Human, Technology and Organisation at IFE Nuclear in Halden

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KEY FIGURES

Institute for Energy Technology

Divisions

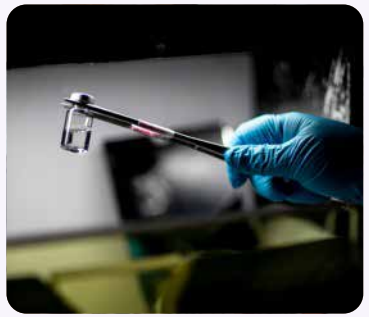
Energy
Research and innovation

Nuclear Power
Research and innovation

Technology and property

Nuclear Operations and Safety

Subsidiaries



Agilera Pharma AS (49%)

IFE Invest AS (100%)

1948 established

>40 nationalities

550 employees*

1453 (2025) MNOK turnover

13100 m² laboratories

* As of 20.02.2026

IFE and the Halden Projects

Institutt for atomenergi

HALDEN PROJECT HTO

Man, Technology & Organisation

Fuels & Material

HAiLDEN

1948 1951 1958 1967 1970 2018 2021 2027

OECD Halden Reactor Project

1979

Photo: United States Department of Energy.

From 1979, the Halden Project became one of the world's leading research centers for what became known as **MTO**.

Photo: IFE

Today, MTO is widely used in:

- Energy and utilities
- Oil and gas
- Aviation
- Healthcare
- Railways and transportation
- Other high-risk industries

Organizations use the MTO framework for:

- Incident investigations
- Risk assessments
- Safety management
- Organizational improvement initiatives

But, for many treated in silos

MTO Element	XXX Example
Human	operator dependence, automation, human-machine interfaces, human performance, training, certification
Technology	Cooling, low-pressure design, heat removal, modular architecture, AI, safety systems
Organization	Licensing strategy, regulatory interaction, quality assurance, safety management, safety culture, industrial partnerships

Operability is decided in the gaps between projects

New reactor concepts assume high automation and small crews — before anyone has defined how they will be run

Digital upgrades move decisions from the panel to the data layer

- Organisations are being restructured around fleets, not single units
- **Each is run as a separate project. IFE works across all three.**

An operating concept is defined years before first concrete

A shared operating model across vendors, OEMs, contractors, licence-holders and regulators

AI-assisted generation and comparison of staffing, role and task allocation options

- Control room philosophy and operating model derived directly from the Concept of Operation (ConOps)
- **Outcome: an operating concept that survives licensing review**

Test the design with real operators before it is frozen

From concept description to a runnable operator-in-the-loop prototype in days

Try out interfaces, alarms and procedures under realistic disturbances

- Cheap to discard — the point is to kill weak concepts early
- **Outcome: design decisions backed by observed performance, not opinion**

Integrated Operations and data-driven operations that hold up under scrutiny

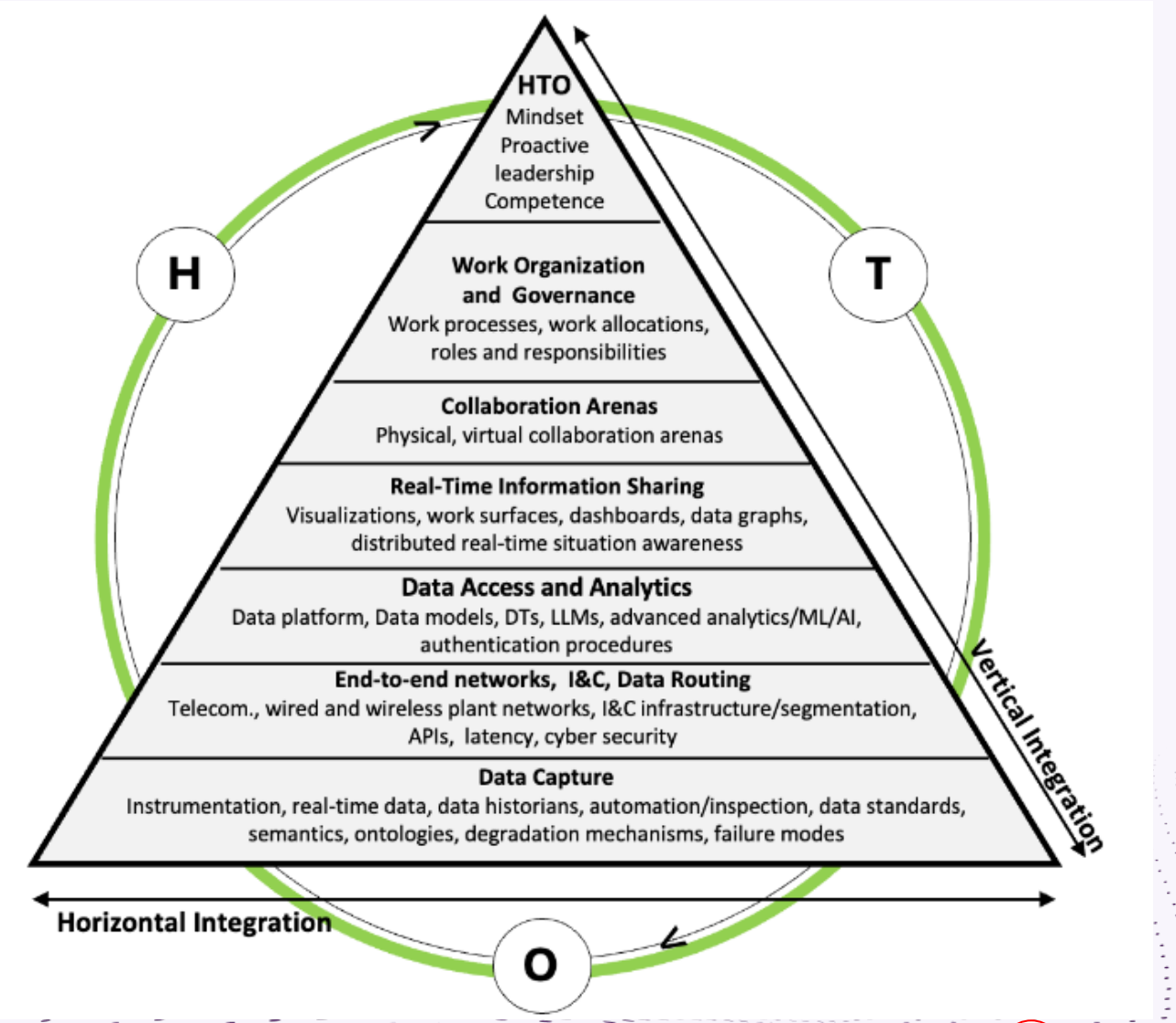
Issues that should be repeatedly assessed through the execution of SAS/I&C modifications/upgrading projects:

***People**: Leadership and competence requirements for administration of new infrastructure, contractor involvement;*

***Technology**: Instrumentations (analog, digital), data formats, servers, data routing, interfaces, cyber security, segregation;*

***Process**: Condition monitoring and remote control of all topology components, service agreements, 3rd party access;*

***Governance**: Ensuring compliance with internal and regulatory (updated/recently changed) requirements*



From Lilleng, T. INL Webinar (2025)

Operation centres: remote, autonomous, supervised

IFE's support

- Concept of operation model for all involved stakeholders
  - Vendors, OEM, Contractors, License-holder, regulators
- Control room philosophy and design including control room operation model
- Human Factors Engineering Program plan
  - Early Verification & Validation activities
  - Operator training

Relevant HTO issues

- Highly automated plants
- Multi-unit monitoring & control
- Remote operation center
- Operator competence and role

Goal

Ensure safe and efficient operation of plant fleet in normal and abnormal conditions

Test the new organisation before you have to live in it

Operational-scenario HF methods put a proposed organisation through realistic disturbances

Built on full-scale simulators, human reliability studies and crew coordination research

- Reveals where a reorganisation breaks: handovers, authority, workload, competence gaps
- **Outcome: evidence for the organisational choice, in a form regulators recognise**

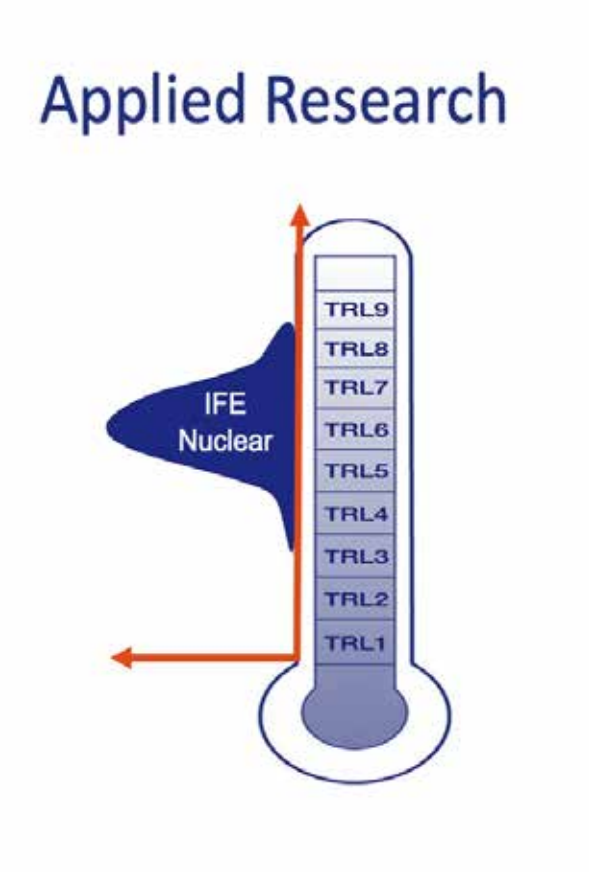
Bring us in while the concept is still moving

Why IFE Nuclear:

- 75 years of operating research reactors and researching nuclear technology and safety
- Established networks across operators, vendors, regulators and international organisations

Where we work:

- AI-driven concept of operations and rapid simulation prototyping
- Integrated Operations (IO), data-driven operations and remote operation centres
- Autonomy, automation and multi-unit monitoring
- Operational-scenario HF methods for organisational change



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Thank you for your attention!

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