CLIMATE AND POLLUTION AGENCY

Environmental Risk Assessment

In the Oil and Gas Industry

Bonn Agreement BE-AWARE Risk Assessment Workshop
24 – 26 September 2012

Kirsti Natvig, senior adviser

CONTENTS OF THIS PRESENTATION

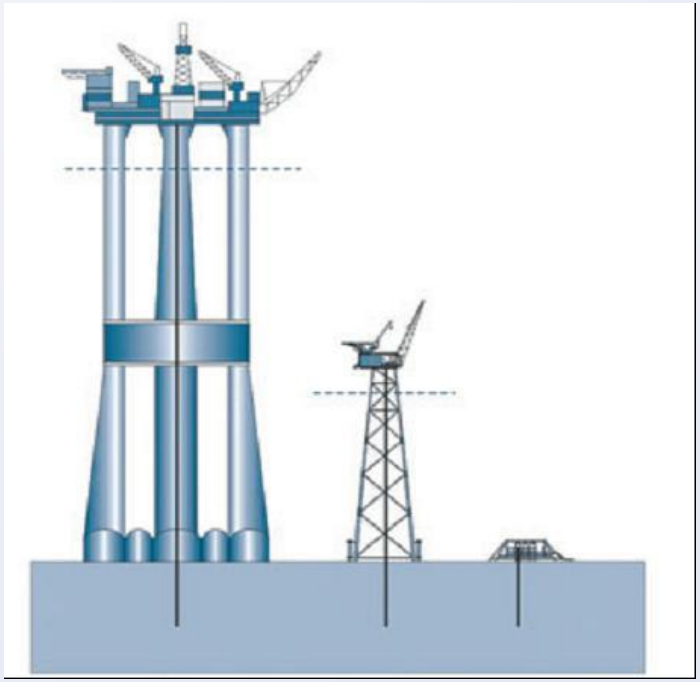
- The Oil and Gas Industry
- Climate and Pollution Agency (Klif)
- Basis for environmental risk assessment (ERA)
- Main elements in ERA
- Example: ERA in sea areas off Lofoten Islands
- Protection of sensitive areas
- Methodology

Oil and gas fields in production on the NCS

- First oil discovery: 1969
- First oil production: 1971
- Fields in production today:
  - 57 fields in the North Sea
  - 12 fields in the Norwegian Sea
  - 1 field in the Barents Sea
- Exploration activity:
  - 72 wells drilled in 2009, 46 in 2010, 54 in 2011
- Landbased activity
  - oil refineries
  - oil terminals/gas terminals
  - petroleum prosessing plants
- Supply bases, waste treatment facilities, decommissioning plants

Figur 11.1 Område på den norske kontinentalsokkelen, februar 2010

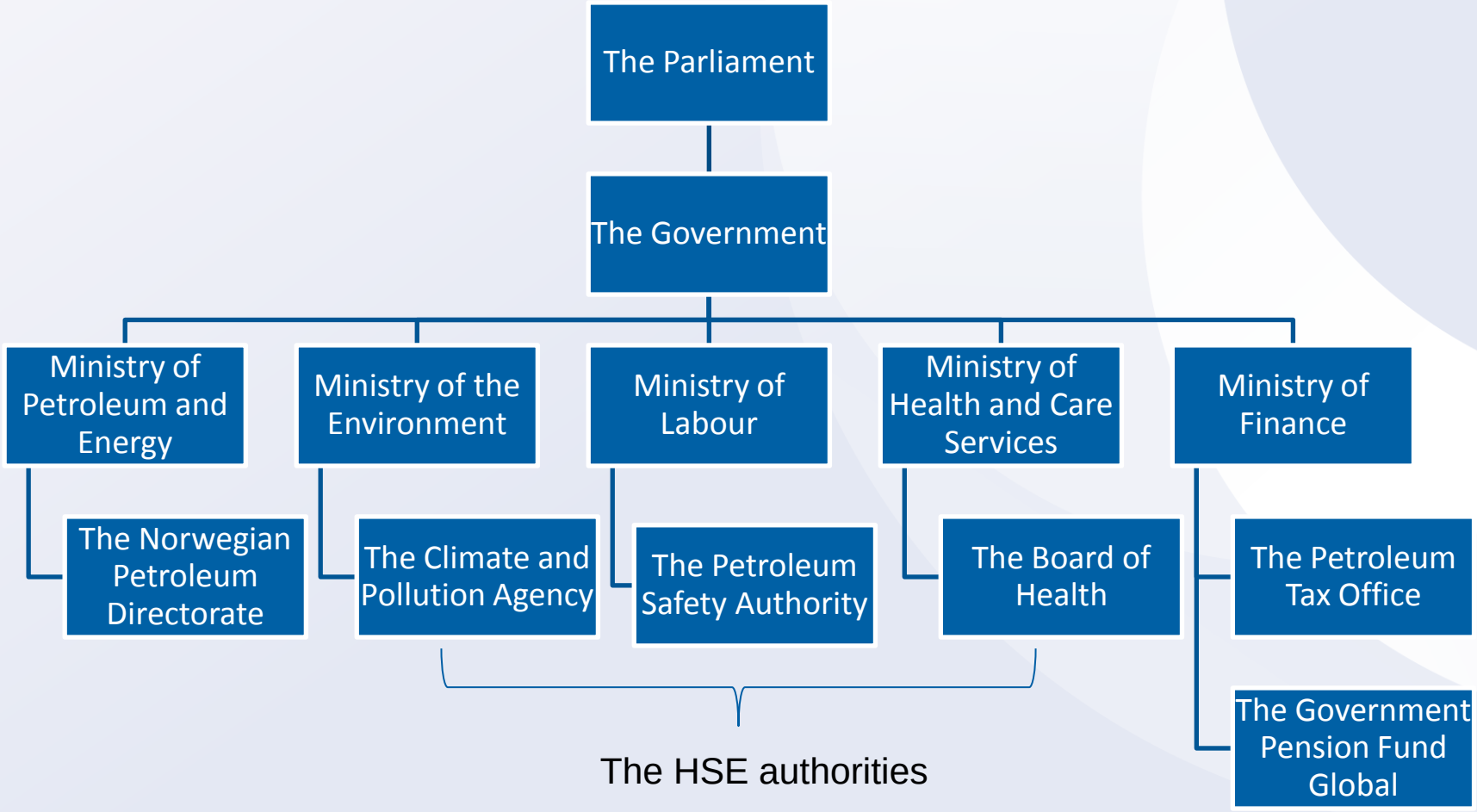
Facts (2011)



