



## **Activities and Risks**

**John Campbell**

**The International Association of  
Oil and Gas Producers**

# Offshore Protocol mechanisms (for managing risks arising from operational discharges)

**OGP**

- **Best available, environmentally effective and economically appropriate Techniques (Article 3)**
- **Authorisations (Article 5)**
- **Waste management for operational discharges (Article 9)**
  - Chemical use plan (Art.9.1)
  - Annex I (permitted discharge under 'special' permit at concentrations above agreed limits)
  - Annex II (permitted discharge under 'general' permit)
- **Oil and oily mixture and drilling fluids and cuttings (Article 10)**



# Barcelona Convention – definition of “Pollution”

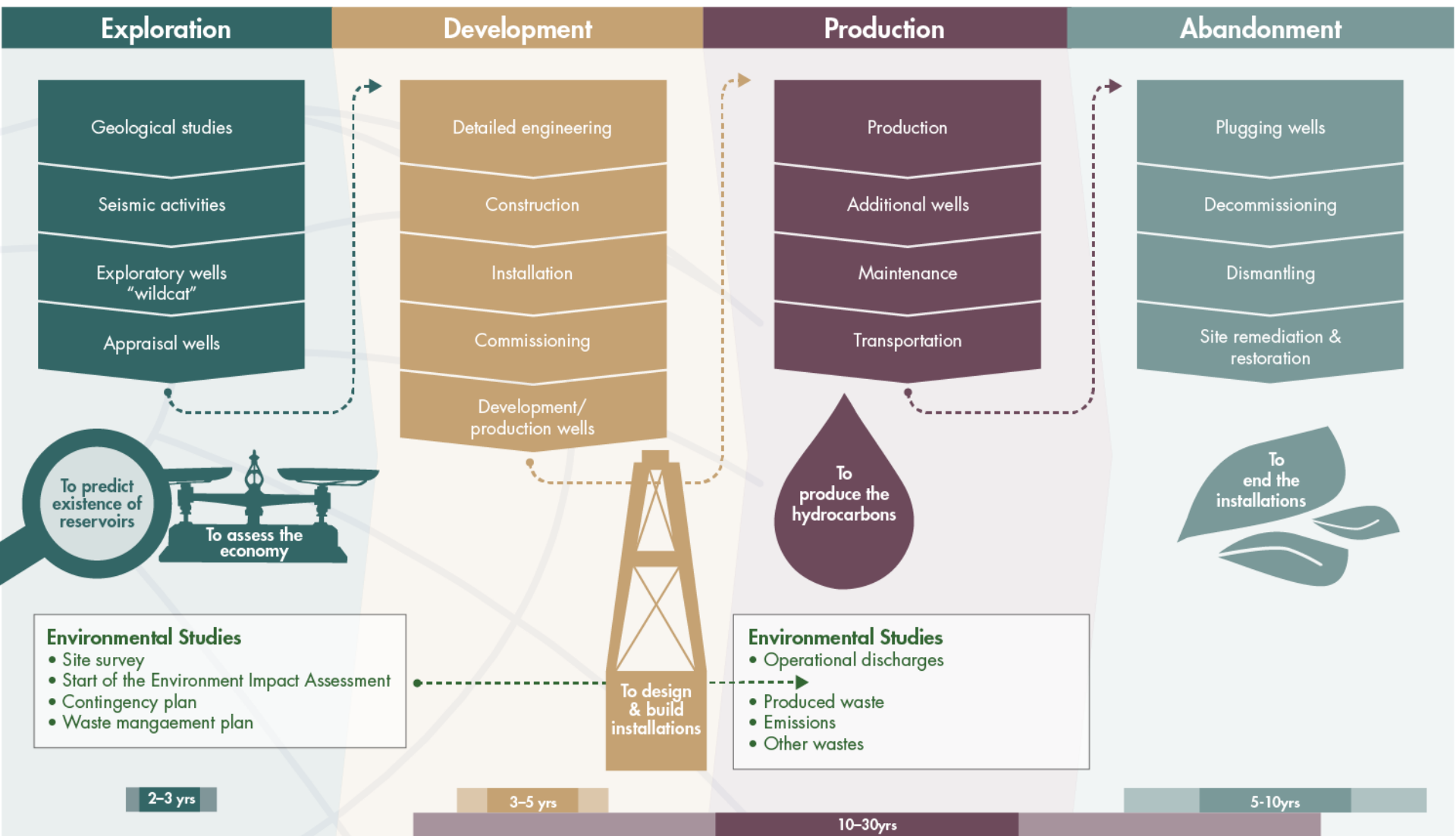


- ... “Pollution” means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results, or is likely to result, in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of seawater and reduction of amenities.

