RISP - Erfaringsbasert beslutningsstøtte i utviklingsprosjekter

Tore Sagvolden, Stavanger 21.11.2023

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Innhold

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RISP prosjektet

- Initiativ fra operatørene (NOROG/Offshore Norge)
- Prefase 2015 -2017
- Hovedfase 2018-2019
- Etterfase 2020-2023

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This version comprises:

1. **Risk informed decision support in development projects (RISP). Main report**. Prepared by Tore Sagvolden, 13 December 2019.
2. **Workgroup 1 - Risk management**. Prepared by Joar Dalheim et.al., 1 February 2019.
3. **Workgroup 2 – Explosion**. Prepared by Linda Fløttum et.al., 10 March 2019.
4. **Workgroup 3 – Fires**. Prepared by Espen Gåserud et.al., 4 November 2019.
5. **Workgroup 4 - Other accidents**. Prepared by Joar Dalheim et.al., 4 November 2019.
6. **Workgroup 5 - Risk management and regulatory framework including standards**. Prepared by Rune Nerland et.al., 6 December 2019.
7. **RISP – Ship collision risk**. Prepared by T. Dammen and C.S. Madsen, 4 November 2022. *This is an update of chapter 3 in the Workgroup 4 report.*
8. **High Voltage Hazards**. Addendum to "RISP Report: Work Group 4 - Other Accidents". Prepared by Lars Rogstadkjernet, 17 November 2022. *This is an update of chapter 6 in the Workgroup 4 report.*
9. **RispEx-decision support for explosion load design**. 22.09.2023. *This report describes a simple model for estimation of explosion design loads in an early project phase, complementing the Workgroup 2 report.*

Mål

- "The overall objective of the RISP project is to further develop and concretise principles and ideas provided by the NOROG project into methods and guidelines and establish a new common "industrial practice".

A main recommendation from the NOROG project was that during a development project:

- Traditional quantitative risk analyses should for standard designs as a main rule be replaced by simplified assessments.
- This should be done to provide the best possible support for decisions being taken on an on-going basis.
- Thus, the emphasis on detailed calculations of total risk, and measurement against risk acceptance criteria such as FAR and 1x10-4, should be changed.
- Rather than continuing to seek very detailed risk descriptions, the aim in the future should be to provide better decision support at the right time when the developed concept is well known.