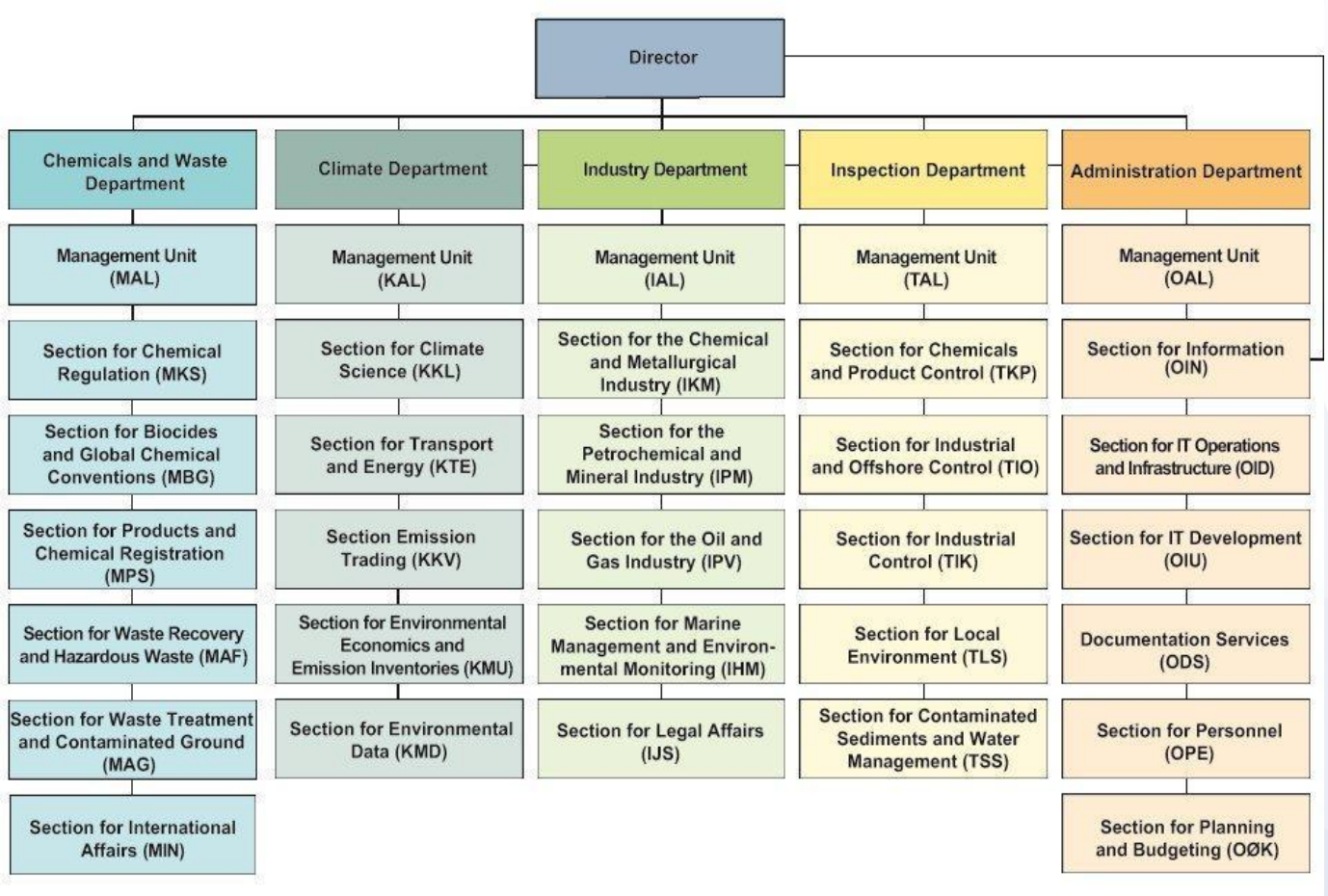
- Approximately 50 reporting offshore units
- Different choices of development on the NCS:
  - 12 concrete gravity based platforms
  - 32 fields with steel installations
  - 9 production vessels
  - 6 semi-submersible platforms
  - 4 unmanned wellhead installations
  - a large and increasing number subsea installations
  - a number of drilling rigs

- 60 - 400 m water depth + one at 1100 m
- 45 - 320 km from the shore

The Norwegian regulatory authorities for the oil and gas activities



Klif organisation



Section for the Oil and Gas Industry in Klif

- **16 employees**
  - Chemical engineeres
  - Marine biologists
  - Toxicity experts
  - Chemists

- **Cooperation and assistance**
  - Internal:
    - offshore control, hazardous waste,
    - chemicals, climate, legal affairs, etc.
  - External:
    - PSA, NPD, NCA etc.

