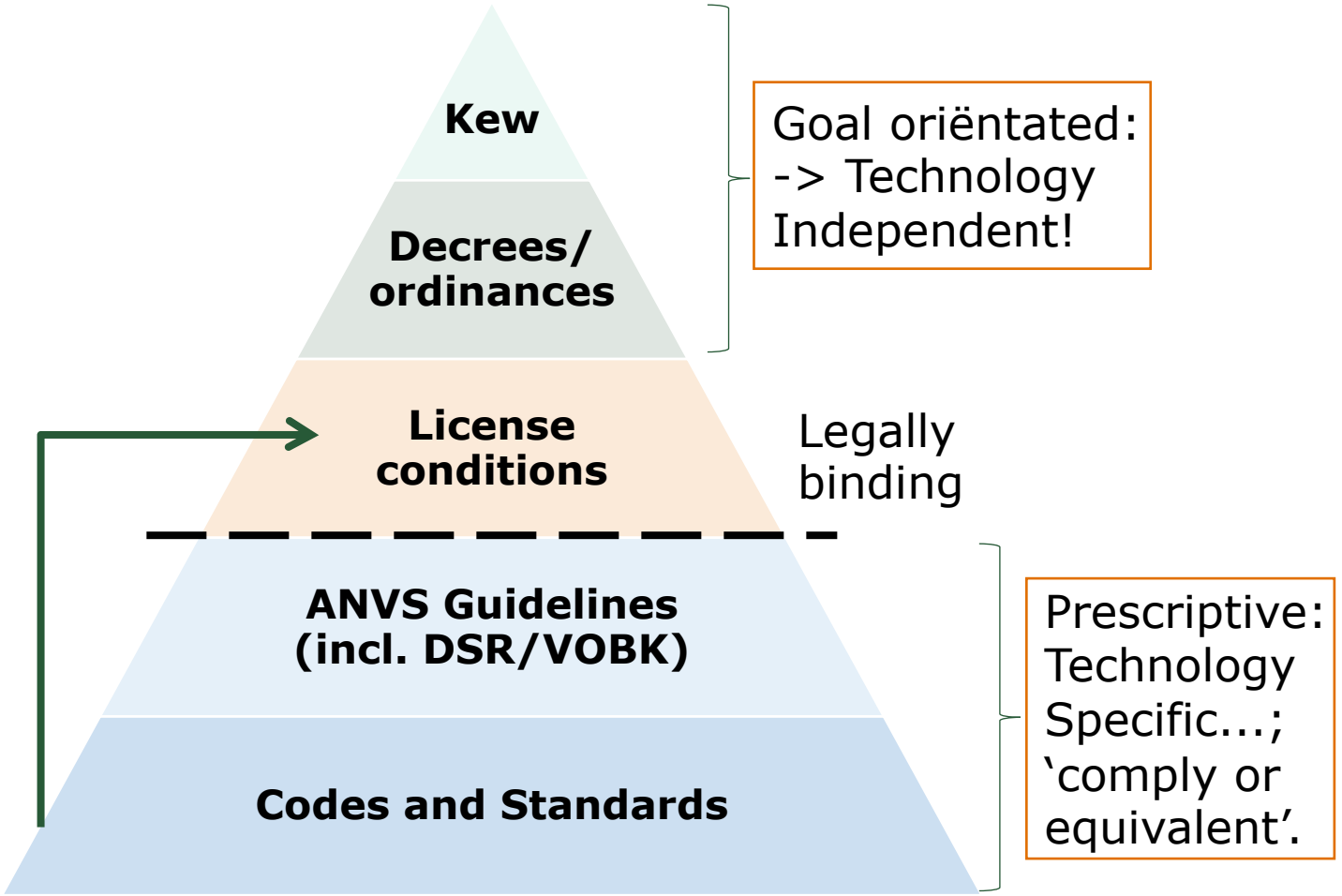


- System uncertainties
  - Innovative safety concepts
  - Reliability of new systems
  - Unknown unknowns