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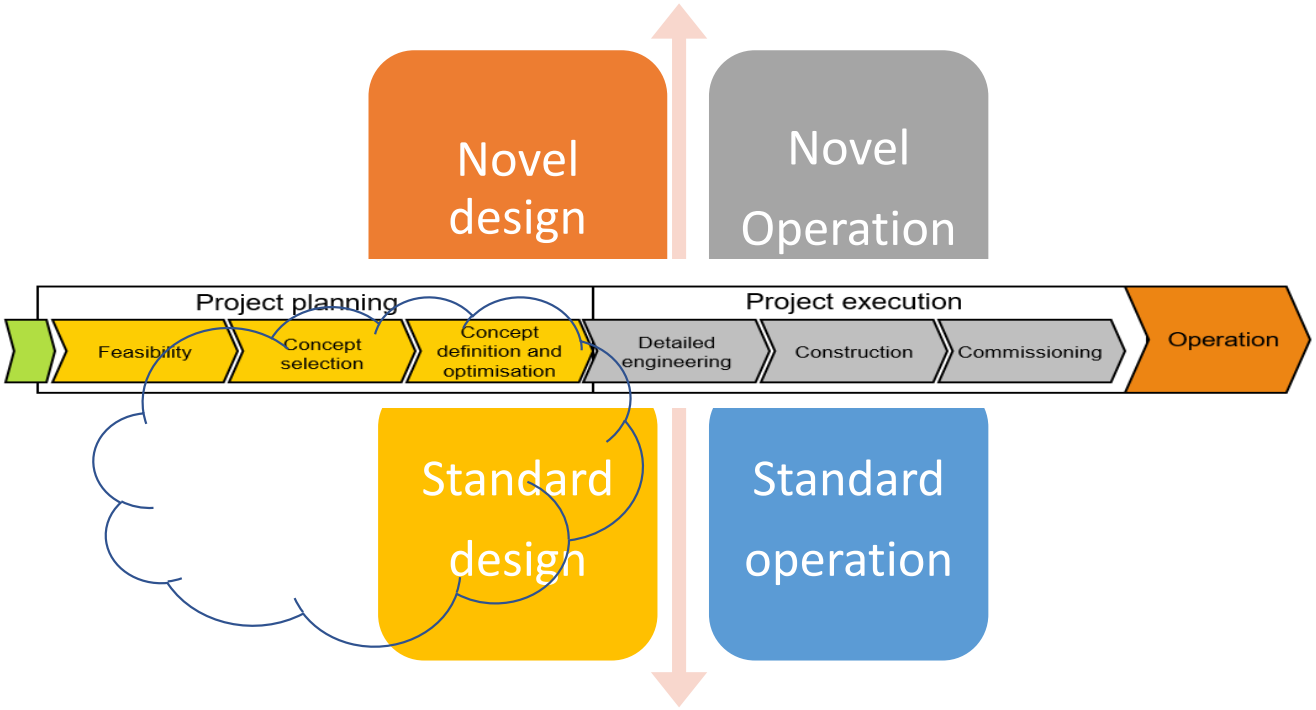
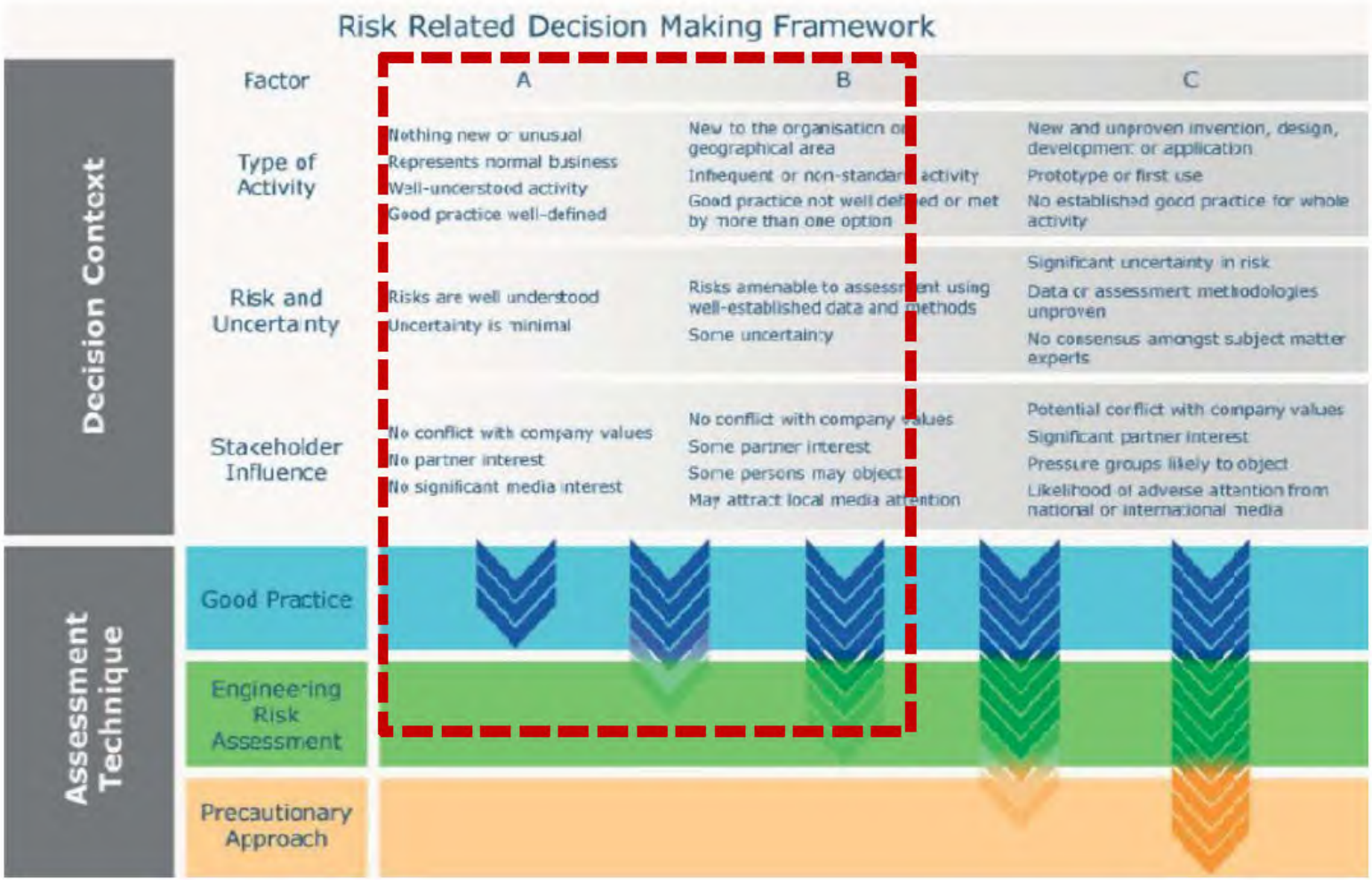
Kontekst: Utbyggingsprosjekter på norsk kontinental sokkel




