Recommended Practice for Managing Environmental Aspects and Impacts of Seabed Mining

Jens Laugesen, DNV GL

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A Recommended Practice for Managing Environmental Aspects and Impacts of Seabed Mining

- DNV GL launches a recommended practice for seabed mining

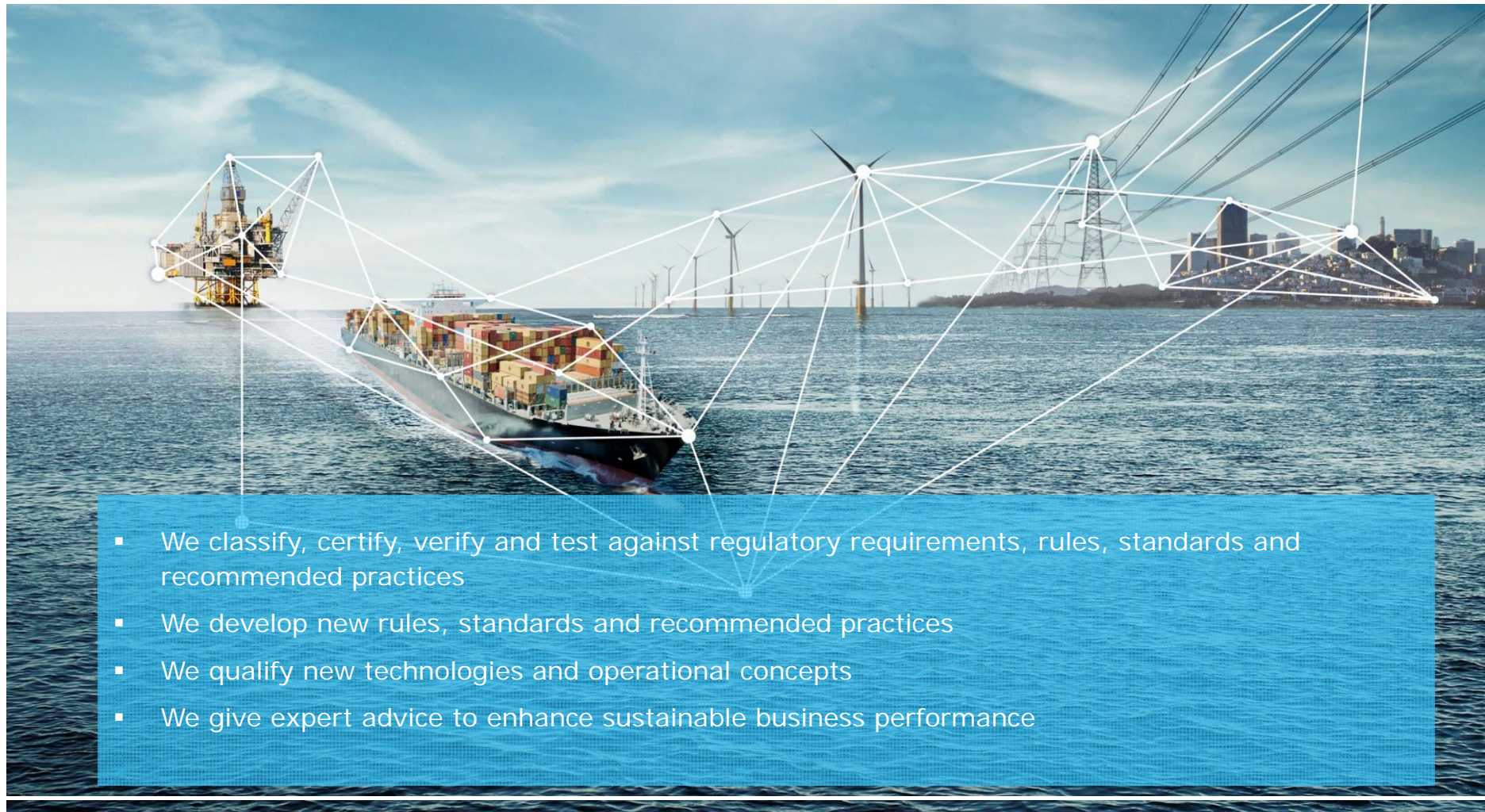https://www.dnvgl.com/oilgas/download/dnv-gl-rp-O601-managing-environmental-aspects-and-impacts-of-seabed-mining.html

Picture: Øyvind Fjukmoen, DNV GL

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OUR PURPOSE

TO SAFEGUARD LIFE, PROPERTY AND THE ENVIRONMENT

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DNV GL: 15 000 people in more than 100 countries

- We classify, certify, verify and test against regulatory requirements, rules, standards and recommended practices
- We develop new rules, standards and recommended practices
- We qualify new technologies and operational concepts
- We give expert advice to enhance sustainable business performance

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What is a Recommended Practice?