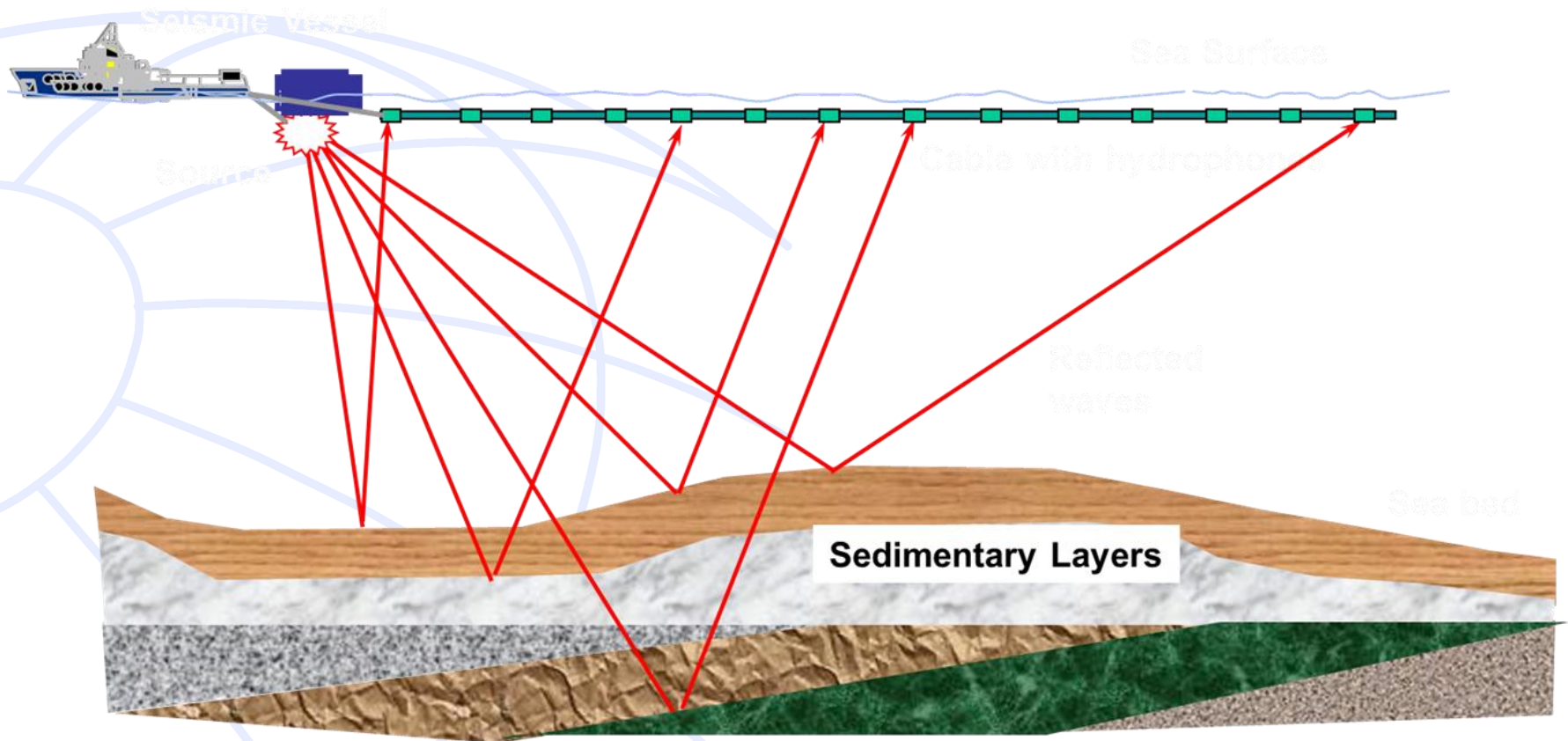


## Protocol, Article 1 (d) (i)-(iii)

- **Scientific research**
- **Exploration activities (seismological activities and exploration drilling)**
- **Exploitation activities (installation of facilities, development drilling, recovery of hydrocarbons, pipelines and transfer to ships, maintenance)**



## Exploration Seismic





# Exploration Activities and Risks

- **Seismic Survey (2-D, 3-D)**
  - Sound – mitigation include seasonal restrictions, soft-start/ramp-up, hard start, Marine Mammal Observers
- **Exploration drilling**
  - Deep water (>300 metres) or shallow water, bottom-type (further shallow seismic)
  - Drilling muds (water based, synthetic based, oil-based) recovery of drilling fluids, discharge of fluids and cuttings, physical alteration of the sea-bed, contamination
  - Drilling incident ('blow out') triggering emergency response
  - Relief wells
  - Cementing fluids...