Risk Related Decision Making Framework
Decision Context
Factor
A
B
C
Type of Activity
Nothing new or unusual
Represents normal business
Well-understood activity
Good practice well-defined
New to the organisation or geographical area
Infrequent or non-standard activity
Good practice not well defined or met by more than one option
New and unproven invention, design, development or application
Prototype or first use
No established good practice for whole activity
Risk and Uncertainty
Risks are well understood
Uncertainty is minimal
Risks amenable to assessment using well-established data and methods
Some uncertainty
Significant uncertainty in risk
Data or assessment methodologies unproven
No consensus amongst subject matter experts
Stakeholder Influence
No conflict with company values
No partner interest
No significant media interest
No conflict with company values
Some partner interest
Some persons may object
May attract local media attention
Potential conflict with company values
Significant partner interest
Pressure groups likely to object
Likelihood of adverse attention from national or international media
Assessment Technique
Good Practice
Engineering Risk Assessment
Precautionary Approach

HAZID – Risikoklassifisering - typisk

Classification	Description
1	The hazard potential is judged to be negligible compared to risk acceptance criteria
2	The hazard is well known and is judged to be handled sufficiently by standards, normal design development and operations
3	The hazard has a significant potential and has issues that needs to be considered/evaluated further during maturing of the concept, e.g. in separate studies (risk assessment) or in later phases
4	The hazard has a large potential compared to risk acceptance criteria, is a threat to feasibility or key information is missing. The hazard needs to be considered further in this phase to clarify required measures.

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Krav til metoder

Requirements to the method or model

According to requirements in the scope of work of the RISP initiative the method or model:

- shall ensure **the same level of safety** as currently achieved
- shall be based on **best available knowledge**
- theoretical and empirical **basis shall be available for review**
- shall be **transparent**
- must be **traceable**
- shall be **openly available** to the industry

