Petroleum Safety Authority Norway
Trends in Risk Level
‘Risk Level’ Measuring Scheme

Methodology

Petroleum Safety Authority

- First as part of the Norwegian Petroleum Directorate.
- Safety regulator since 1973.
- Regulatory responsibility for safety and the working environment in Norway's petroleum sector.
- Reports to the Ministry of Labour and Social Affairs.
- About 170 employees.

OUR AREA OF RESPONSIBILITY

65 Rigs/units with AOC

CA **300** Subsea installations

8 Land-based plants

CA **25 000** People

15 400 Km subsea pipelines

Southern North Sea	Central North Sea	Northern North Sea	Norwegian Sea	Barents Sea	Land-based plants
Brynhild	Atla	Brage	Alve	Goliat	1 Kårstø
Blane	Alvheim	Byrding	Draugen	Snøhvit	2 Kollsnes
Ekofisk	Balder	Fram	Heidrun		3 Sture
Eldfisk	Bøyla	Fram H-North	Hyme		4 Mongstad
Embla	Edvard Grieg	Gimle	Kristin		5 Nyhamna
Flyndre	Enoch	Gjøa	Maria		6 Tjeldbergodden
Gaupe	Gina Krogh	Gullfaks	Marulk		7 Melkøya
Gyda	Grane	Gullfaks South	Mikkel		8 Slagentangen
Hod	Gudrun	Knarr	Morvin		
Oselvar	Gungne	Kvitebjørn	Njord		
Tambar	Heimdal	Oseberg	Norne		
Tambar East	Islay	Oseberg South	Ormen Lange		
Trym	Ivar Aasen	Oseberg East	Skarv		
Ula	Rev	Sindre	Skuld		
Valhall	Ringhorne East	Snorre	Tyrihans		
	Sigyn	Statfjord	Urd		
	Skirne	Statfjord North	Åsgard		
	Sleipner West	Statfjord East			
	Sleipner East	Sygna			
	Svalin	Tordis			
	Vale	Troll			
	Vilje	Tune			
	Volund	Valemon			
		Vega			
		Veslefrikk			
		Vigdis			
		Visund			
		Visund South			

85 Fields in production at 1.1. 2018

Trends in risk level
Background

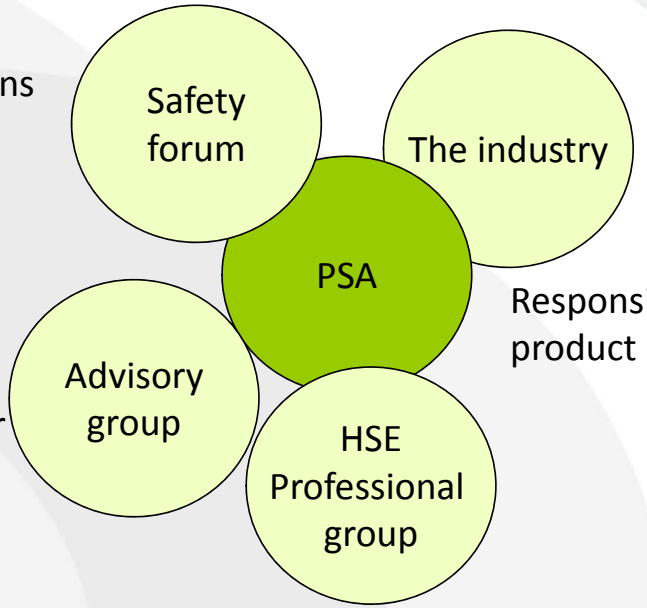
- Large structural changes in the petroleum industry during the late 90's led to 'friction' between the employers organisations and the unions in regards to the potential effect of changes on safety
- The unions claimed that the safety was suffering
- The employer organizations claimed that safety had never been better based on indicators like loss of work time
- The authorities lacked the necessary information to establish an independent view of development in 'safety level'
- In 1999 it was decided to establish a methodology with the purpose of measuring important parameters that influence safety and working environment
- First yearly report published in 2001. Continuous development of the methodology

Objectives

- Measure the development in risk level
- Measure effects of the HSE related work in the industry
- Contribute to identifying areas that are critical to HSE on industry level
- Create focus on specific HSE issues
- Increase insight into potential causes of accidents and undesirable conditions