Regulatory framework: fit for any future developments

- **Nuclear Energy Act (Kew) sets the frame;** (most prominent law, other laws do also apply)
- **(Ministerial) Decrees and ordinances;** contain additional, more specific regulation,
- **Further Conditions specified in License;** may include international norms such as IAEAstandards/ WENRA reference levels
- **ANVS Guidelines, e.g. VOBK/DSR;** specify LWR requirements, comply or equivalent principle, annex with application for SMR's
- **Various industrial codes and standards** may be used by the applicant to support the safety case, part of the licensing base



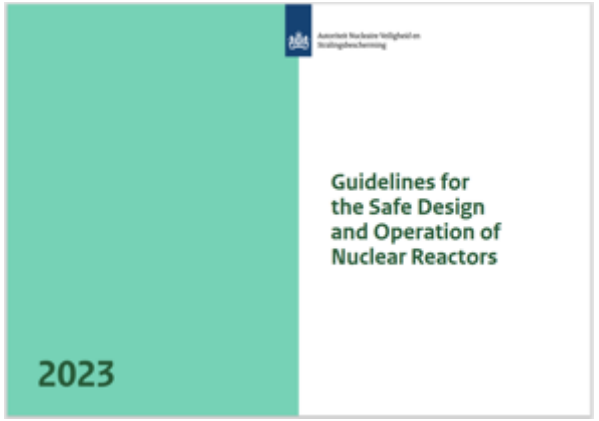
Legally binding requirements

- Formal legal framework is goal oriented, allows for specific implementation.
- 2014/87/EURATOM (implemented in ‘regeling nucleaire veiligheid’)
  - Principle of defense in depth
  - Practical elimination of early and large releases
- Nuclear facilities, ores and fissile materials decree:
  - Dose limits for anticipated operational occurrences->
  - Individual risk < 10^{-6} per year.
  - Group risk < 10^{-5} per year for 10 direct fatalities

    (Or n^2 times smaller for n times direct fatalities)

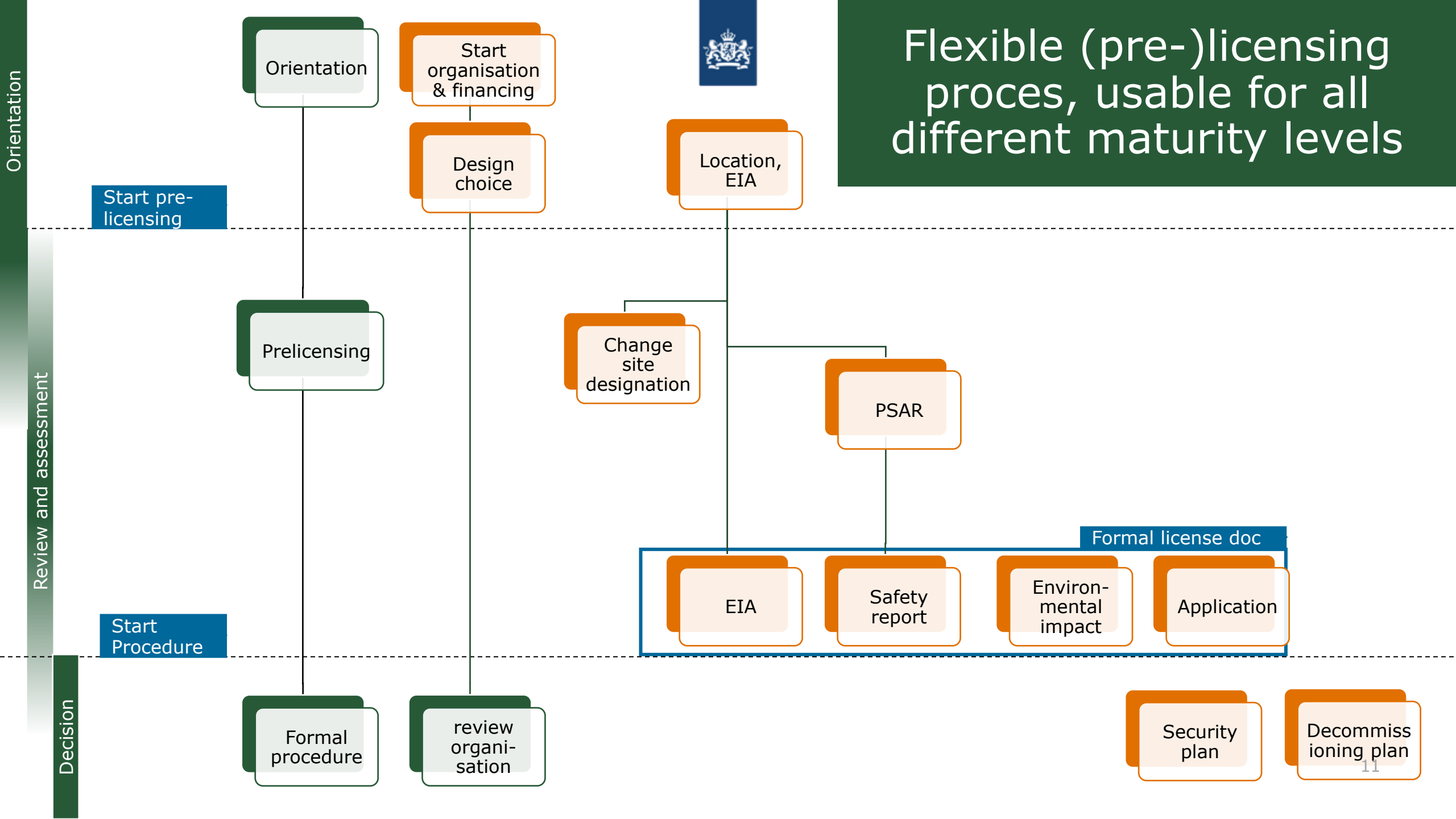
Frequence	Allowed effective dose	
	Adults	Children
$F \geq 10^{-1}$	0,1 mSv	0,04 mSv
$10^{-1} > F \geq 10^{-2}$	1 mSv	0,4 mSv
$10^{-2} > F \geq 10^{-4}$	10 mSv	4 mSv
$F < 10^{-4}$	100 mSv	40 mSv

