



**PALLAS**

An NRG initiative

# **PALLAS** **HFR Successor for the Future !**

IAEA Safe Management and  
Effective Utilization

Fred Wijtsma NRG PALLAS

# NRG: Nuclear Research & consultancy Group

- The Netherlands' leading expert;
- First-rate R&D Infrastructure with High Flux Reactor (HFR) and Hot Cell Laboratories;
- 420 nuclear market orientated professionals, providing irradiation services and nuclear consultancy;
- One of the world major supplier for medical and industrial isotopes;
- Turnover € 65 million of which 45% outside the Netherlands;
- Located in Petten and Arnhem, but activities are world-wide!



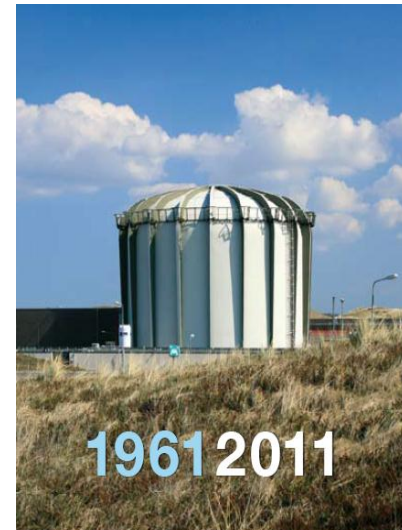


## 'Petten' Marks Fifty Years of Forward Thinking

A series of unique events in November 2011 found at:  
[www.petten50years.eu](http://www.petten50years.eu)

### Three Milestones:

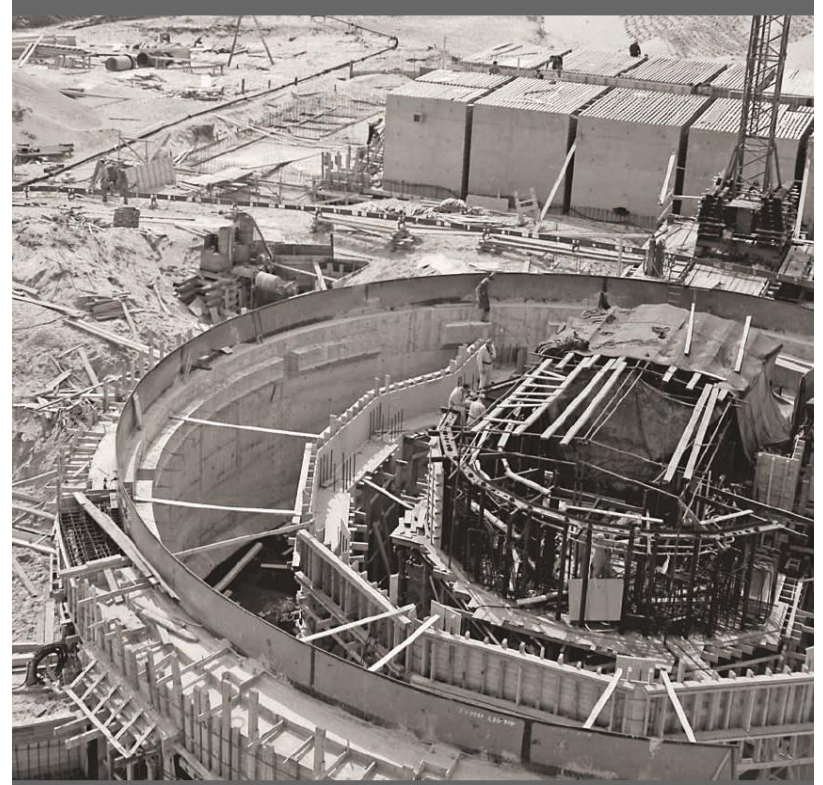
- The signing of the so called 'site license agreement' 25th of July 1961 between the Dutch Government and The European Commission;
- The High Flux Reactor (HFR) first criticality achieved on Friday 9 November 1961;
- 2011: daily 24,000 treatments worldwide with HFR products .