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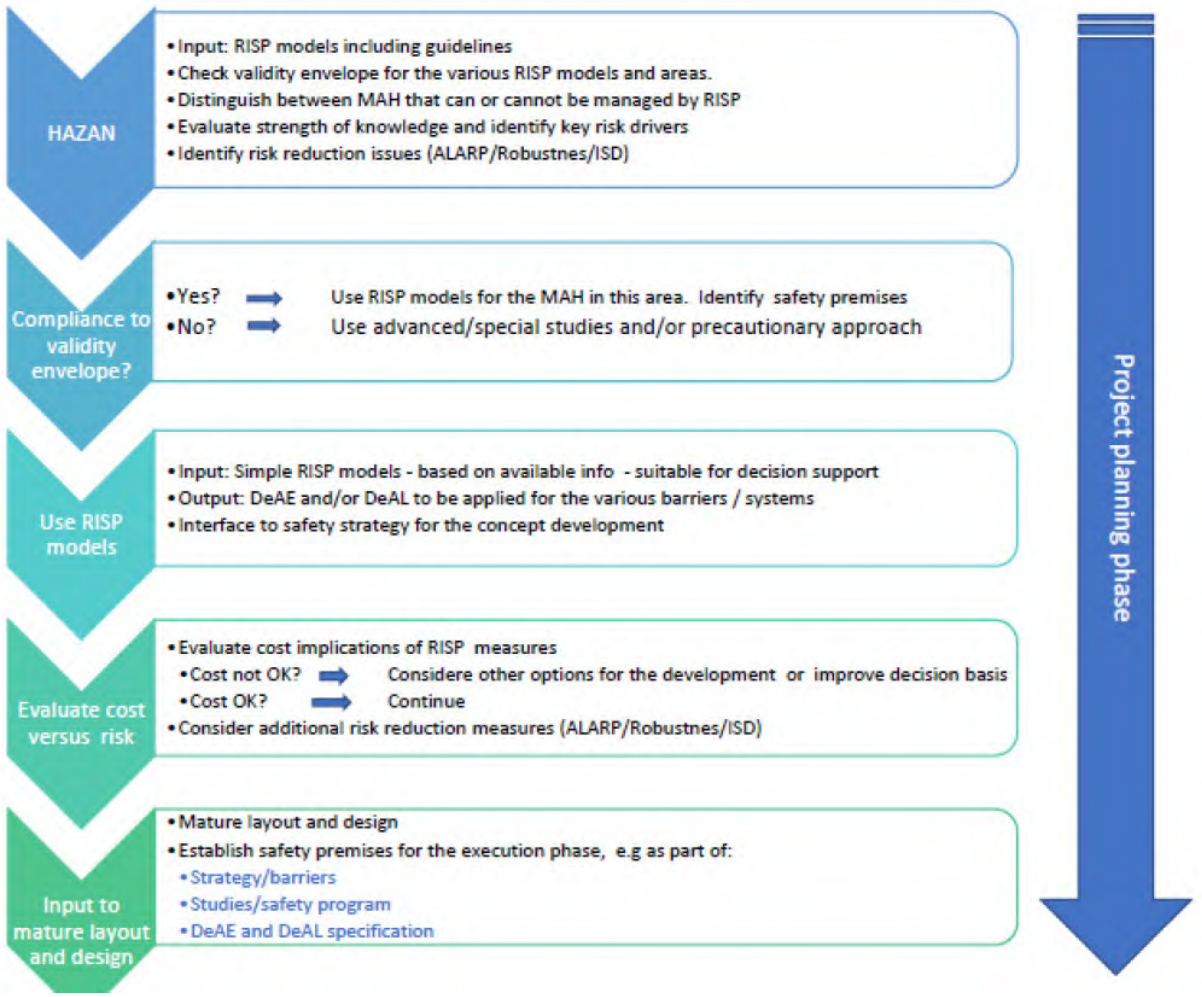
RISP - Arbeidsprosess