Trends in risk level
Participants and contributors

Reference group:
Employers associations, unions and authorities
Tripartite



Data / information/ knowledge

Responsible for the product

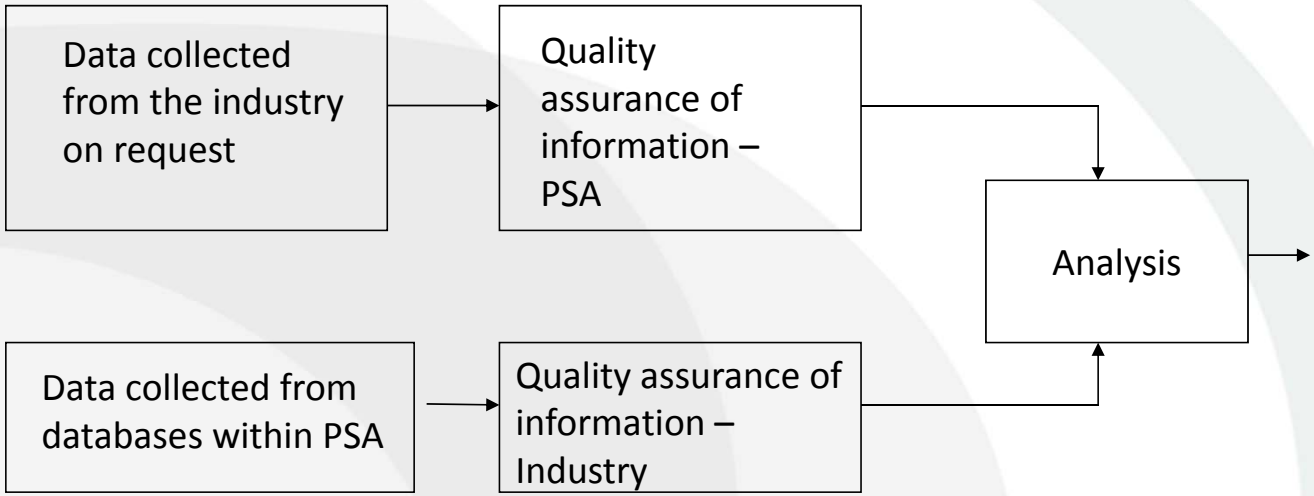
Advise on further development.
Tripartite

Professional experts

Trends in risk level Methodology

Collecting data

Quantitative information



Indicators used

- Lagging indicators
  - Based on undesirable events
    - Accidents, incidents and near misses
- Leading indicators
  - Based on availability of safety critical barriers
  - Based on maintenance data
  - Based on questionnaire survey (every second year)
    - Workers on facilities view on HSE related work that influence their safety and health
- Qualitative in-depth studies