- DNV GL invests 5 % of the total annual revenues in research and innovation
- Development of Recommended Practices is one of these investments
- A Recommended Practice is a guideline on a specified topic that is of interest for DNV GLs clients
- A Recommended Practice contains sound engineering practice and guidance
- A Recommended Practice is an open document that can be downloaded from DNV GLs homepage.

Why a recommended practice on environmental aspects and impacts of seabed mining?

- DNV GL went first through existing guidelines and literature on environmental aspects and impacts of seabed mining

- Existing guidelines and literature contain a large amount of information on environmental aspects and impacts

- What DNV GL could add to this is to show how a risk-based approach can be used to protect the environment during seabed mining activities in the exploration and the exploitation phase as well as during decommissioning.

- Further the ambition is that the RP shall increase the overall awareness of environmental impacts and risks from seabed mining activities and demonstrate how to best manage these risks in accordance with the precautionary principle.

- This Recommended Practice aims at covering risk management issues which are particular for seabed mining and protecting the marine ecosystem.

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For whom is the recommended practice?

The recommended practice has been mainly developed for the following target groups but can also be used by others:
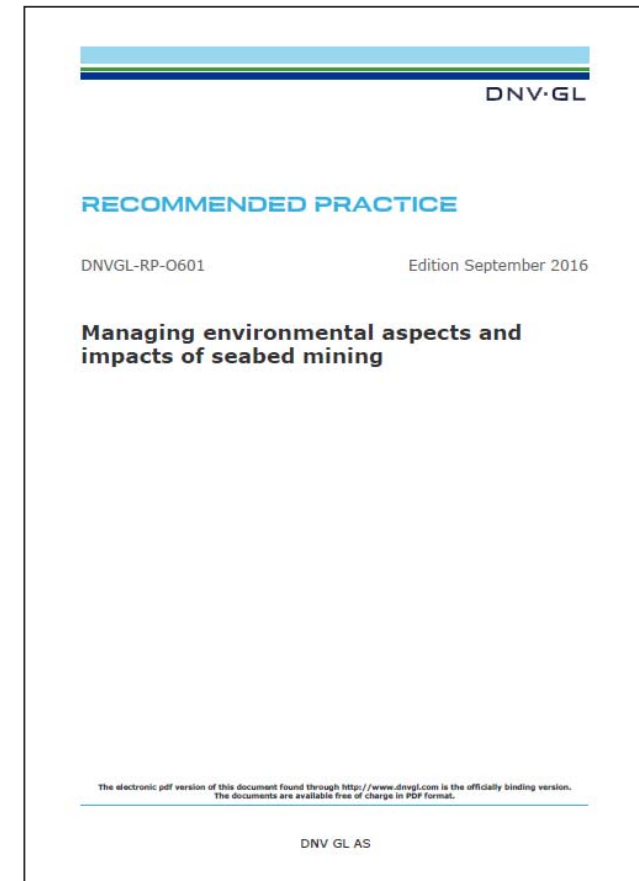
- Mining companies or general contractors

- Companies developing equipment for seabed mining

- Regulatory authorities (national and international like the International Seabed Authority (ISA) for seabed mining)