Technical Guidance



- VOBK / DSR (Dutch Safety Requirements)
- Written for large LWR's, grading applies
- 'Comply or Equivalence' principle applies
- Based on IAEA Safety Standards Series
- Main topics include requirements for:
  - Safety objectives, technical requirements --->
  - Postulated events and (external) hazards
  - Application of the single failure criterion
  - Safety demonstration & documentation

Flexible (pre-)licensing proces, usable for all different maturity levels

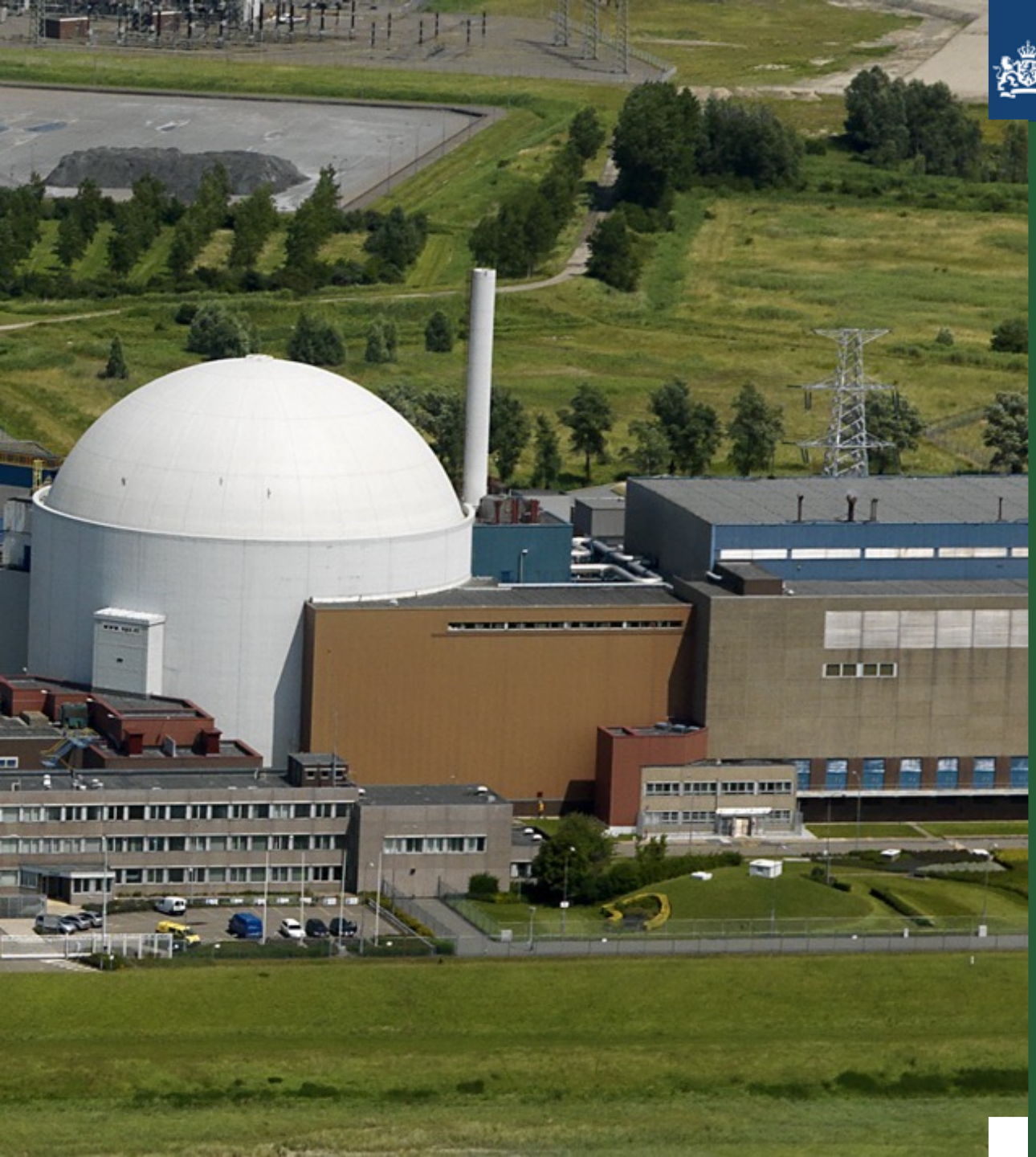


Key Notes

- Netherlands is blessed with a flexible, goal-oriented framework, capable of licensing any and all types of reactor technologies;

- Responsibility for the applicant to provide a robust safety case and execute licensing activities in a timely and predictable way;

- For licensing purposes, it is useful to have a translation to more conventional technologies i.t.o. defense in depth, barriers etc...



LTO Borssele

"[...] Therefore NPP Borssele will operate for a longer time, of course with respect to its safety."

What’s required

- Legal:
  - Amending Nuclear Energy Act (end date 31 December 2033) including environmental impact assessment
  - Application for change to license documentation
- Technical:
  - Substantial studies required to validate proven readiness for LTO beyond 2033 (>60 years). Involvement of IRSN as TSO of ANVS is expected.
- Business case
  - Operator needs a valid business case, including fuel contracts and strategy, waste disposal, etc.

Current status

- Preliminary discussions ANVS / licensee with respect to planning, SALTO mission, extra periodic safety review, license application.
- Feasibility studies performed by licensee on aging and conceptual aging
- Environmental impact assessment procedure to change the nuclear energy act was started.
- Discussions around asking an extra periodic safety review and possibilities of stakeholder involvement by ANVS earlier then in the formal licensing procedure in the end.

New build

"[this cabinet puts in motion] ... the necessary steps for the construction of two new NPPs."

Status new builds NL

- Borssele site designated as preferred location.
- Environmental impact assessments will start later this year, will also assess ‘Maasvlakte’ (Port of Rotterdam)
- 2024 a feasibility study will be performed by three suppliers (KNHS, EDF, Westinghouse)
- 2025 expected start of Tendering process for nuclear supplier

Current status ANVS

- Focus on preparations workforce
- Inform Dutch ministries and vendors regarding specific Dutch regulation and procedures during feasibility study and tendering process
- Advised Ministry of Economic Affairs and Climate to take nuclear requirements into account for their site evaluation and informed Ministry on Conceptual Safety Document
- Will assess and advise on the starting notification of strategic EIA expected end 2023
- Experience in Pallas Research Reactor extremely valuable