# The High Flux Reactor in Petten

## Key Aspects

- 1961: Start full operation;
- 1984: Reactor vessel replacement;
- 2006: HEU – LEU conversion;
- Increase of maintenance costs;
- Risk of reduced availability;
- Change in use over lifetime;
- Identified need for replacement reactor: **PALLAS!**



**Fifty** years of experience in running the **HFR** is the basis for defining **PALLAS**

# Design and Safety Requirements

- Renewal of site evaluation and characterization;
- Redundancy and diversity for safety systems;
- Common cause/mode failure proof;
- Defence in depth applying all 5 levels of DiD;
- Full scale PSA (level 1 to 3);
- Independent of existing HFR infrastructure and utilities;
- Largely based on NPP requirements but using graded approach;
- Second shut-down system and secondary control room;
- Influence of Fukushima accident evaluation.

**Main feature: Fully compliant with IAEA safety guides and international good practice!**

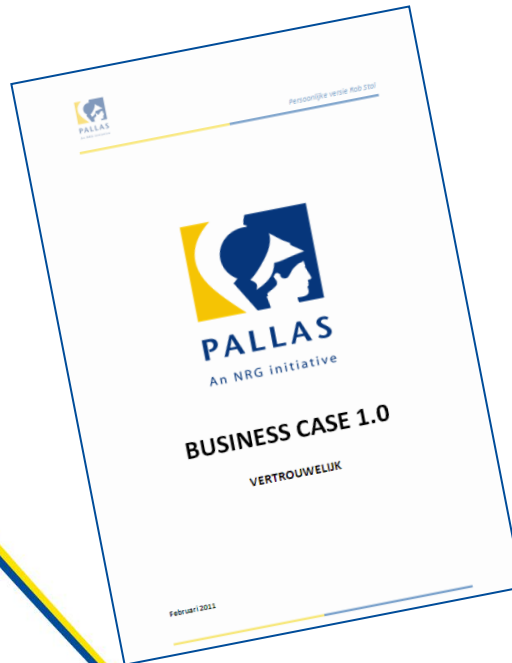
# Technical Requirements for PALLAS

- Tank-in-pool reactor type;
- Flexible power level from 30 to 80 MW;
- Isotope production requirements with nuclear research capabilities in the reflector zone and reactor core;
- Fuel and targets fully LEU : Uranium-silicide but suitable for UMo
- Additional requirements expected from Dutch licensing authorities:
  - Withstand high internal pressure;
  - Aircraft crash (both military and commercial type);
  - Long “grace period” in case of accidents (including BDBA);
  - Core Damage Frequency < 10<sup>-6</sup>;
  - Post-Fukushima requirements.

**Main feature: Flexible design for  
NRG’s business of tomorrow!**

# Business Case PALLAS

- The BC PALLAS shows that cost of capital (equity & loans), operations and decommissioning can be paid for.
- The business focus is on the production of (medical) isotopes and on irradiation services to the nuclear industry.
- The business case PALLAS meets the requirements for support as stated by the Dutch government in their letter to parliament.
- This business case enables the project to finance the design, licensing and construction.