Draugen photo: NCA

Main tasks and responsibilities

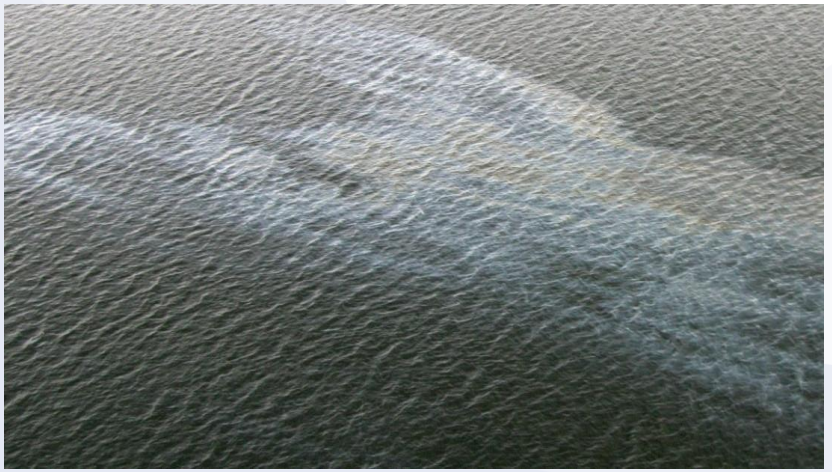
- **Issue licences/permits**
  - Offshore industry including oil spill preparedness and response requirements
  - Land based petroleum plants and terminals
  - Decommissioning plants
- **Adviser for the MoE**
- **Give comments during opening processes and on EIAs**
- **International work**
  - OSPAR, EU
  - Contact and coopetation with many countries

- **Development of regulations and requirements**
- **Assist in preparing Integrated Management Plans for the marine resources and ecosystems**
- **Follow up and control the industry**
  - enviromental monitoring , advisory services, follow up reports etc
- **Provide information on environmental status to the public**

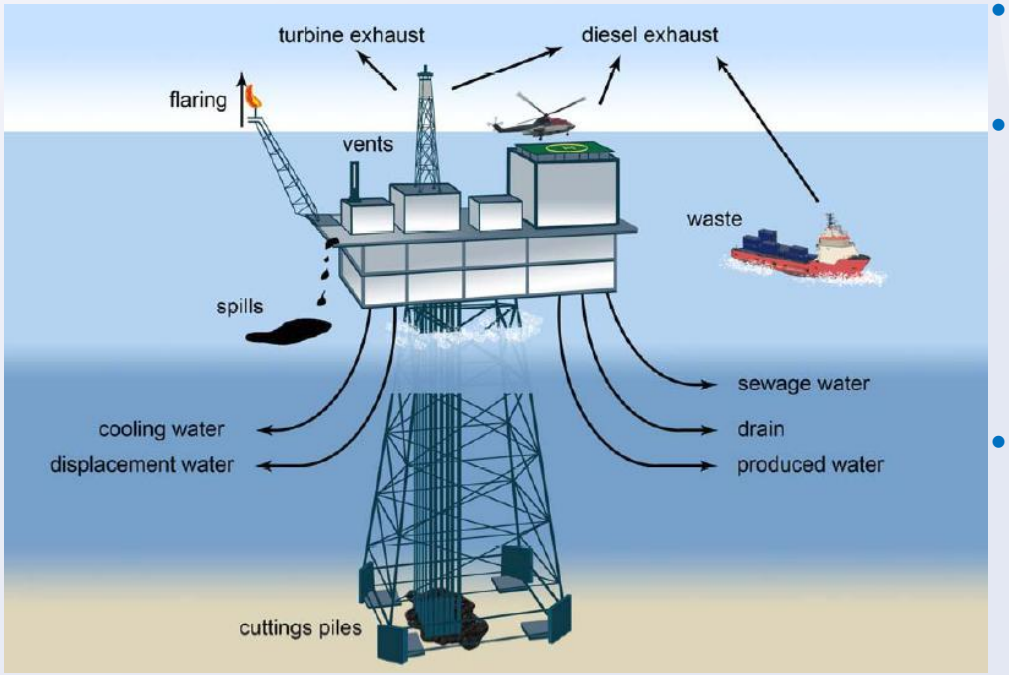
Permits and requirements

Exploration drilling, production drilling, production, pipelines, storage of CO2

- Discharges to sea of oil, chemicals and cuttings
- Injection for pressure support and storage
- Emissions to air of CO2, NOx, nm VOC
- Oil Spill Preparedness