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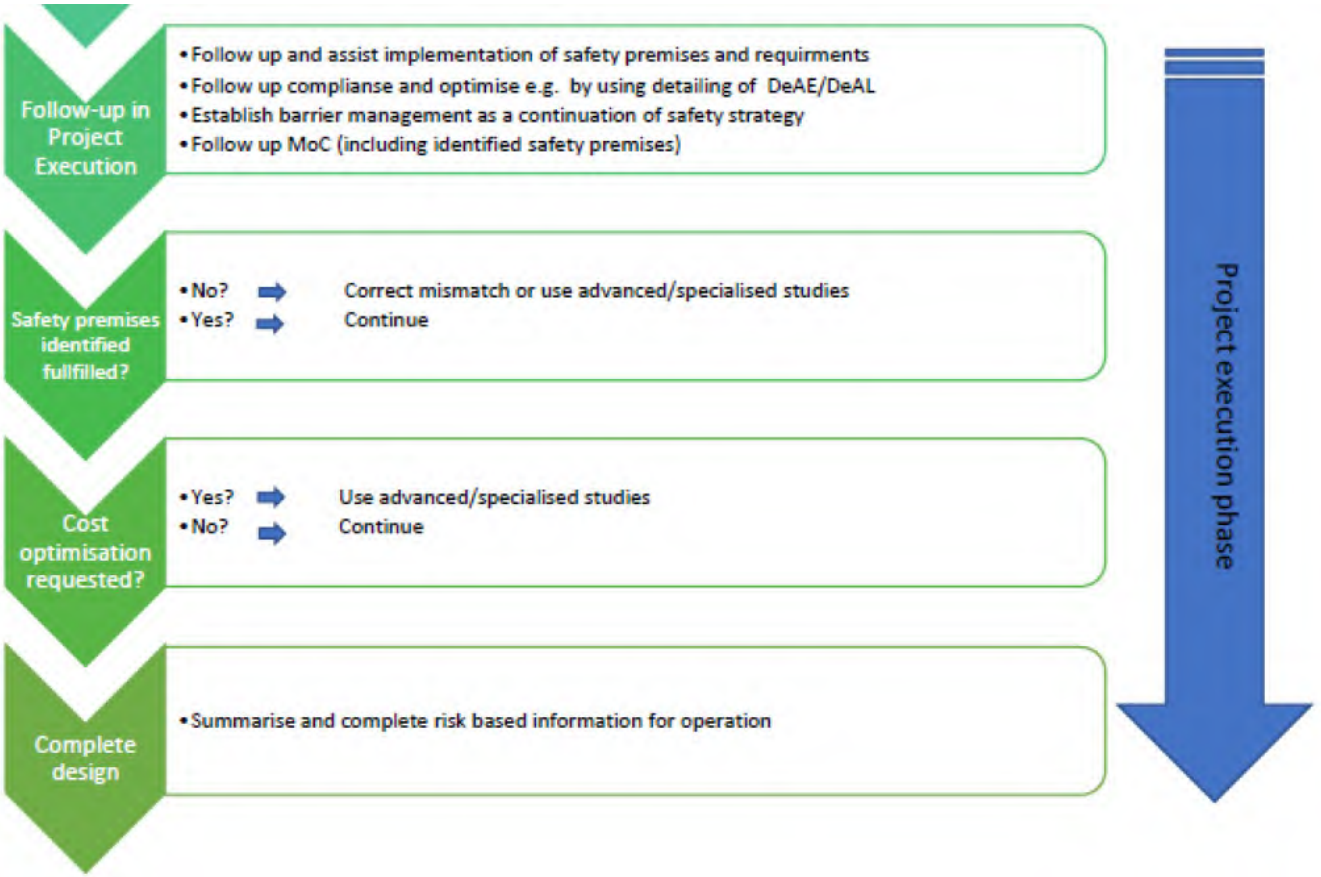
RISP - Arbeidsprosess



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Gyldighetsområde for RISP modellene

Validity envelope

The RISP validity envelope describes constraints and conditions for using the RISP methods and models. The aim has been to describe the envelope as precisely as possible to simplify the application in use. The validity envelope is expected to be challenged as part of HAZAN in each development project. A topic for the HAZAN is to conclude if the RISP methods and models can be used or if there are special constraints and conditions for the use. Key elements in the validity envelope include:

- General aspects:
  - The (relevant part of) concept is considered proven for the current situation and conditions. This means that aspects considered potentially as novel or unproven, are evaluated specifically regarding the validity envelope. Examples of aspects that may be necessary to evaluate (in addition to technical aspects) includes operational philosophy, reservoir conditions, process conditions and environmental conditions.
  - The MAH causes and effects are well understood
  - Necessary resources and competence for a proper management of MAH are available for the development project. See e.g. the PSA Framework regulations section 10,11 and 12. Guidelines describing appropriate principles for management of MAH are described in e.g.:

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HAZAN

The HAZAN is considered a crucial and important basis for management of MAH in a development project and it needs to be comprehensive and well planned. The HAZAN typically includes one or more documented and structured workshops with stakeholders and subject matter experts involved.

By following the HAZAN process, the following is considered:

- It is evaluated whether there is something unique with the proposed design
- Relevant hazards are identified and classified (HAZID)
- It is evaluated whether hazards are different than normal for the areas on the facility. This includes evaluation of uncertainty, strength of knowledge and whether criteria for use of the simplified RISP methods are met per area and type of hazard.

The above provides decision support to conclude if the RISP methods and models can be used or if special studies or considerations are needed.

The HAZAN process may provide useful decision support at early stages of the project execution for any type of project. It can limit the need for changes to design caused by new or changed safety requirements at later stages.

The HAZAN process is carried out by performing the following steps:

1. Describe characteristics of the suggested development.
2. Identify and analyze initiating events including hazards and uncertainty factors. This includes:
    - Identify, evaluate and classify MAH
    - Identify key risk drivers
    - Identify and consider risk reduction issues
3. Evaluate and demonstrate strength of knowledge
4. Check predefined validity envelope for RISP methods and models and identify safety premises
5. Decide on use of RISP models and identify any need for additional information and special studies or considerations to be performed.

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Kunnskapsstyrke

a) *Validity of assumptions: To what extent does the design basis, layout etc. reflect how the* design actually will become? Do we have reasons to believe there will be changes, or can we assume that what we see is what we get?
b) *Level of understanding of relevant phenomena:* Are there any reasons that the suggested design should end up with particular challenges for each of the hazards (fire, explosion etc.)? Are the hazards being discussed in the meeting similar to what we normally can expect, or are there any indications that this will be a special case?
c) *Availability of data:* What is the quality and maturity level of the design basis, layout drawings etc.? Do we have knowledge supporting that it is or is not correct? Are there any other projects with similar challenges that we can address and validate the design against? To what extent are there available relevant accident statistics and is the quality of the data sufficient to conclude on the need to design against the hazard?
d) *Level of agreement/consensus among experts:* After all discussions; is there a common agreement in the HAZAN group? Do we have reasons to assume that anyone outside the group would disagree? Based on the discussions so far; are we confident that the risk is understood and controlled sufficiently?

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Eksempler på RISP modeller (per 2019)

Table 1: Samples of RISP models established.

Hazard	Key model	Comment
Ignited process fire	- Structural integrity (including secondary structure): DeAE = WCPF. Method to establish DeAL and potentially generic loads. - Escalation to process equipment: DeAL – 250 kw/m^2 for 2 minutes (no escalation) and 350 kw/m2 for 15 minutes (no escalation causing > 30 kg/s). - Global main safety functions (escape routes, evacuation means, muster area): DeAE 30 kg/s. Duration 15-60 minutes.	- Initial fire > 30 kg/s: Estimated annual frequency of 0.7 x 10^{-4} per year for a large process module. - Typical WCPF for structural integrity in a naturally ventilated module: 5-30 kg/s

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Eksempler på RISP modeller (per 2019)

