



ONSHORE DRILLING IN GREENLAND BACKGROUND INFORMATION FOR PREPARATION OF GUIDELINES TO ENVIRONMENTAL IMPACTS ASSESSMENT

Technical Report from DCE – Danish Centre for Environment and Energy

No. 402

2026



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GRØNLANDS NATURINSTITUT GREENLAND INSTITUTE OF NATURAL RESOURCES

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Susse Wegeberg¹
David Boertmann¹
Kim Gustavson¹
Janne Fritt-Rasmussen¹
Josephine Nymand²
Anders Mosbech¹

¹Aarhus University, Department of Ecoscience

²GINR – Greenland Institute of Natural Resources



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Authors:	Susse Wegeberg ^{1*} , David Boertmann ¹ , Kim Gustavson ¹ , Janne Fritt-Rasmussen ¹ , Josephine Nyman ² , Anders Mosbech ¹
Institutions:	¹ Aarhus University, Department of Ecoscience ² GINR – Greenland Institute of Natural Resources [*] No longer employed at AU at the time of publication
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Abstract:	This background memo provides information for defining the process towards development of an Environmental Impact Assessment (EIA) for onshore petroleum exploration drilling activities in Greenland. The Memo contains the DCE and GINR advice to EAMRA on the preparation of guidelines for the industry on EIA development.
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background information for EAMRA and did not have a separate scientific reviewer. However, some of the co-authors served as actual scientific reviewers only.

Subsequently, in 2020 DCE/GINR revised the report at EAMRA's request only to update dead and outdated links and to amend a single sentence that had become outdated over time.

In accordance with the applicable procedures in start 2017 for this type of background report delivered to EAMRA the report was not published. However, with EAMRA's approval in 2026, the 2020 updated version is now being published.

For publication, the following changes have been made:

- The report has been transferred to the current DCE – Danish Centre for Environment and Energy Technical Report template, including a datasheet with links to EAMRA's comments on both the original 2017 report and the updated 2020 version.
- Dead and outdated links have been updated or deleted if no longer publicly available.
- Minor typographical changes have been made.
- In chapter 1, "Introduction", separate guidelines for preparing an EIA-report for onshore seismic surveys were described as "will be developed". They were developed and published later in 2020 and the text and links in the report are updated accordingly.

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Preface

This background memo provides information for defining the process towards development of an Environmental Impact Assessment (EIA) for on-shore petroleum exploration drilling activities in Greenland. The Memo contains the DCE and GINR advice to EAMRA on the preparation of guidelines for the industry on EIA development. The EIA is prepared by the industry and is part of the application and approval process of the drilling activities.

The memo information is primarily based on:

- Existing guidelines for development of EIAs for offshore petroleum exploration drilling activities in Greenland
- Existing guidelines for development of EIAs for mining activities in Greenland ([Link](#)).
- Meetings with authorities in Alaska (state and federal) regulating petroleum exploration and production activities in Alaska in November 2016.

Summary

This background memo provides information for defining the process towards development of an Environmental Impact Assessment (EIA) for on-shore petroleum exploration drilling activities in Greenland. The Memo contains the DCE and GINR advice to EAMRA on the preparation of guidelines for the industry on EIA development.

The EIA report is prepared by the industry and is part of the application and approval process of the drilling activities. The EIA does not cover the socio-economic aspects, which is covered by a separate Social Impact Assessment (SIA). The EIA report should, however, describe direct environmental effects on human use, e.g., hunting, fishing, drinking water.

The EIA process includes six (6) reports, in chronological order, for:

1. Scoping Report

The application process for an onshore drilling operation shall be initiated by submission of a scoping report of the activity, including a) locality(ies) of the activity, b) description and extent of the activity, c) list of chemicals considered for use in the activity, d) potential direct and derived (e.g. from shipping) environmental impacts/consequences as well as e) potential environmental consequences for inhabitants in the area (e.g. on hunting and fishing)

2. Terms of Reference

Based on the scoping process, the Terms of Reference (ToR) report is developed. In the ToR the content of the EIA report is defined and will include outline for the studies and reports below: Environmental Studies Programme including Environmental Baseline Studies and Monitoring, and Local Use and Local Knowledge report.