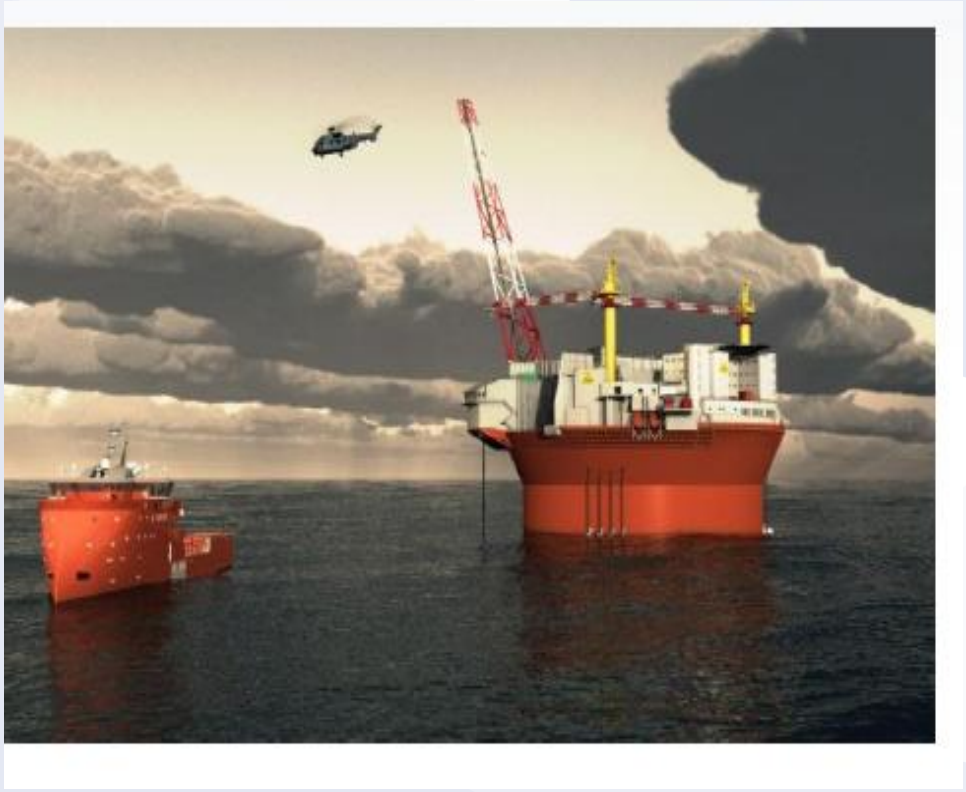
Pressures on the environment from oil and gas activities



- **Many pollution sources**
- **Main pressures include:**
  - operational and accidental discharges of crude oil and produced water containing substances such as oil components, polyaromatic hydrocarbons, alkyl phenols, heavy metals
- **In addition concerns related to:**
  - atmospheric emissions,
  - cutting piles
  - low level naturally occuring radioactive materiale,
  - placement of installations and pipelines on the seabed.

Main environmental challenges related to oil and gas activies in Norway

- Long-term impact of discharges of oil components cannot be ruled out.
- National emissions of climate gases have to be reduced by 20% by 2020. Huge challenge to reduce emissions from the petroleum sector. Electrification and CCS may be necessary.
- Activities in the north and closer to the coast will be a challenge for the oil spill preparedness and response
- More chemicals needed in order to meet the goal of the petroleum authorities to exploit more of the existing field
- Water production increases as fields are older
- decommissioning - a new business /landbased facilities



Basis for environmental risk assessment (ERA)

- **Activity description:**
  - **Exploration drilling, or**
  - **Drilling of production wells, or**
  - **Production**

- **Risk assessment (RA), identification of:**
  - **Risk reducing measures**
  - **Expected acute pollution (oil spill) scenarios**
    - **described as release rate and duration**