Ignited riser fire	DeAE: Ignited leak in any of the riser segments that will give the worst fire exposure of the main load bearing structures, safe area and evacuation means.	- DeAE covers annual fire frequency levels between 1×10^{-5} and 1×10^{-3} - ESD valves and SSIVs can be credited as segregation for the riser segments. The closure time needs to be reflected regarding heat loads and duration. This presumes the valves are treated as safety systems with testing and performance requirement (typical reliability level of 98 % or higher). This implies that the valves have requirements for closing time and internal leak that are verified through testing. - The assessment of DeAE shall include possible escalations (to other risers, wells, and/or process equipment). - Main load bearing structure shall be intact to ensure escape to safe area and time for evacuation. Default time for evacuation is set to 60 minutes but should preferably be based on installation specific considerations. - Safe area/mustering area shall be intact and functional to allow time for evacuation. Default time for evacuation is set to 60 minutes but should preferably be based on installation specific evaluations.

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Passerende fartøy

Collision from passing vessels	Not a DeAE	- Presumes compliance to traffic surveillance, alert and evacuation procedure (NORSOK S-001, section 25) - Presumes installation location away from traffic separation scheme (TSS), at least half of the width of TSS. - Important to do a Vessel traffic survey of AIS data and assess degree of operational barriers in place.

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Kran bomfall

Crane boom fall	Not a DeAE	- Crane boom fall can be expected with a frequency of no more than 5×10^{-5} per platform year. - Crane boom fall should be considered as part of ALARP process. Guidance is given on protection energies and layout

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Refleksjoner

- Trekke ut læring fra 30 + år med kvantitative risikoanalyser for moden design.
- Mer:
  - Detaljering tilpasset beslutningstidspunkt
  - Effektive (kost/tid)
  - Konsistente
  - Relevante
- Mindre
  - Endring
  - Misbruk
  - “Hylleprodukter”
- Ivareta
  - Dagens sikkerhetsnivå
  - Kompetanse

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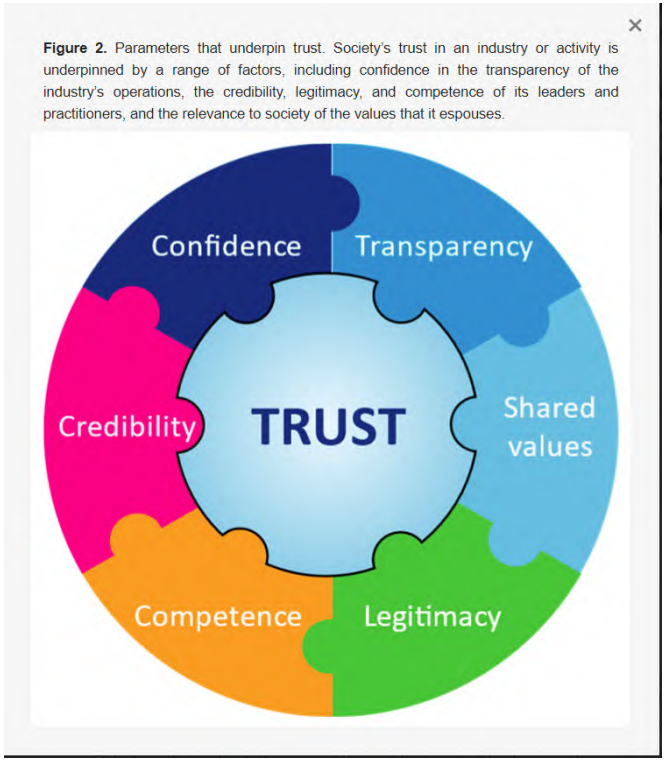
Refleksjoner

- Etablert effektive modeler for kjente konsepter
- Iboende konservatisme som kan være kostnadsdrivende
- Klare begrensninger på hvilke behov modellene svarer ut
- Nyttig med omforent forståelse av styrker og svakheter i analyser, verktøy og modeler
- Overgang til drift ikke tatt tak i
- QRA
  - Ingen bedre til å skille mellom DeAE og “rest hendelser”
  - Frambringer fenomen forståelse og viktige versus mindre viktige forhold
  - Forutsetter systematisk innsamling av erfaringsdata
  - Analysen blir ikke bedre enn bestillingen og kompetansen som puttes inn.