3. Environmental Studies Programme

An Environmental Studies Programme (ESP) report shall be prepared in collaboration with the Greenland authorities, and their advisors, and approved before development of the EIA report. The ESP shall describe how the environmental part of the site surveys shall be carried out in order to collect the information necessary for i) regulation of activities; ii) describe the environmental baseline (environmental baseline studies, EBS); and iii) planning the monitoring programme.

4. Environmental Baseline Studies and Monitoring

The Environmental Baseline Studies and Monitoring (EBS) report shall be submitted for approval by the authorities as a separate report, EBS report, before the information is included in the EIA. Baseline data may need to reflect the variation over several years

5. Local Use and Local Knowledge Studies

Local knowledge shall be included in the preparation of the EIA report and include mitigation of conflicts between the drilling activities and the local use of the area for hunting, fishing, recreation and tourism.

6. Environmental Impact Assessment Report

The Environmental Impact Assessment (EIA) report shall include information from the Environmental Studies Programme (ESP), Environmental Baseline Studies (EBS) and Local Use and Local Knowledge Studies (LUS) reports as well as supplied with list/plans, as appendices, for:

- Off-Road Travel Management Plan
- Chemicals
- Disposal Plan
- Environmental Monitoring
- Environmental Management
- Waste Handling
- Decommissioning

Furthermore, the application material, besides the EIA, shall be supported with:

- Application for chemicals, use and potential discharge/disposal, as well as a justification of choice of drilling mud system
- Oil Spill Contingency Plan.

Sammenfatning

Dette notat er baggrundsinformation til en vejledning om udvikling og indhold af en miljøvurdering (Vurdering af Virkning på Miljøet, VVM, på engelsk: *Environmental Impact Assessment, EIA*) af aktiviteter vedrørende olieeffterforskningsboringer på land i Grønland.

En VVM-rapport udarbejdes af det selskab, der planlægger aktiviteten, og den er en del af ansøgnings- og tilladelsesprocessen for olieeffterforskningsboringer. En VVM dækker ikke de socioøkonomiske aspekter af aktiviteterne, som vurderes separat (i en *Social Impact Assessment, SIA*). En VVM-rapport bør dog beskrive de direkte miljømæssige effekter på de ressourcer, som er vigtige for befolkningen i forhold til fangst, fiskeri, drikkevand m.m.

En VVM-proces omfatter udarbejdelse af seks rapporter, i kronologisk rækkefølge:

1. Scoping

Ansøgningsprocessen for en boreoperation på land indledes med indsendelse af en *scoping report* om aktiviteten. Den bør indeholde a) beskrivelse af hvor aktiviteten(erne) foregår og det område som forventes påvirket af aktiviteten(erne), b) beskrivelse og omfang af aktiviteten(erne), c) fortegnelse over kemikalier, der forventes anvendt i forbindelse med aktiviteten(erne), d) potentielle direkte og indirekte (fx fra skibstrafik) miljømæssige indvirkninger/konsekvenser samt e) potentielle miljømæssige konsekvenser for befolkningen i området (fx på fangst og fiskeri). *Scoping*-rapporten skal i offentlig høring.

2. Terms of Reference

På baggrund af *scoping* rapporten og de kommentarer den offentlige høring giver anledning til, udarbejdes en rapport for *Terms of Reference (ToR)*. Denne definerer indholdet af VVM-rapporten, herunder hvilke miljøundersøgelser, der er behov for. Disse undersøgelser beskrives nærmere i nedenstående tre rapporter (3,4 og 5).

3. Environmental Studies Programme

Programmet for miljøundersøgelser beskrives i rapporten for *Environmental Studies Programme (ESP)*. Det udarbejdes i samarbejde med de grønlandske myndigheder og deres rådgivere, og skal godkendes før VVM-rapporten udarbejdes. *ESP*-rapporten skal beskrive hvilke miljøundersøgelser, der skal udføres og hvordan de vil blive gennemført, således at den nødvendige information indhentes til i) regulering af aktiviteterne; ii) beskrivelse af miljøets baggrundstilstand (*environmental baseline studies, EBS*); samt iii) planlægning af miljøovervågningsprogrammet (*monitoring programme*). Denne information tilvejebringes ved:

4. Environmental Baseline Studies and Monitoring

som selskabet skal udføre, og som skal beskrives i en separat rapport; *Environmental Baseline Studies and Monitoring (ESB)*. Denne skal godkendes af de grønlandske myndigheder og den skal indgå i VVM-rapporten.