- Consulting companies

- Technical experts and third parties

- Insurance companies

- Investors/Lenders

- NGOs

Picture: Øyvind Fjukmoen, DNV GL

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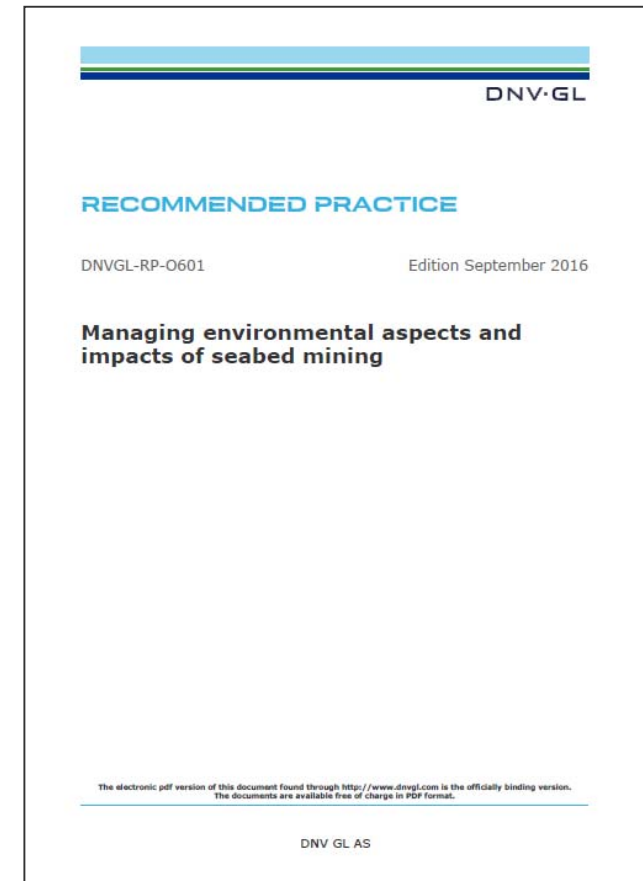# DNV GLs recommended practice follows several codes and standards

- The Recommended Practice(RP) follows the codes and standards set by the International Seabed Authority (ISA) but uses a practical approach that can be directly applied.

- Further inline with ISO 31000 Risk Management standard and ISO 14001 Environmental Management Systems standard.

- The RP is risk-based with recommendations for the processes to protect the environment during seabed mining activities (from planning to decommissioning).

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RECOMMENDED PRACTICE

DNVGL-RP-O601   Edition September 2016

Managing environmental aspects and impacts of seabed mining

The electronic pdf version of this document found through http://www.dnvgl.com is the officially binding version.
The documents are available free of charge in PDF format.

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DNV GLs recommended practice on seabed mining

Main structure of the RP:

I. Regulatory requirements

II. Environmental Impacts from Seabed Mining

III. Environmental Risk Management

- Environmental Baseline Study

- Environmental Impact Assessment

- Environmental Management Plan

- Decommissioning of a site

IV. Example

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I. Regulatory requirements

- United Nations Convention on The Law of the Sea

  o Part XI of the United Nations Convention on the Law of the Sea (ISA)

- United Nations Environment Programme (UNEP)

- International Union for Conservation of Nature (IUCN)

- The Convention on the Protection of the Marine Environment of the Baltic Sea Area, (Helsinki Convention)

- The London Convention

- Convention for the Protection of the Marine Environment of the North-east Atlantic (OSPAR Convention)

- International Convention for the Prevention of Pollution from Ships (MARPOL)

- Others: Code for Environmental Management of Marine Mining (The International Marine Minerals Society, IMMS)

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II. Environmental Impacts from Seabed Mining