# Field Appraisal

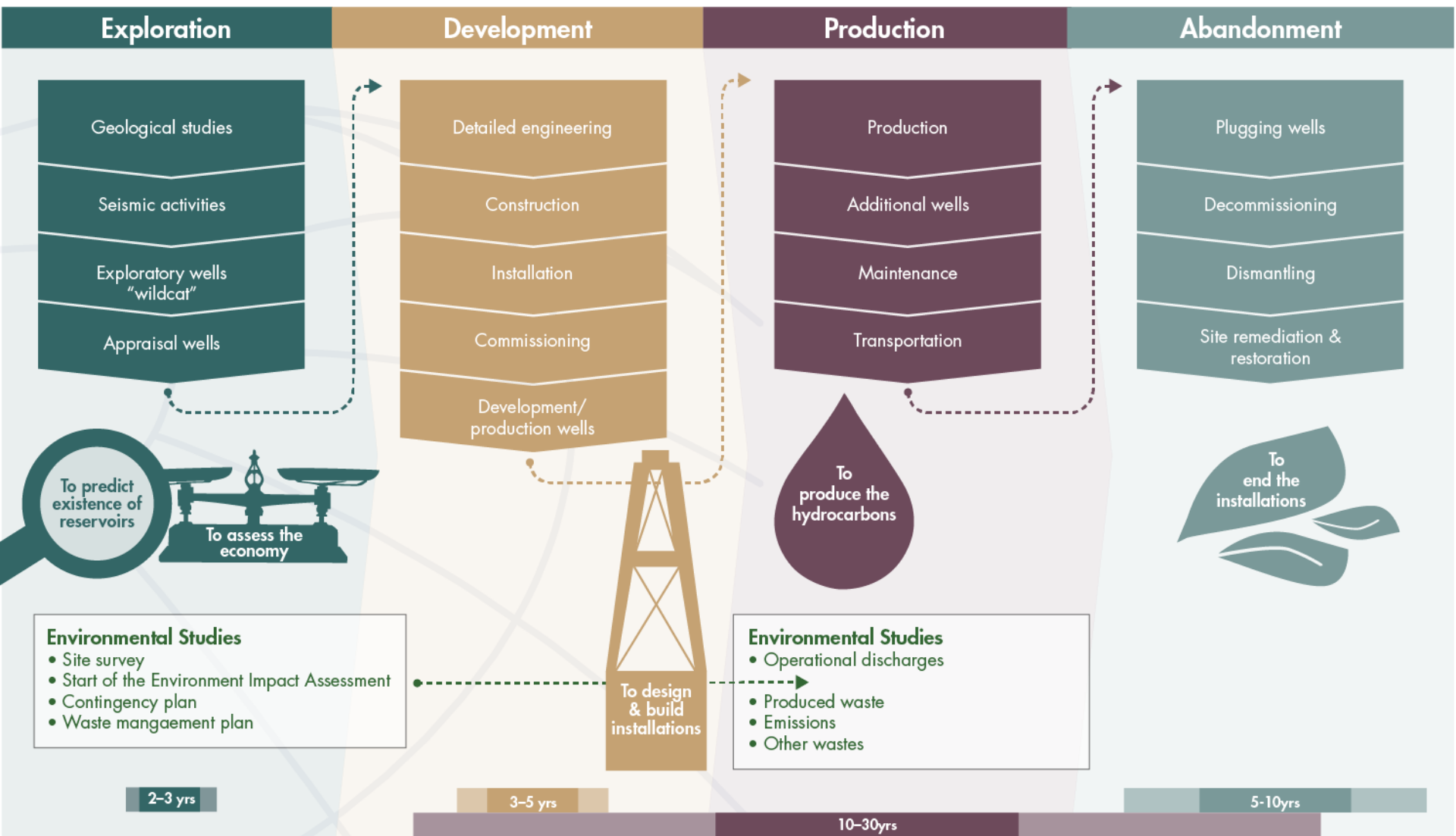
- **Seismic survey**
  - Risks and mitigation as for exploration seismic
- **Additional wells to evaluate the type of deposit, its scope and its likely yield**
  - Risks as for exploration drilling