5. Local Use and Local Knowledge Studies

Lokal viden om fangst, fiskeri, turisme, rekreative aktiviteter m.v. i det påvirkede område skal indhentes (*Local Use and Local Knowledge Studies, LUS*) og inkluderes i VVM-rapporten, og tiltag til at afværge evt. konflikter mellem boreaktiviteterne og de lokales brug skal beskrives.

6. Environmental Impact Assessment

Selve VVM-rapporten om aktiviteterne skal omfatte information fra *Environmental Studies Programme (ESP)*, *Environmental Baseline Studies and Monitoring (EBS)* og *Local Use and Local Knowledge Studies (LUS)* rapporterne samt suppleres med lister/planer (som appendikser):

- Planer for kørsel i terræn
- Fortegnelse over alle kemikalier
- Affaldsplan inkl. plan for deponering af affaldsstoffer
- Miljøovervågningsplan
- *Environmental Management Plan*
- Plan for dekommissioning

I ansøgningsmaterialet skal der, udover VVM-rapporten, også indgå:

- Ansøgning om brug og evt. udledning/deponering af kemikalier, herunder en begrundelse for valg af boremuddersystem
- Beredskabsplan for oliespild.

Eqikkaaneq

Allaaserisami uaniipput paasissutissat Kalaallit Nunaanni nunami uuliaqarneranik misissueqqissaarluni qillerinerit avatangiisinut sunniutissaannik naliliinermi ilitsersuutit suliarineqarnissaannut imassaanullu tunngasutillit.

Avatangiisinut sunniutissanik naliliineq pillugu nalunaarusiaq ingerlatseqatigiiffimmit sulianik ingerlatsisussamit suliarineqartarpoq, aammalu uuliaqarneranik misissueqqissaarumalluni qinnuteqaateqarnermut akuersisutillu suliarineqarneranut ilaavissussatut suliarineqartarluni. Avatangiisinut sunniutissanik naliliineq inuiaqatigiit inuuniarnikkut atugaannut sunniutissanik naliliinermik imaqqarneq ajorpoq taakkumi immikkoortillugit naliliivigineqartarmata (Inuiaqatigiinnut sunniutissanik naliliineq immikkoortillugu suliarineqartarmat). Kisiannili avatangiisinut sunniutissanik naliliinermut atatillugu piniarneq, aalisarneq imeqqarneq allallu eqqarsaatigalugit inuiaqatigiit pisariaqartitaannut pingaarutilinnut avatangiisitigut toqqaannartumik suut sunniuteqartussat nassuiarneqartussaapput.

Avatangiisinut sunniutissanik nalilersuineq nalunaarusianik arfinilinnik imaqqarpoq ima tulleriinnilersorneqartunik:

1. Suut misissuiffigineqarnissaannik aalajangiineq

Nunami qillerinissamik qinnuteqaatit suliami tassani suut *misissuiffigineqarnissaannik nalunaarusiamik* aallarnerneqartarput. Taassuma imarisariaqqarpai a) suliat sumi ingerlanneqassanersut aammalu piffik sulianit sunnerneqartussatut naatsorsuutigineqartoq, b) suliat suussusiinik qanorlu annertutigissusiinik nassuiaat, c) akuutissat suliamut atatillugu atorneqartussat nalunaarsorneqarfiat, d) avatangiisit toqqaannartumik toqqaannangitsumillu (soorlu umiarsuit angallannerisigut) suliamit sunnerneqartussat kiisalu e) tamatuma inuisa avatangiisitigut sunnerneqaatigisinnaasai (soorlu piniarneq aalisarnerlu eqqarsaatigalugit). *Suut misissuiffigineqarnissaannik nalunaarusiaq* tamanut tusarniaassutigineqassaaq.

2. Avatangiisinut sunniutissanik misissuinermit najoqqutassat

Suut misissuiffigineqarnissaannik nalunaarusiaq kiisalu tamanut tusarniaanermi oqaaseqaatigineqartut tunngavigalugit *naliliinermi najoqqutassat pillugit nalunaarusiaq* suliarineqassaaq. Tassani avatangiisinut sunniutissanik nalunaarusiap suut imarissanerai aalajangerneqassaaq, soorlu avatangiisitigut misissuinerit suut pisariaqartinneqarnerisut aalajangerneqassalluni. Misissuinerit taakku nalunaarusiani tulluuttuni pingasuni (3, 4 aamma 5-imi) erseqqinnerusumik nassuiarneqassapput.