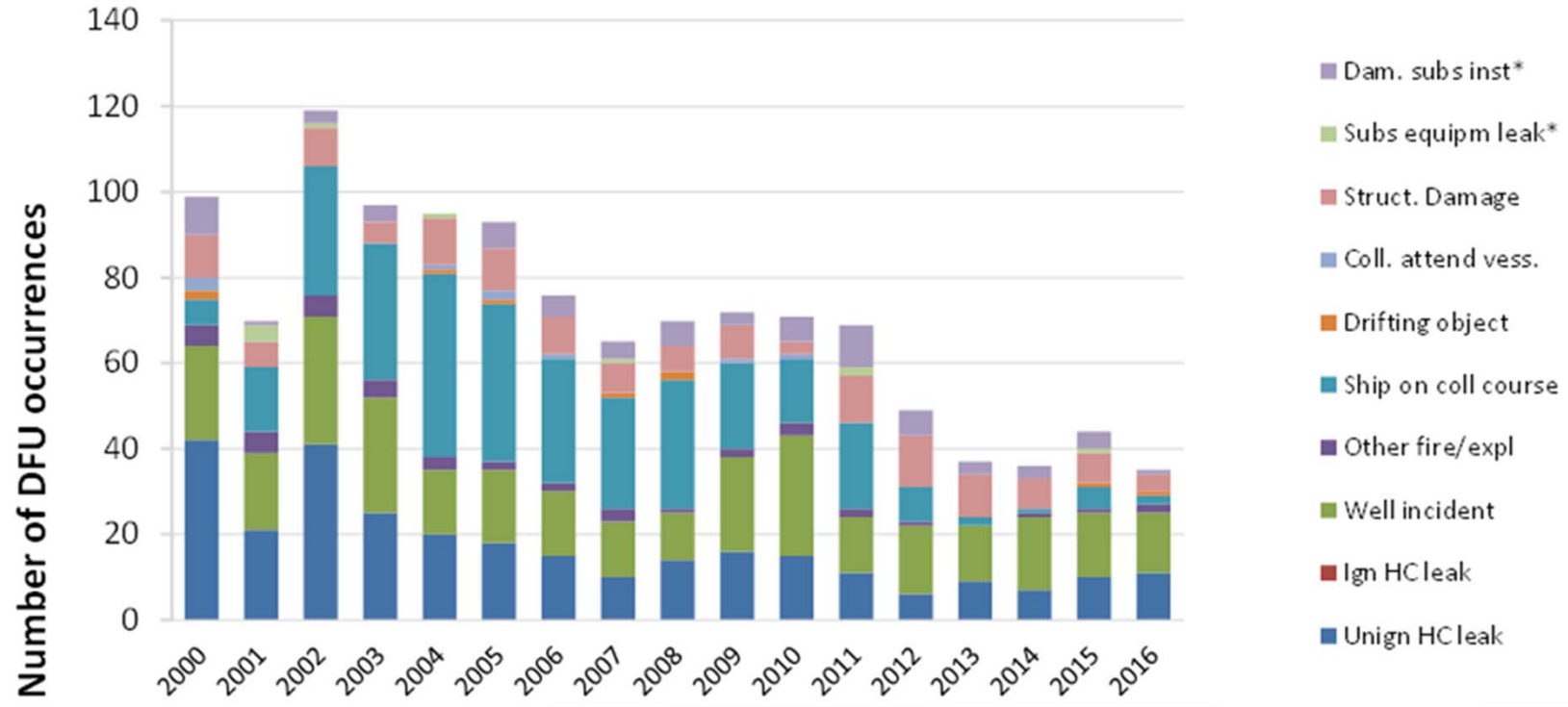
Accident precursors / indicators

- Non-ignited hydrocarbon releases
- Ignited hydrocarbon releases
- Well kicks/ loss of well control
- Fire/ explosion – non process fluids
- Vessel on collision course
- Drifting objects
- Collision with filed related vessel, shuttle tanker
- Structural damage, stability, anchoring, dynamic pos failure
- Releases from subsea production systems, pipelines, risers
- Damage to subsea production systems
- Helicopter
- Man over board
- Serious injury – personnel
- Occupational illness
- Total power failure
- Diving accident
- H2S emission
- Falling object