## Field development

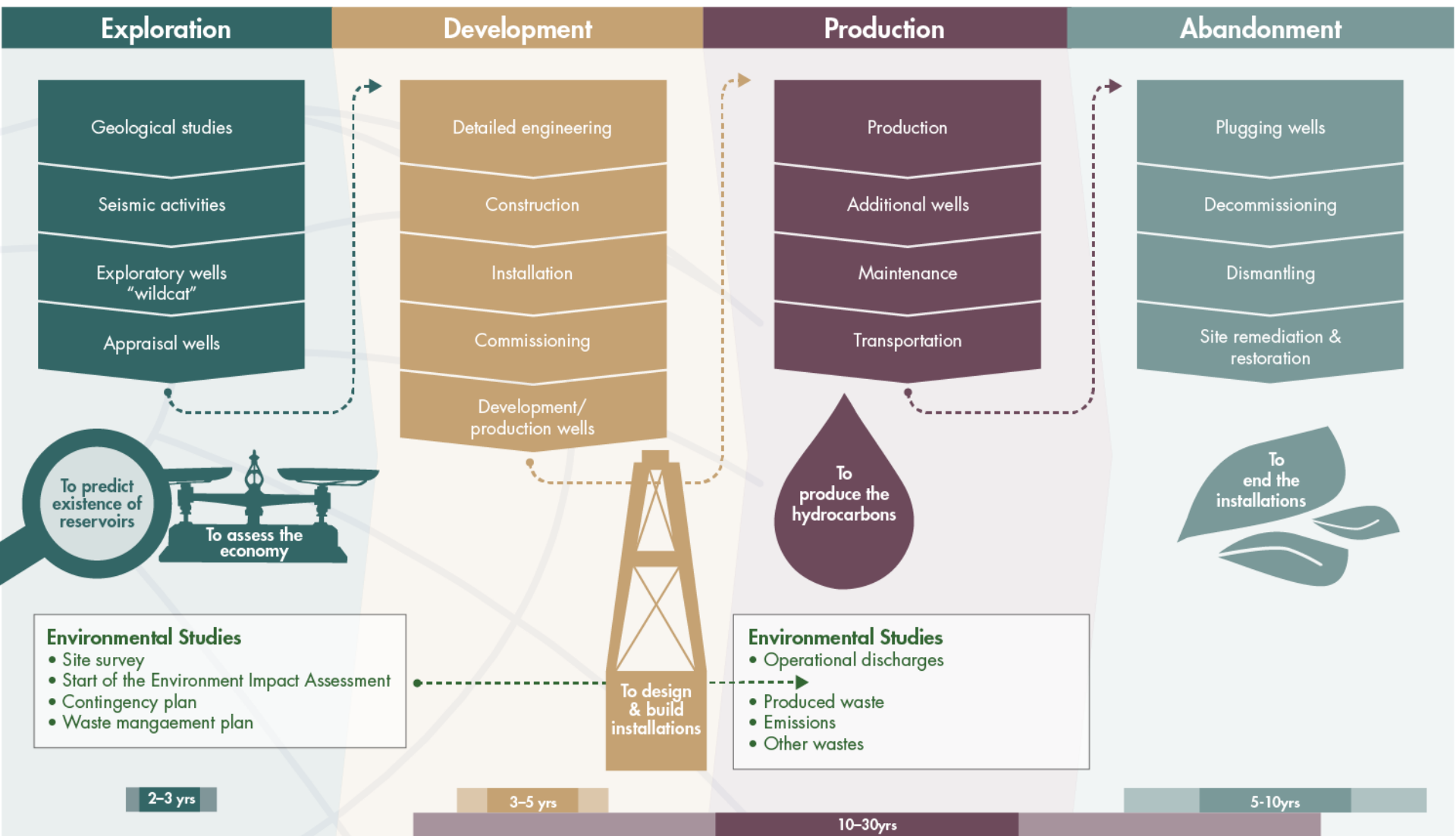
- Installation of facilities and infrastructure