3. Avatangiisinik misissuinerit

Avatangiisit misissuiffigineqarnissaat immikkut aamma nalunaarusiorneqassapput. Nalunaarusiaq taanna Kalaallit Nunaanni oqartussat siunner-sortaallu suleqatigalugit suliarineqassaaq, aammalu avatangiisinut sunniutissanik naliliilluni nalunaarusiaq suliarineqalersinnagu akuerineqaaqassalluni. Avatangiisinik misissuinerit pillugit nalunaarusiami nassuiarneqassapput avatangiisitigut misissuinerit suut ingerlanneqassanersut qanorlu ingerlanneqassanersut, taamaaliornikkut paasissutissat tulluullugit taagukkani

pisariaqartinneqartut pissarsiarineqassapput i) suliat pillugit malittarisassat; avatangiisit sunnerneqanngikkallaramik qanoq issusiinik allaaserisat, kiisalu iii) avatangiisit malinnaavigineqarnissaat pillugit pilersaarusiorneq. Paasisutissat taakku ima pissarsiarineqassapput:

4. Avatangiisit sunnigaatinnatik qanoq issusiinik misissuinerit avatangiisillu malinnaavigineqarnerat

taakku ingerlatseqatigiiffimmit suliarineqassapput immikkullu nalunaarusi-uunneqassallutik; tassa *Avatangiisit sunnerneqannginnerminni qanoq issusiinik misissuinerit avatangiisillu malinnaavigineqarnerat*. Nalunaarusiaq taanna Ka-laallit Nunaanni oqartussat akuerineqassaaq avatangiisinullu sunniutissanik nalunaarusiamut ilaassalluni.

5. Najukkami atuineq aamma najukkami ilisimasanik misissuinerit

Piffimmi sunnerneqartussami piniarneq, aalisarneq, takornariartitsineq, sunngiffimmi sammisat allallu pillugit nunaqavissut ilisimasaat pissarsiarineqassapput aammalu avatangiisinut sunniutissanik nalunaarusiammut ilanngunneqassallutik, aamma qillerinerit nunaqavissullu nunamik atuine-risa akornanni aqqiagiinngissutaasinnaasut nassuiarneqassapput.

6. Avatangiisinut sunniutaasinnaasunik naliliineq

Qillerinerit suliallu tassunga atasut avatangiisinut sunniutigisinnaasaannik naliliinermut nalunaarusiaq makkunanga paasisutissanik imaqaassaaq: avatangiisinik misissuinerit, avatangiisit sunnerneqannginnerminni qanoq issusiinik misissuinerit aammalu najukkami atuineq kiisalu nunavissut ilisimasaat pillugit misissuinerit nalunaarusiorneqarneri kiisalu nalunaarsuiffinik / pilersaarusanik ilanngussartaqassallutik makkununga tunngasunik:

- Nunakkut qamutit motorillit atorlugit ingerlaartarnissamut pilersaarutit
- Akuutissat tamarmik nalunaarsorsimaffiat
- Eqqagassalerinermut pilersaarut, aamma eqqagassat qanoq eqqarneqartarnissaanut pilersaarut
- Avatangiisit malinnaavigineqarnissaannut pilersaarut
- *Avatangiisinik aqutsinermut pilersaarut*
- Suliat unitsinneqarnissaannut pilersaarusiaq

Avatangiisinut sunniutissanik naliliinermut nalunaarusiap saniatigut qinnuteqaammut aamma ilanngunneqassapput:

- Akuutissanik atuineq pillugu aammalu akuutissanik maangaannaq maqitsisoqassappat maqitsinissamik qinnuteqaatit, aamma qillerinermi marraap perrassaatitallip aalajangersimasup atorineqarnissaanut tunngavilersuutit
- Uuliamik maqisoornissamut upalungaarsimalluni pilersaarut.