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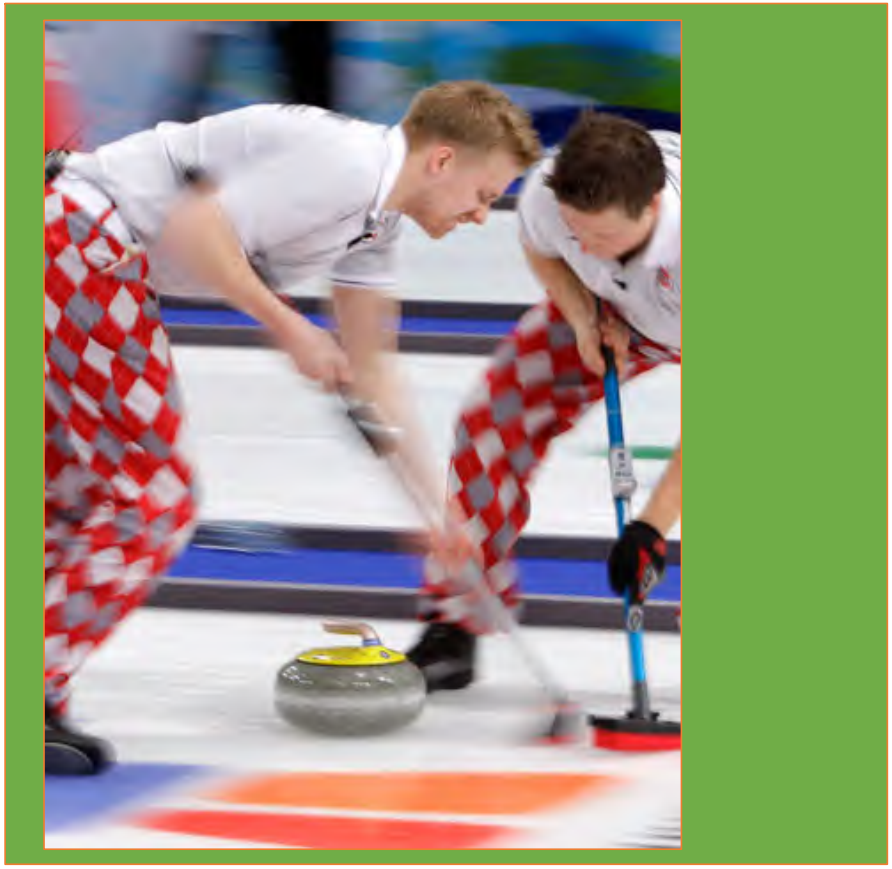
Styring av storulykkesrisiko – i prosjekt tidlig fase

- Klarlegge den tekniske basis for prosjekt gjennomføring
- Balansere og omsette funksjonelle krav
- Tydeliggjøre hva som er sikkert nok
  - Kan vi forsvare risikoen?
  - Hvorfor kan vi ikke ta risikoen?
- Absolutte krav versus ALARP



Addressing Complexity with Complication

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"Since all models are wrong the scientist cannot obtain a "correct" one by excessive elaboration. On the contrary following William of Occam he should seek an economical description of natural phenomena. Just as the ability to devise simple but evocative models is the signature of the great scientist so overelaboration and overparameterization is often the mark of mediocrity."

- George Box, statistician

Utility Vs Error

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"Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful"

- George Box, statistician

Styring av storulykkes risiko – design og operasjon

- TILLIT
- For hvem?
- “SLO” – Sosial Licence to operate
- Hvilken rolle spiller risikoanalysene?


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