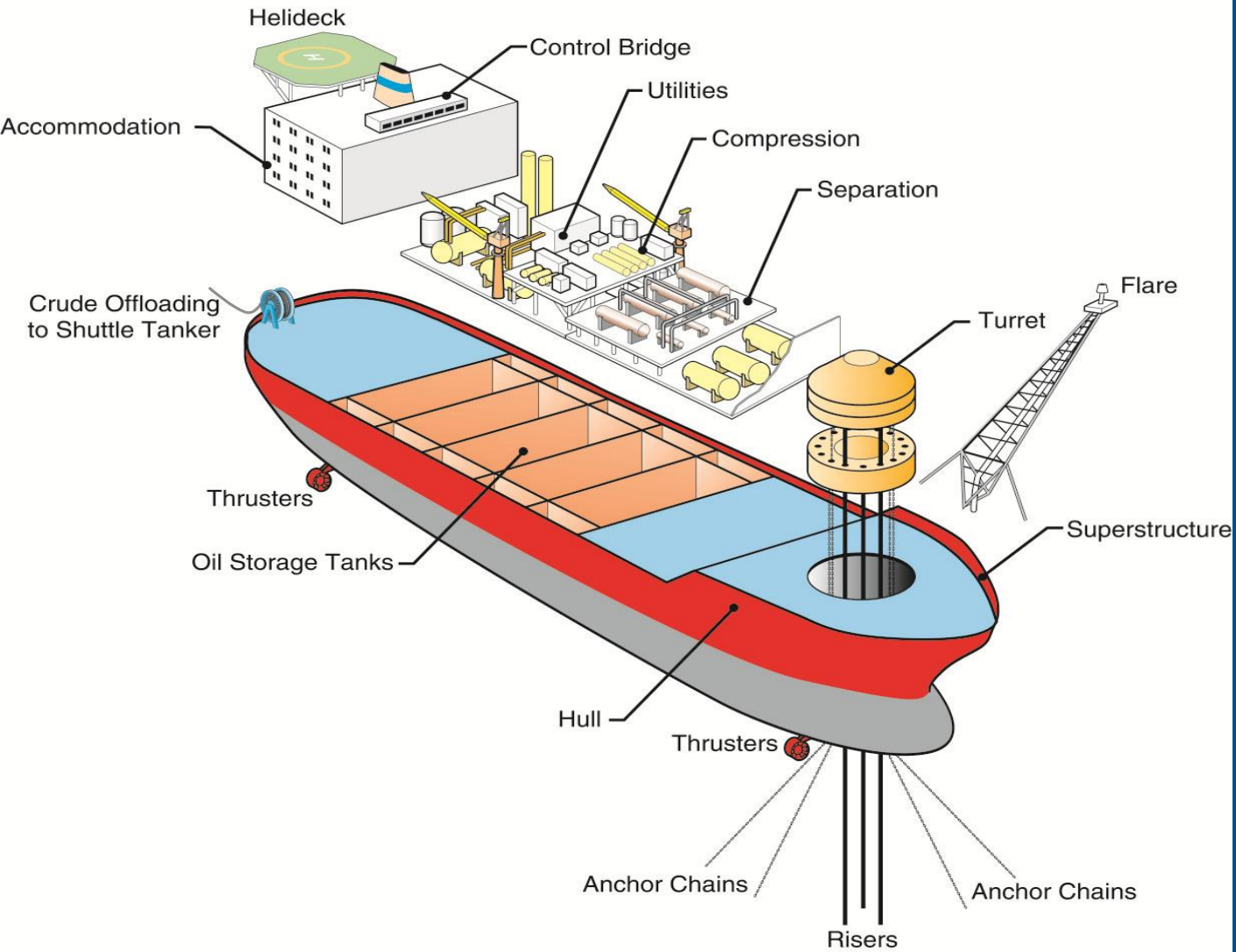


# Field Development

- **Additional Seismic**
  - **Installation of facilities**
    - Structure – fixed, floating, sub-sea
    - Pipelines – laid on sea bed, trenched, trenched