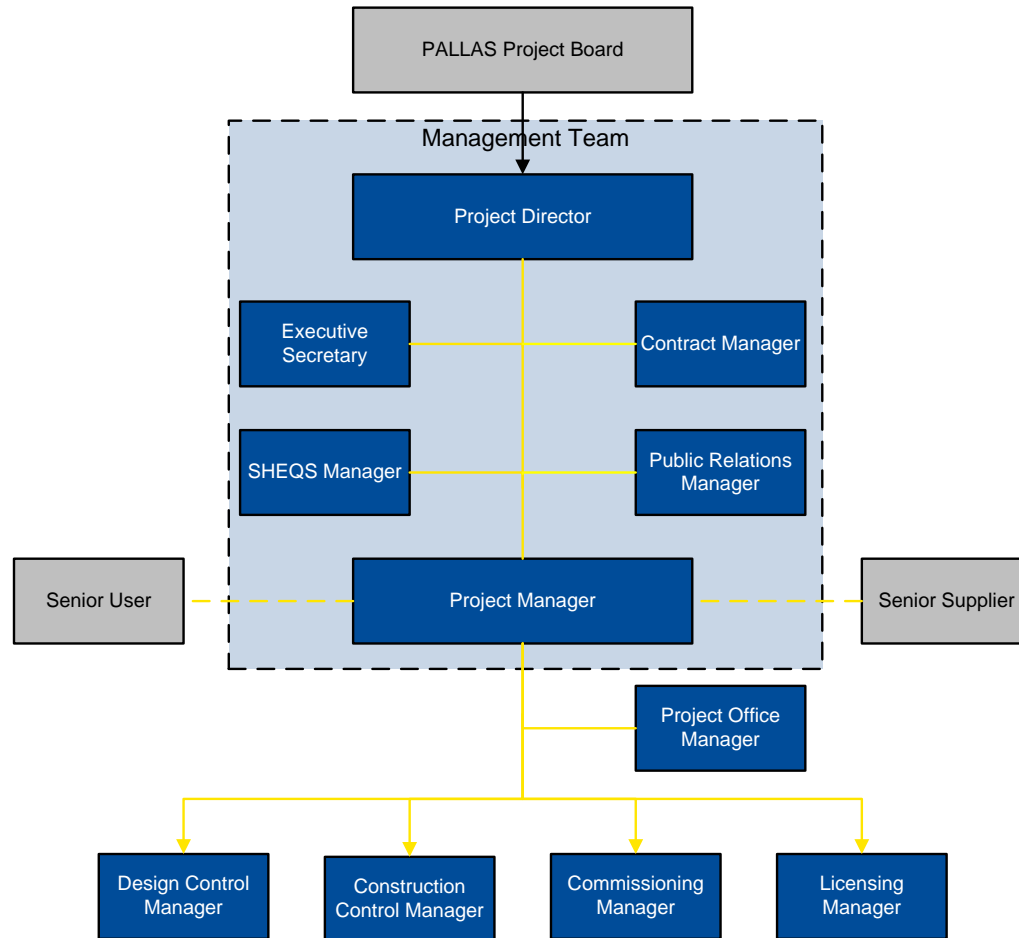


# PALLAS Project History 2002 - 2011

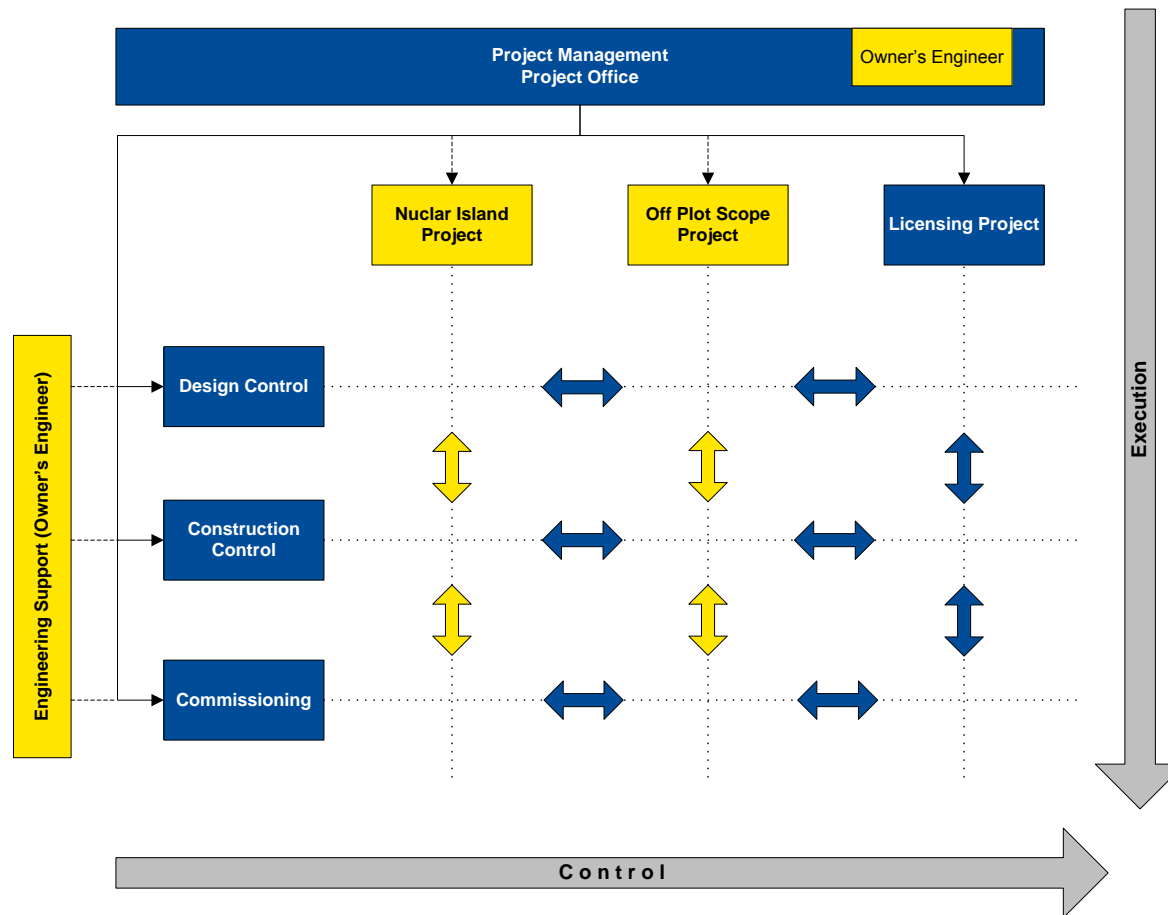
- 2002 – 2006:
  - Necessity for HFR replacement investigated;
  - PALLAS project gained broad society support.
- 2007:
  - Preliminary requirements for PALLAS drafted;
  - Licensing procedure discussed with licensing authorities.
- 2008:
  - Employer Requirements Specification finalised;
  - Tendering procedure started on the basis of an EPC-contract.
- 2009 - 2011:
  - Contractual negotiations discontinued;
  - Participation of stakeholders in architectural aspects;
  - Environmental Impact procedure started;
  - PALLAS organization erected.