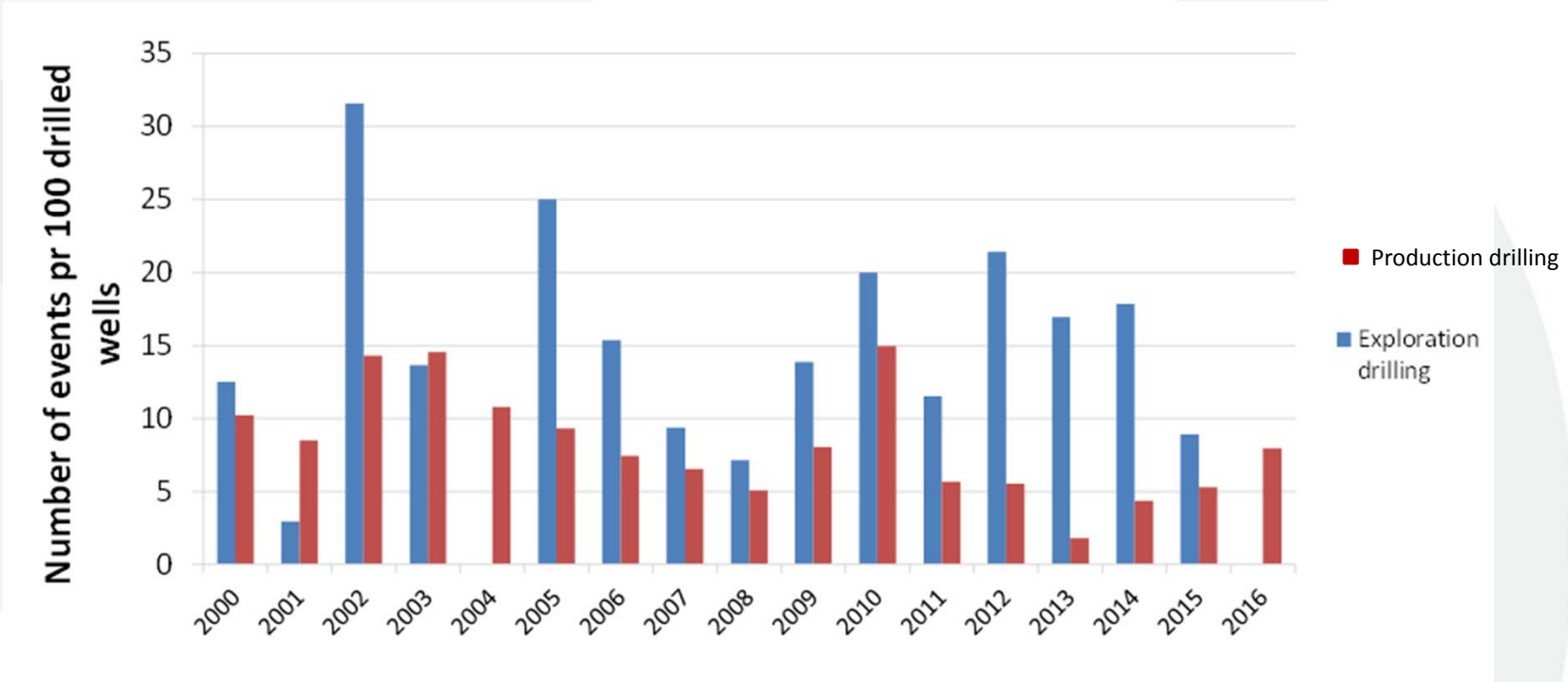
Black: Major accident potential

Accident precursor frequency

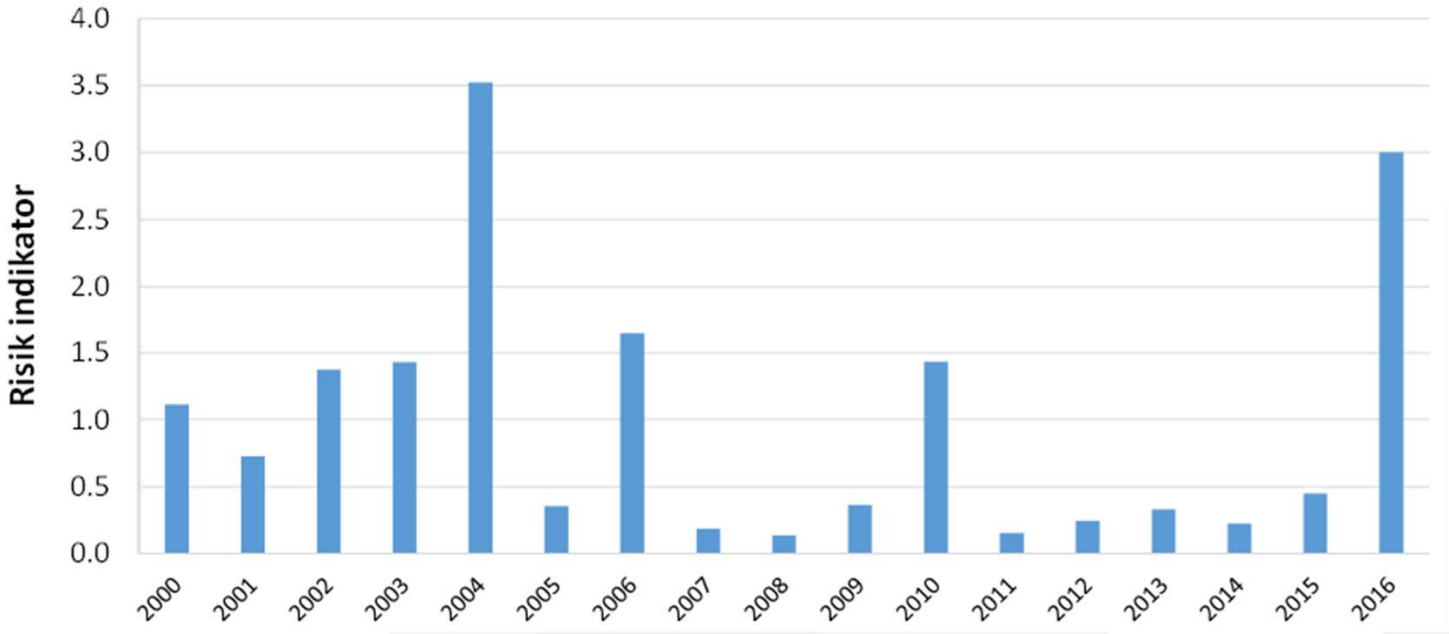
‘Major accidents’