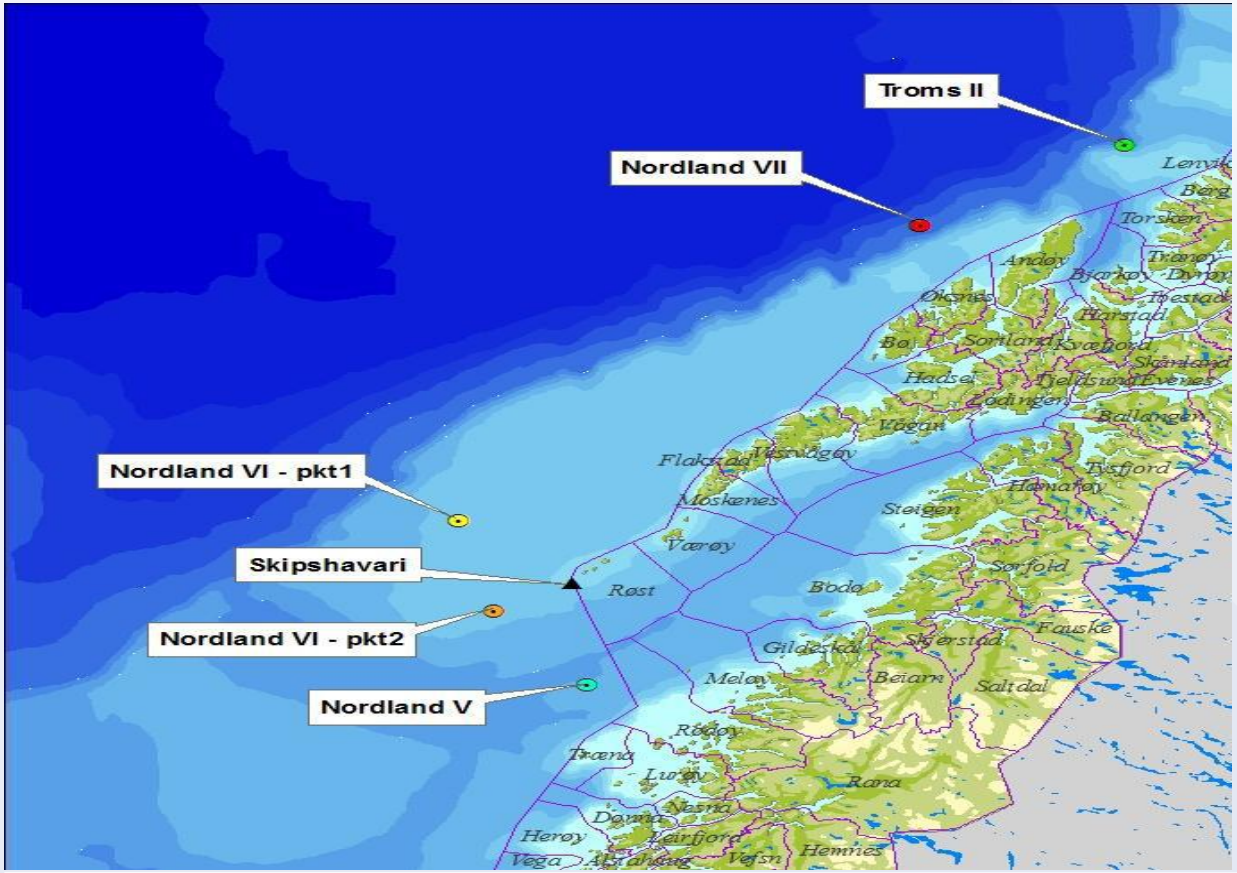
Main elements in ERA

1. **For expected scenarios: Modelling of oil spill distribution on the sea surface and in the water column based on relevant data on**
   - **oil weathering**
   - **oceanic and coastal current data**

2. **Criteria for environmental damage**
   - **Vulnerability considerations connected to a.o. fish and seabirds affect how the criteria for damage is described**