and covered, rock dumped, commissioning
    - Development drilling (muds and cuttings, well integrity)
    - Start of production
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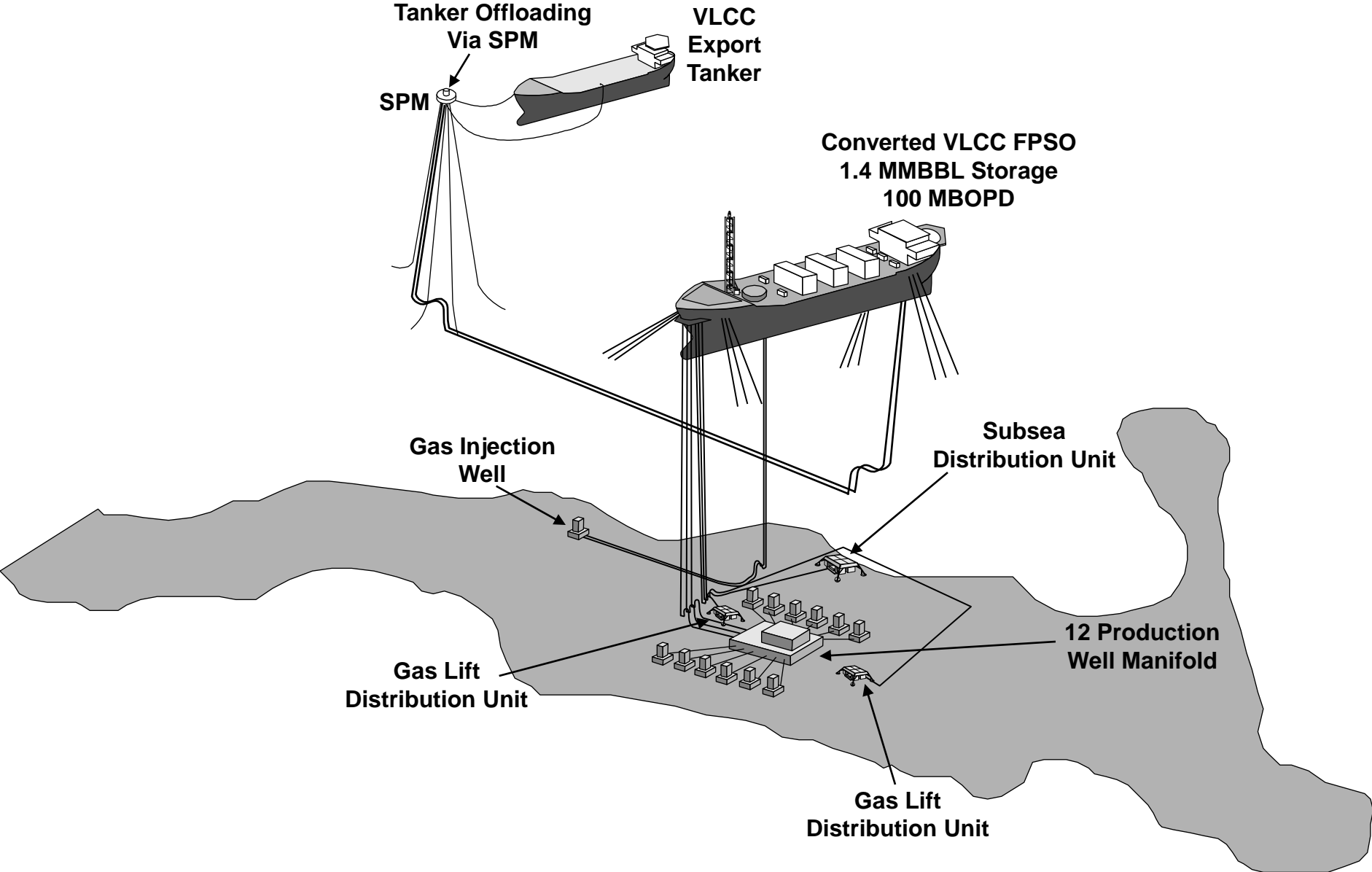