Number of well control incidents, normalised



Well control incidents, contribution to potential loss of life



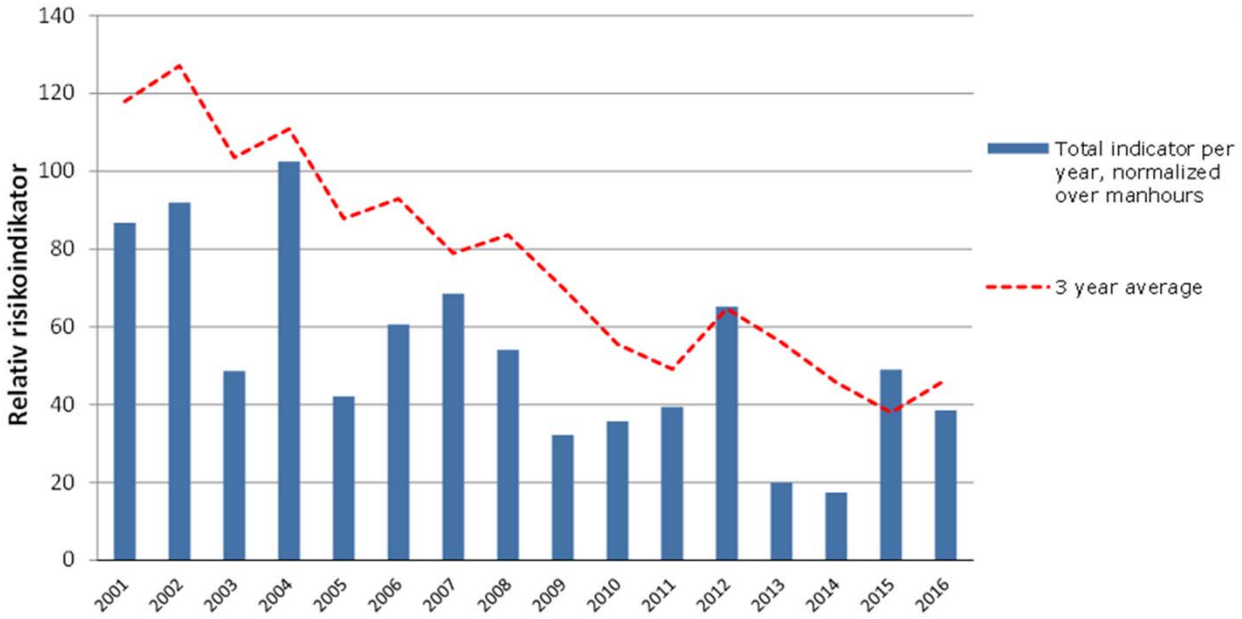
Major accident risk – risk management

- Risk must be managed
- Hypothesis – major accident risk
  - If the number of incidents with major accident potential are reduced, and the potential in regards to major accidents are reduced in the incidents that remains – risk management is becoming more efficient
  - Potential is evaluated based on real life risk assessments for the same type of plants where the incidents occur. Potential Loss of Life (PLL) forms the basis for a set of weight factors for each type of incident and each type of plant