3. **Modelling of possible damage to sensitive species in the affected area**

Scenarios from the sea area off Lofoten islands

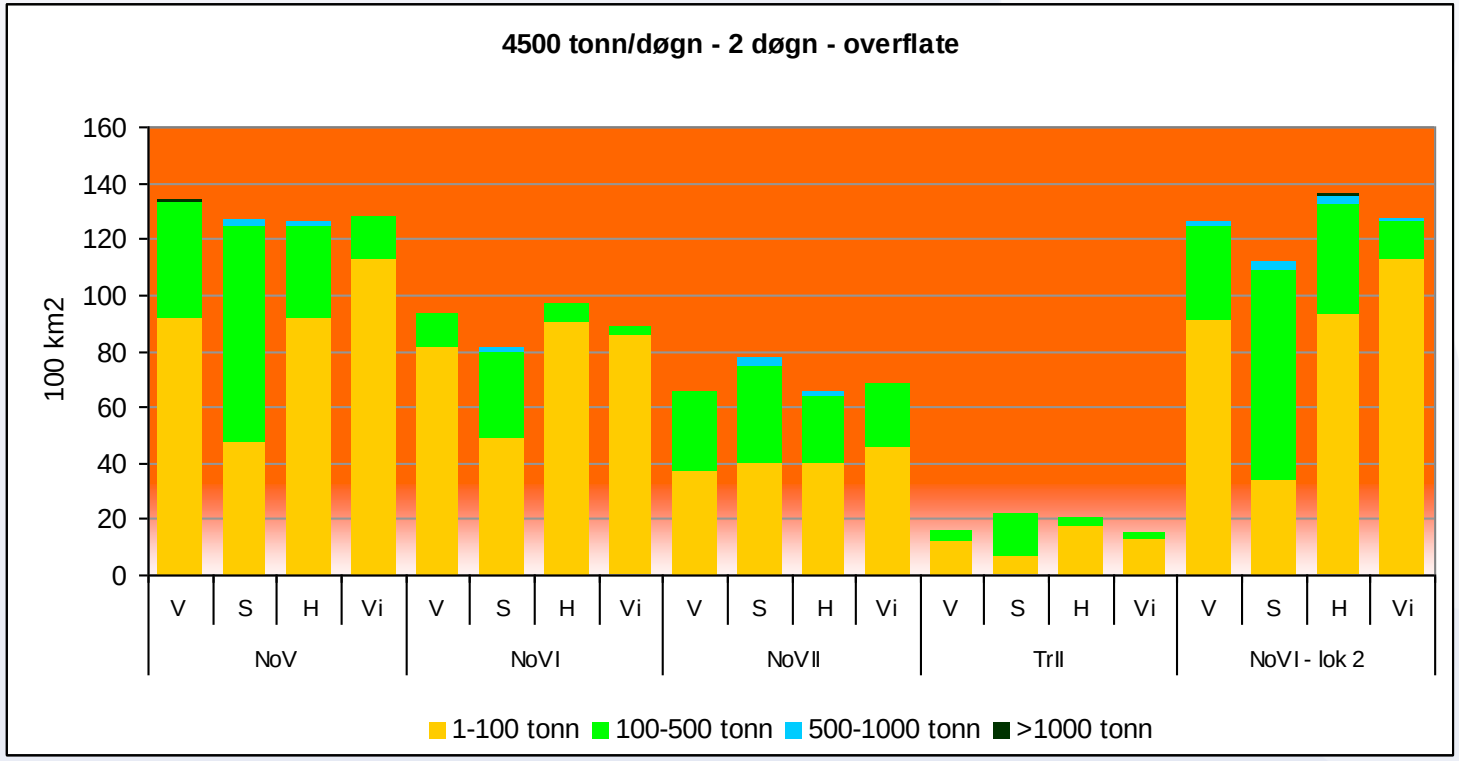


CLIMATE AND POLLUTION AGENCY

Scenarios from the sea area off Lofoten islands

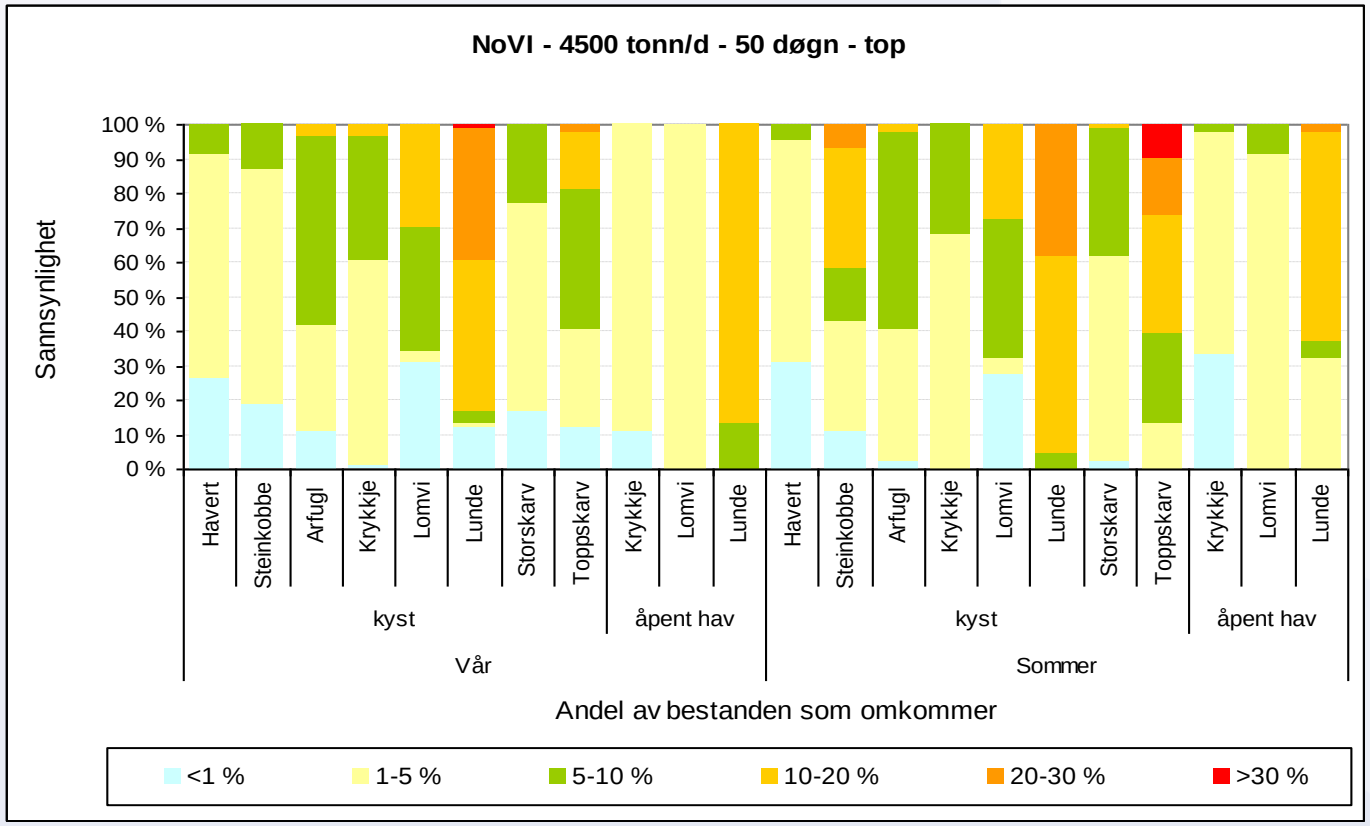
Scenario no	Release rate (t/d)	Release duration	Volume (t)
1	500	2 hours	42
2	35	14 days	490
3	1000	2 days	2000
4	4500	2 days	9000
5	8500	2 days	17000
6	4500 1000 200	2 days 13 days 35 days	29000
7	4500	14 days	63000
8	4500	50 days	225000
9	15000	4 days	60000

Oil spill distribution modelling results (DnV 2010)