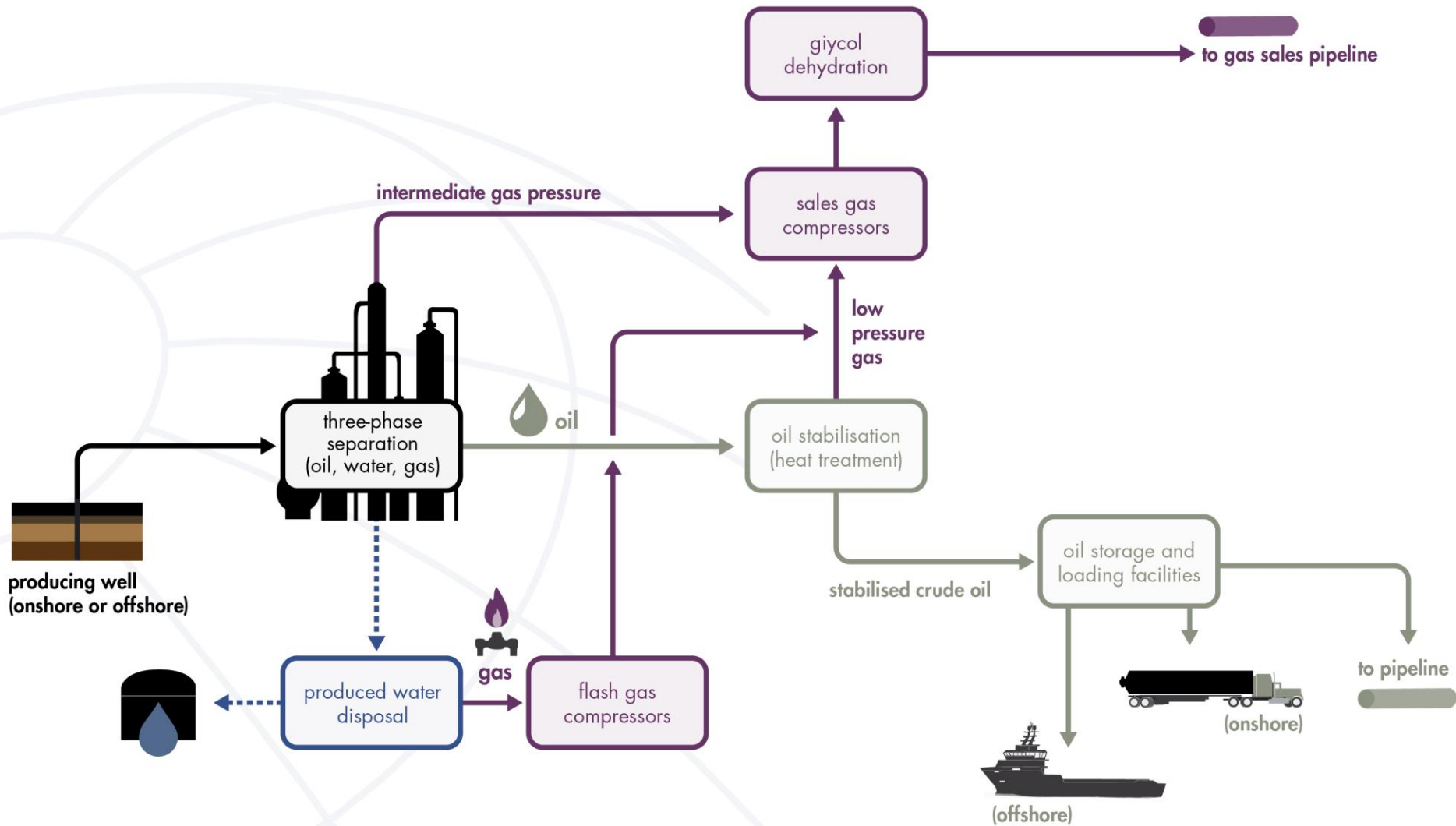
## TYPICAL TURRET MOORED FPSO





# Kuito Phase 1A Development





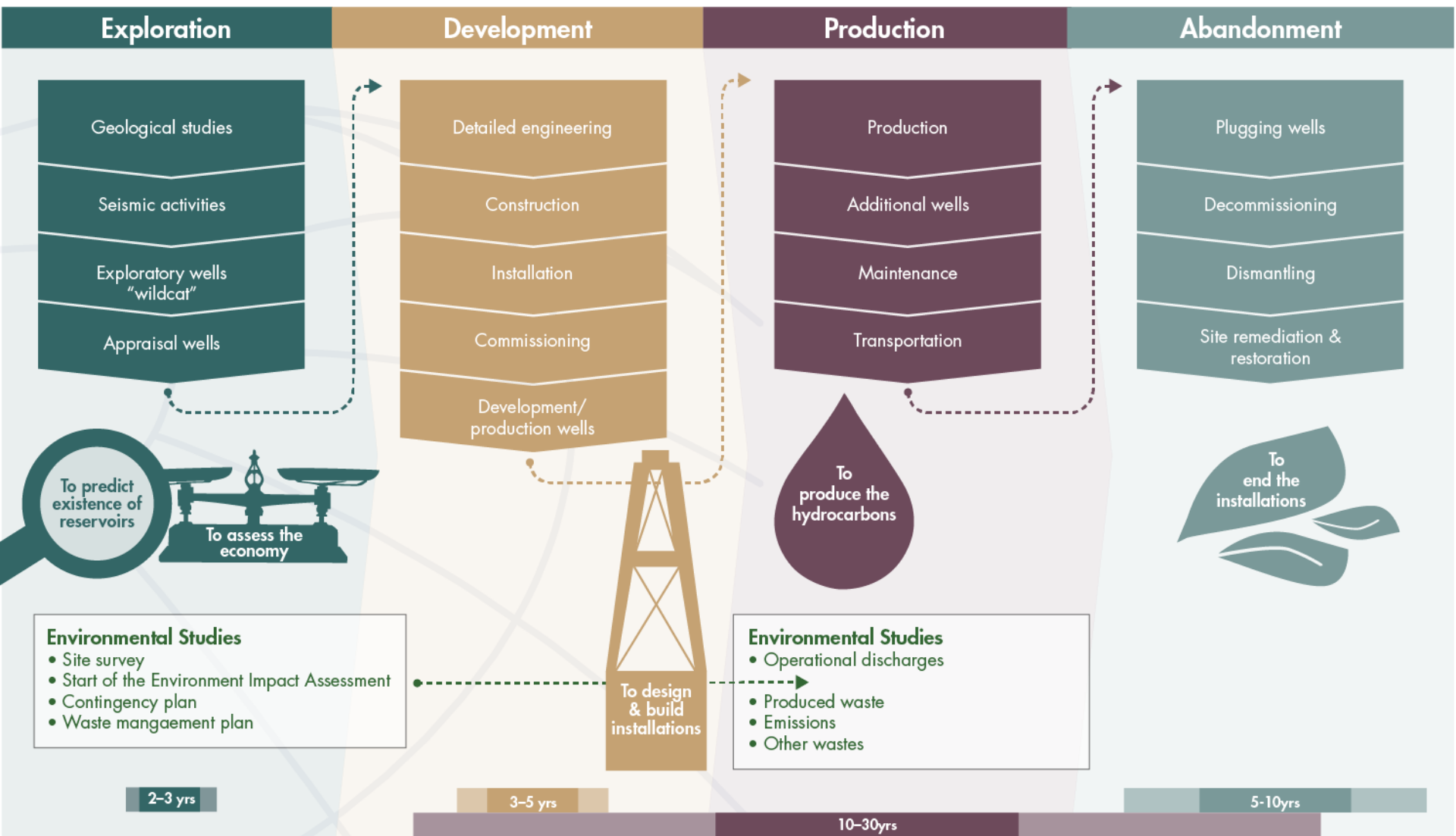
# Production (possibly over 30-40 years)

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- **Discharges from oil production:**
  - Increasing volumes of water as production advances
  - Oil contamination (controlled by performance standard and application of Best Available Techniques)
  - Produced water will contain residues of production chemicals, biocides, H<sub>2</sub>S scavengers, scale inhibitors, completion and work-over chemicals (controlled via the Chemical Use plan)
  - Contaminants mobilised by geochemical transformations in the reservoir
- **4-d Seismic**
- **Discharges from gas production:**
  - Substantially lower volumes of production water (containing process chemicals)
- **Maintenance**
- **Scales, sludges and sands**
- **Loss of containment episodes during production, transfer to vessel or loss of pipeline integrity**

# Production Discharges

- **Produced water (which will be the largest discharge by far)**
  - 40 mg/l is a technology standard
  - Oil in water concentrations (below the standard) are not considered to pose a significant risk
  - Most chemicals (probably >90% by weight) are biologically benign
  - Natural components in produced water (from the reservoir) may occur at higher concentrations than in seawater, but they are also not biologically significant
- **Produced water can be re-injected for disposal but this is not necessarily BAT**



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# OGP



# Decommissioning

- **Full or partial removal**
- **Plugging & abandonment of wells**
  - Longer term seepage concerns
  - Longer-term liability for operator or owner?
  - Pipeline infrastructure
- **Availability of handling facilities on shore**
- **Naturally occurring radioactive scale**
- **What if a coral reef has been established on the platform**
- **Rigs to reefs?**



## Remember...

- **The entire cycle can take 40-50 years which is 'several terms of office'**
  - **Thank you!**
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