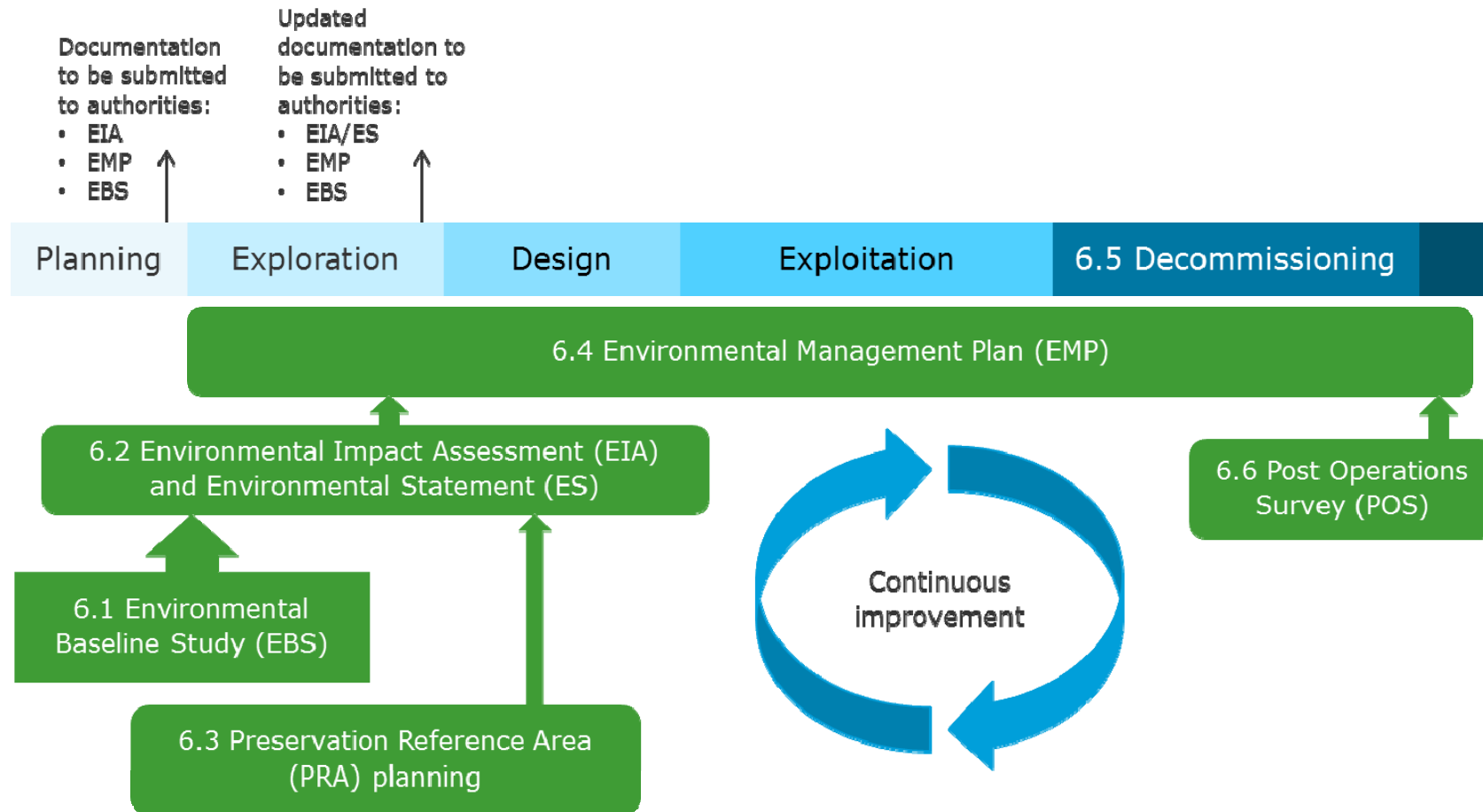- THE MOST SIGNIFICANT ENVIRONMENTAL IMPACTS
  - Direct destruction of seabed habitat
  - Sediment disturbance and plume discharges
  - Emissions to air
  - Discharges to water
  - Thermal pollution
  - Light pollution
  - Noise and vibrations
  - Invasive species
- IDENTIFICATION OF ENVIRONMENTAL ASPECTS, HAZARDS AND IMPACTS
  - Description of the Environmental Aspect and Hazard Identification (ENVID) method

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III. Environmental Risk Management

Documentation to be submitted to authorities:
- EIA
- EMP
- EBS

Updated documentation to be submitted to authorities:
- EIA/ES
- EMP
- EBS

| Planning | Exploration | Design | Exploitation | 6.5 Decommissioning | |

6.4 Environmental Management Plan (EMP)

6.2 Environmental Impact Assessment (EIA) and Environmental Statement (ES)

6.1 Environmental Baseline Study (EBS)

6.3 Preservation Reference Area (PRA) planning

Continuous improvement

6.6 Post Operations Survey (POS)

Timeline for a typical seabed mining project and the environmental risk management tasks and activities that shall be performed

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III. Environmental Risk Management - Decommissioning

- Decommissioning is required when production in a mining field and the use of the facilities are to cease permanently.

- Decommissioning means that all installations left on the seabed have to be removed.
  - This includes equipment, waste, spills, stockpiles of material, etc.
  - Any exceptions from removal of the installations must be assessed and good reasons given for this option.

- The Contractor shall submit a decommissioning plan.
  - The Contractor, preferably assisted by personnel with expert knowledge of the area and project, should identify waste types, hazardous substances and other environmental problems that may arise during the decommissioning phase.