CLIMATE AND POLLUTION AGENCY

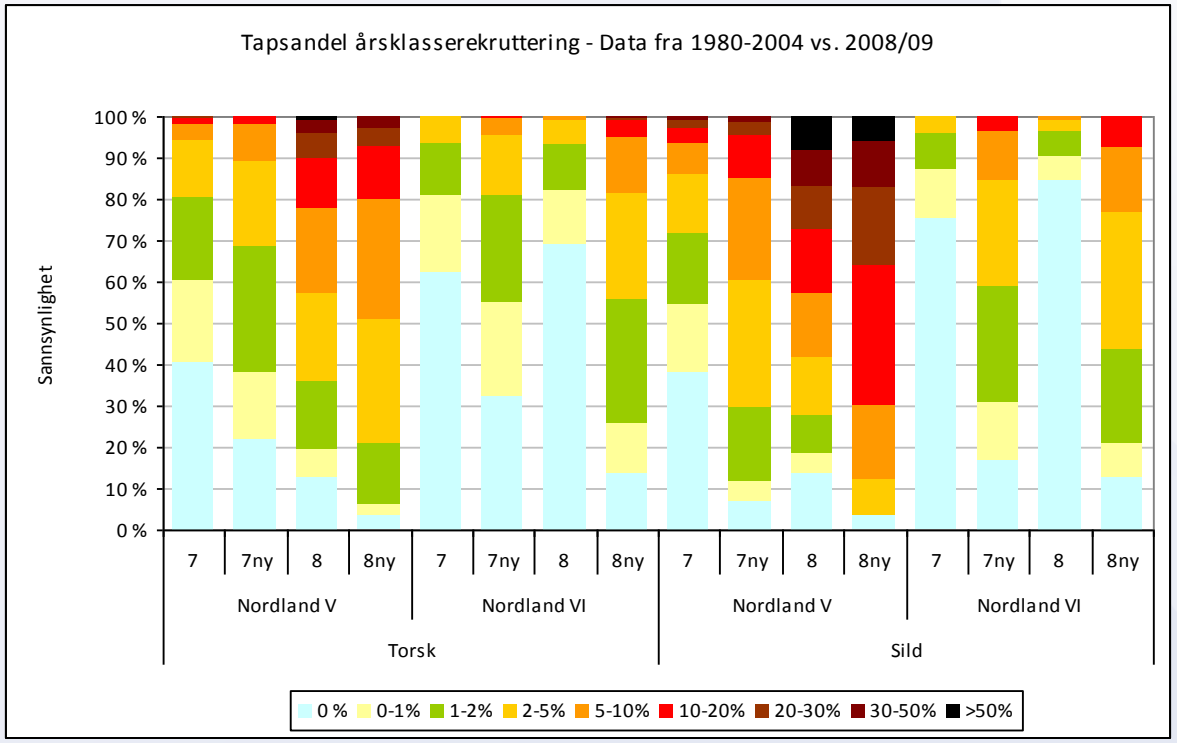
Effect on Seabirds



Modelled seabird loss probability given as share of stock of different species at a 4500 tonn/d – 50 days oil spill (Source: DNV 2010).

CLIMATE AND POLLUTION AGENCY

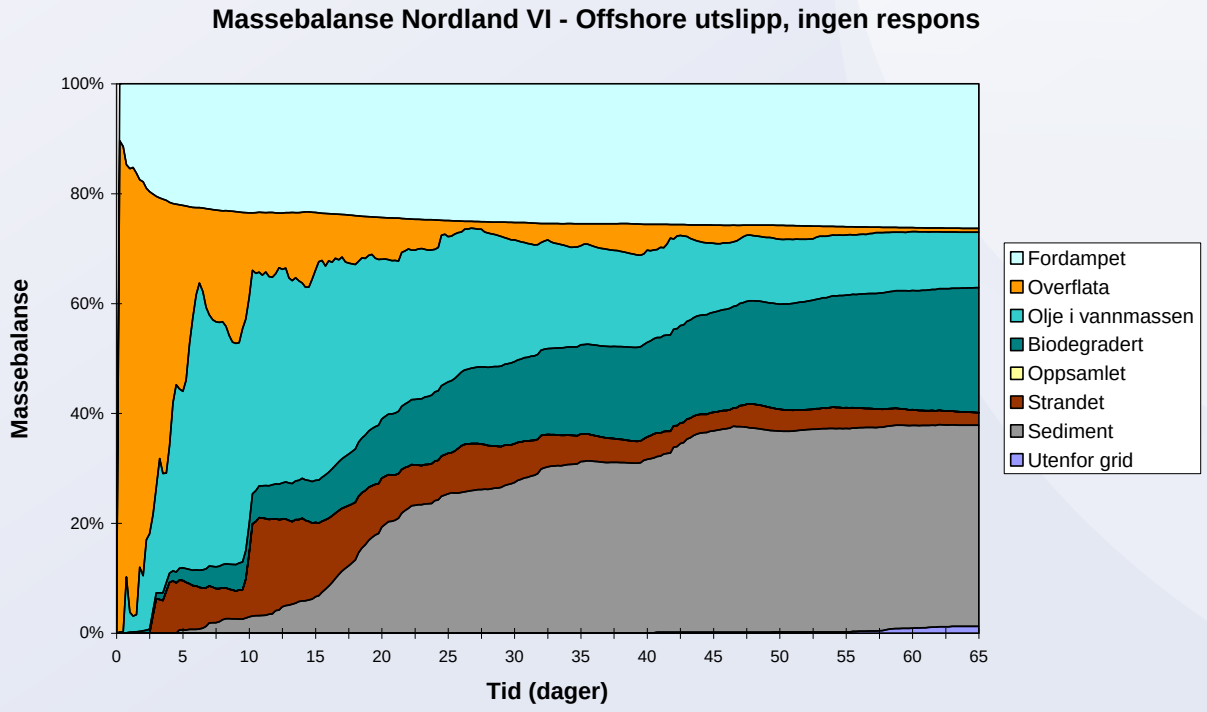
Effect on Fish



Scenario 7 and 8, modelled possible loss of cod and herring year class reqruiting