# PALLAS Line Organization



# PALLAS Project Organization



# PALLAS Nuclear Island

One EPC-agreement based on functional specification (URS):

- EU tender procedure for competitive dialogue and consultation between employer and qualified suppliers
- System responsibility lays with main Contractor
- Deliverables:
  - Nuclear Reactor and associated infrastructures;
  - Commissioning isotope production rigs;
  - Commissioning experimental devices and loops;
  - Auxiliary and EI&C systems;
  - Building and building related systems.
- Facility and rig design to be based on HFR experience.

# PALLAS Off Plot Scope (OPS)

Contracts to be placed via Engineer & Contractor:

- OPS comprises the following systems:
  - Off-site power supply (25 km supply line);
  - Secondary cooling water supply;
  - Renewal of site utilities (e.g. gas, potable water, sewage system);
  - Independent fire fighting systems;
  - Renewal of security infrastructure (“security by design”);
  - (Temporarily) site infrastructure (e.g. roads, offices, etc.).
- All other SSCs necessary for realization and operation of PALLAS;
- Nuclear Island dictates the content of the OPS.

# Decision Making “Progress”

- Decision making progress strongly influenced by:
  - Economical situation in the EU member states;
  - Fukushima accidents and subsequent EU stress test;
  - Predicted worldwide financial crisis.
- Four (4) Dutch ministries involved in decision making process:
  - Ministry of Economic Affairs, Agriculture and Innovation;
  - Ministry of Health, Welfare and Sport;
  - Ministry of Education, Culture and Science;
  - Ministry of Finances.
- Political support of all major parties is in place;
- Political decision has been positive, however financing still pending!

# PALLAS: Status of Today

- Sound Business Case based a.o. on OECD findings and recommendations;
- Users Requirements Specification, Project plan and Licensing Plan available;
- Major project risks with respect to planning and costs due to the Dutch requirements exceeding the IAEA requirements for R&D reactors;
- Project Management Manual compliant with ISO-9001 & 14001 and the IAEA Safety requirements available;
- Stakeholder management is operational (example Landscaping);
- Financing of the project execution urgently needed and expected soon!



# PALLAS 2012 - 2022



- 2012 Tendering
- 2012 – 2015 Licensing, contracting & designing
- 2015 – 2017 Detailed design phase
- 2017 – 2021 Construction and commissioning
- 2022 Acceptance & production

# SHOKRAN!



## Wadih mafih soal???