$$R = \sum_{I} \sum_{J} DFU_{ij} \cdot v_{ij}$$

Major accidents – indicator

Weighted indicator, potential loss of life



Three year rolling average
Normalized – working hours
2000 = 100

$$R = \sum_{I} \sum_{J} DFU_{ij} \cdot v_{ij}$$

Barrier indicators

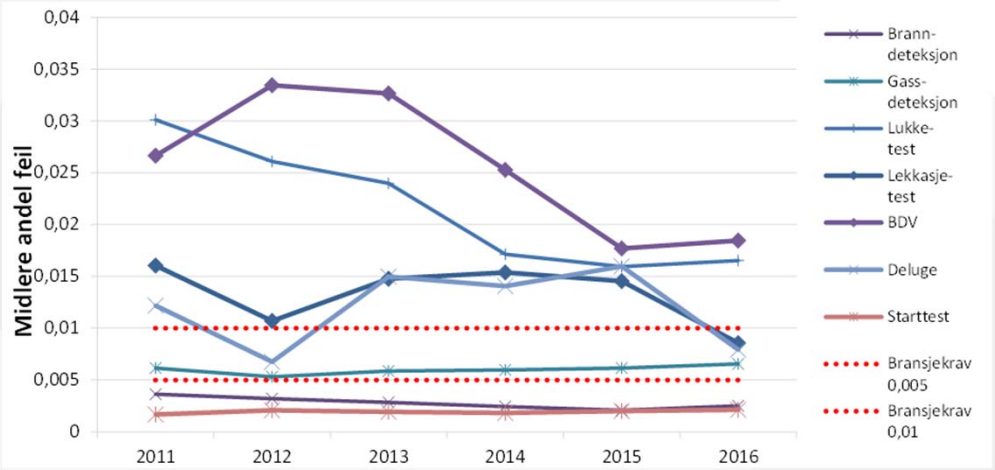
Barrier: technical, operational and/or organisational elements intended individually or collectively to prevent the occurrence of a specific sequence of events, or to influence it in an intended direction by limiting harm and/or loss.

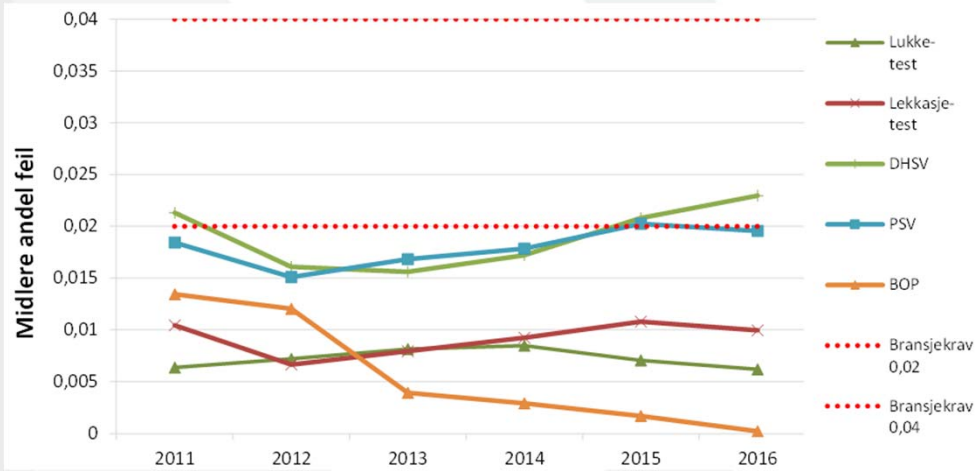
Barrier indicators in ’Trends in Risk Level’ are failure rates and maintenance information

Barrieres

Average failure rate, 3-year rolling average

$$\frac{Number\ of\ failures}{Number\ of\ tests}$$





Trends in risk level

Contributions

- Important for the tri-partite cooperation
  - Establish a common platform in regards to the development of important safety parameters
  - Act as a foundation for areas of improvement
- Generates knowledge
  - Large and unique database (also in international context)
  - Is us by several interest groups, e.g. for safety research
- An important input to PSAs knowledge base in regards to risk based planning
  - Supervisory activities
  - Development of regulatory requirements
  - Input to our Ministry

Reports

- Yearly reports
- See: www.ptil.no/rnnp
  - English summary report available