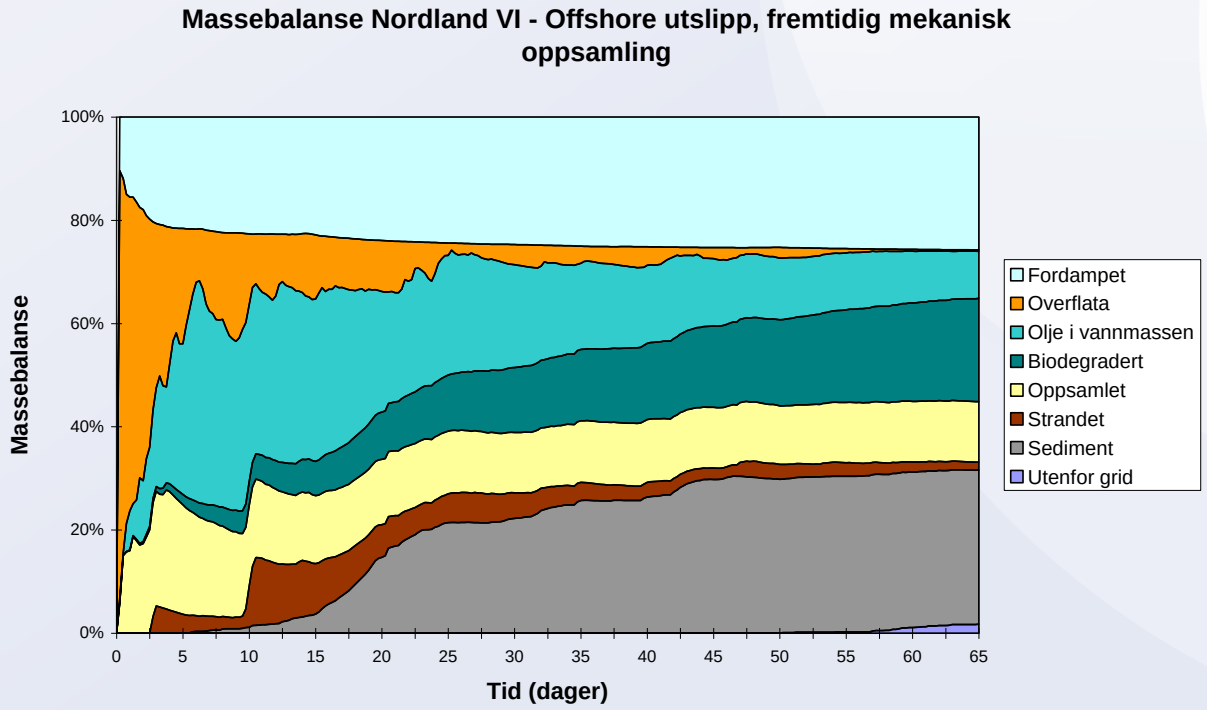
CLIMATE AND POLLUTION AGENCY

Mass balance Nordland VI oil spill, no response



Evaporated
Surface
Water column
Biodegradated
Recovered
On beach
Sediment
Outside grid
(Source: SINTEF 2010)

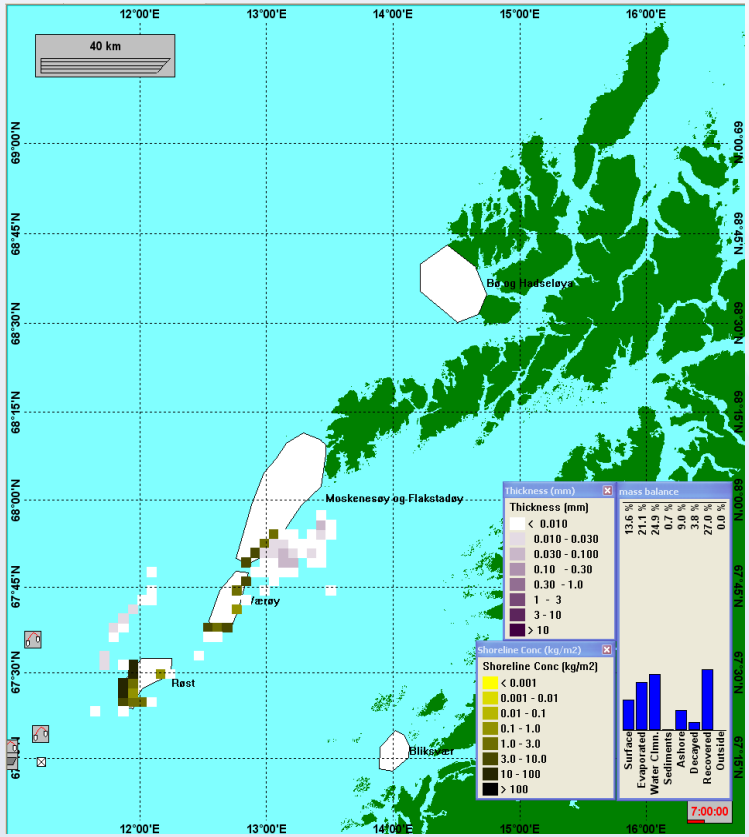
Mass balance Nordland VI, oil spill collection



Evaporated
Surface
Water column
Biodegradated
Recovered
On beach
Sediment
Outside grid

(Source: SINTEF 2010)

Possible oil spill recovery challenge



Source: SINTEF 2010

CLIMATE AND POLLUTION AGENCY

Results from ERA

- Modelling of oil spill transport and distribution both on the sea surface and in the water column is necessary
- It is possible to compare different sensitive areas based on ERA
- The same ERA method and basis criteria must be used in order to be able to compare areas
- ERA can identify valuable and vulnerable areas connected to possible oil spills
- The need for oil spill preparedness can be identified based on RA/ERA

Methodology: www.olf.no

Environmental Risk Assessment of Exploration Drilling in Nordland VI

Report no/DNV Reg No.: A/ 12FJH0G-6

Rev 0, 2010-03-30


Thank you for your attention!