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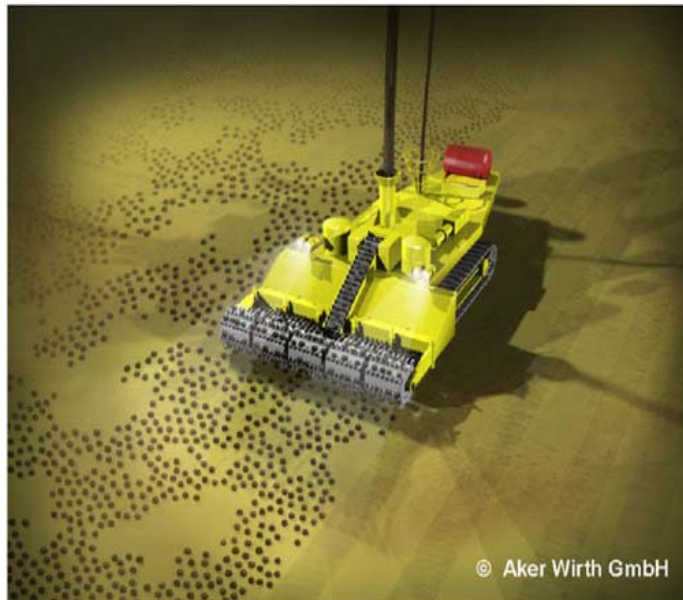# III. Environmental Risk Management - Decommissioning

- Depending on the impact of the mining operation, the decommissioning should also include monitoring of the environmental status in the former mining area.

- In the decommissioning plan, the Contractor also has to state how the removed installations will be brought to land and how they will be handled at an approved waste facility.

- Before the Contractor can be released from its responsibility for the site, an inspection has to be done by the owner of the area or an independent authority representing the owner.

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III. Environmental Risk Management – Decommissioning - Bankruptcy

- Based on experiences from the oil & gas sector, there should be a way to secure funding for the decommissioning (and protect against bankruptcy).

- This can be achieved by obliging the Contractor to deposit the estimated cost of the decommissioning before the mining operation can start.

- The deposit will be repaid to the Contractor after the site inspection, provided the decommissioning has been done in accordance with the contract.

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IV. Example

- To illustrate the risk-based approach an example is included in the RP.

- It is a hypothetical seabed mining case for polymetallic nodules located somewhere in the Clarion-Clipperton zone at 5 000 m water depth.

- The Contractor has defined its environmental objectives and is in the early design phase (initial design).

- The Contractor considers using a production system with 3 major components:
  - A nodule collector
  - A riser system
  - A support vessel

Example of a model for a nodules collector developed by Aker Wirth GmbH
Source: Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)

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IV. Example – hazard identification

- In a first step possible hazards are identified:

ID	Hazards	Description/assessment
1	**Increase in water temperature**	Increase in water temperature from equipment will be negligible. Return water will be released at 0.3 m³/s. Local effects are expected in the form of slightly increased temperature. Effects on the environment are unlikely.
2	**Spreading and deposition of sediments from mining activities at the seafloor**	Modelling has shown that the collector is reasonably probable to spread sediments up to 1 km outside the mining area. The flux dynamics are likely to change in directly mined areas, with alteration of the sediment composition.
3	**Discharge of return water from dewatering process**	The return water can contain suspended solids (fines) with concentrations up to 1000 mg/l. These fines are reasonably probable to spread to outside the mining area (no modeling has been done for these particles).

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IV. Example – hazards are placed in the risk matrix

- Based on the risk assessment the hazards may be placed in a risk matrix
- The three risk categories are:
  - Critical risks (red) shall be reduced by means of risk-reducing actions (reduce the probability and/or consequence(reduce the probability and/or consequence).
  - Significant risks (yellow) shall be monitored and one should consider risk-reducing actions.
  - Insignificant risks (green) do not need to be reduced.

Y-axis: Probability

X-axis: Consequence

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IV. Example – risk treatment measures

I D	Hazards	Risk treatment measures
1	**Increase in water temperature**	No measure.
2	**Spreading and deposition of sediments from mining activities at the seafloor**	This hazard can be reduced by protecting the nodules collector with a cover to reduce the spreading of sediments. Further increased monitoring close to the nodules collector with turbidity measurements to be able to stop mining activities in case of large spreading of particles.
3	**Discharge of return water from dewatering process**	This hazard can be reduced by filtering the return water from particles on the vessel before it is discharged to the sea. This would reduce the consequence because less particles will be released with the return water.

Critical risk

Significant risk

Insignificant risk

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The hearing process

- Internal hearing: Input from experts within DNV GL

- External hearing: 25 international experts

- Main comments concerning improvements:
    - The RP is too superficial, should go more into detail
    - Mitigation measures are not included (only examples)
    - Keep it more factual and make it measurable
    - Information missing on heavy metals and trace elements that may be released during test mining and their concentrations

- Response to comments: DNV GL would like to address comments in a future updated version

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What happens now?

- We hope the RP will be used frequently

- We are very happy for any input and viewpoints you have to the RP.

- We are aware of that the RP cannot be a static document
  - We need to regularly update the document as we get more knowledge
  - There will also be coming more guidelines (ISA etc.) that the RP has to be adapted to

- In the future we hope that the RP also can give more details about recommended number of samples, analyses etc.

Picture: DNV GL

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Other projects - MarMine

DNV GL sponsors and participates in the MarMine project that is lead by NTNU (Norwegian University of Science and Technology).

The objectives of the project are to:

- Assess and develop new knowledge about exploration and exploitation technologies

- Obtain geological samples for mineral characterization, and for assessment of mining and mineral processing potential

A field trip was done to the Arctic Mid-Ocean Ridge in August-September where several hundreds of kilos of rock samples were collected from almost 3 000 m water depth.
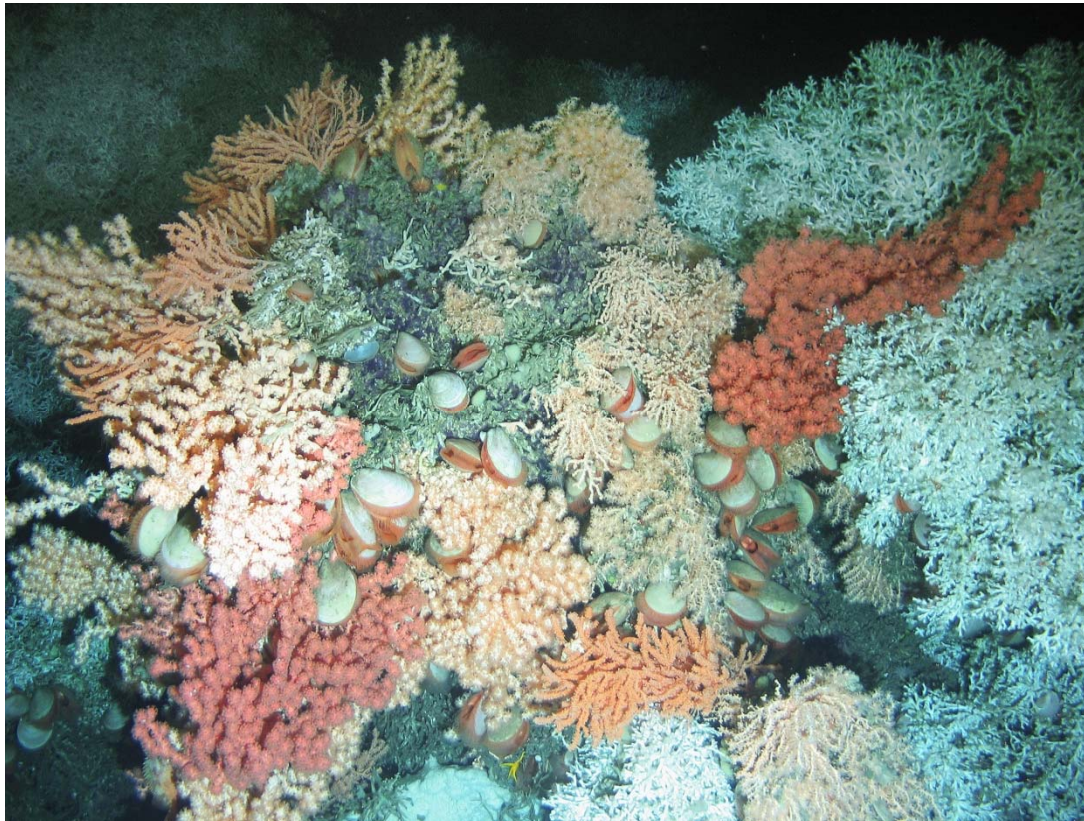

Picture: MarMine

Picture: NTNU MarMine / Lars Ivar Tumyr

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Thanks

- A great thanks to the other authors of the RP: Sophie Davidsson, Karsten Hagenah, Erik Hektor, Daniel Millet and to our project sponsor Tor Jensen.

Picture: Øyvind Fjukmoen, DNV GL

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