List of abbreviations and acronyms

BAT = Best Available Technology

BEP = Best Environmental Practice

DCE = Danish Centre of Environment and Energy, Aarhus University

EAMRA = Environment Agency for the Mineral Resources Activities, Greenland

EBS = Environmental Baseline Studies

EIA = Environmental Impact Assessment

ESP = Environmental Studies Plan

GINR = Greenland Institute of Natural Resources

IMO = International Maritime Organization ([Link](#))

ISO = International Organization for Standardization

MARPOL = International Convention for the Prevention of Pollution from Ships ([Link](#))

MRA = Mineral Resource Authority

NORSOK = Norwegian standards for petroleum industry

SEIA = Strategic Environmental Impact Assessment

1 Introduction

The Mineral Resources Act (of 7th December 2009 with later amendments) Chapters 15 and 18 states that an activity with risk of significant environmental impacts cannot be approved before an EIA-report has been submitted and approved by the government. As onshore petroleum exploration drilling always will require preparation of an EIA-report, the application for onshore petroleum exploration drilling activities in Greenland shall include an EIA report supported by other environmental relevant application documents (drilling mud system application, oil spill contingency plan).

From the EIA report and other environmental relevant application material, the authorities and their advisors can process the potential approval for the activities, including potential stipulations for timing of activities as well as for mitigation.

EIA development process and procedure is described in Table 1.

Separate guidelines for application and selection of drilling mud systems, including requirements regarding ecotoxicological screening of chemicals, categorization and registration as well as Greenland Government's stipulations regarding use and discharge/disposal/treatment of chemicals will be developed.

Separate guidelines for preparing an EIA-report for onshore seismic surveys are developed ([Link](#)).

2 The EIA process

2.1 Scoping

The EIA process is always initiated with submitting a Scope report, which has to be approved by the Greenland Government, and which is subject to a public consultation process of 35 days. Therefore, the Scope report shall also be considered as an information document aimed at the public and especially the people living close to where the activities are planned to take place. The Scope shall inform on activities and their potential derived impacts, which are planned to be carried out in their neighbourhood.

In this report, the extent of the project, including techniques to be used and expected environmental impacts of concern to the public, shall be described.

Hence, the Scope report shall include

1. Location of the activity
2. Description and extent of the activity, including, e.g. number of employees
3. List of chemicals considered for use in the activity
4. Potential direct and derived (e.g. from shipping) environmental impacts /consequences
5. Potential consequences for human use of the activity area (e.g., on hunting and fishing).

2.2 Terms of Reference - ToR

Development of a ToR shall comply with the published Scope report and address the potential concerns raised through the public consultation process for the EIA development.

The ToR shall include an annotated table of contents for the EIA report, special topics/issues of concern and a list and a short description of studies which will be implemented as the basis for EIA. The ToR shall outline expected environmental impacts and the studies to be performed to support evaluation and mitigation of the potential impacts from the activities as well as the environmental baseline studies programme, which documents the environmental baseline before the activities starts.

Table 1. Development process and procedure for an Environmental Impact Assessment (EIA) for onshore petroleum exploration drilling activities in Greenland.

1.	Scoping report	In this report, the scope of the project, including techniques to be used and expected environmental impacts of concern to the public, shall be described. The report is evaluated and accepted for public consultation by EAMRA.
2.	Public consultation of Scoping report	This includes the public reactions on the project and needs for changes and/or mitigation of the project plans may be identified
3.	Terms of Reference (ToR) report	In ToR the frame for the EIA process is determined; the content of the EIA report including needed studies and monitoring. The ToR is evaluated and approved by EAMRA
4.	Environmental Studies Programme (ESP) report	Starting from ToR, the ESP is determined and includes plans for environmental baseline studies. ESP is evaluated and approved by EAMRA
5.	Environmental Baseline Studies (EBS) report	When the EBSs are finalized, the data are compiled, analysed and discussed in a report. The EBS report is evaluated and approved by EAMRA
6.	Local use and knowledge (LUS) report	This report includes local use and knowledge, and may be interview based and prepared in connection with development of the Social Impact Assessment of the project
7.	Development of draft EIA report	Based on ToR, ESP, EBS and LUS, the draft EIA report is developed. The EIA draft report is evaluated and approved to include sufficient information for the public consultation by EAMRA
8.	Public consultation of draft EIA report	Public consultation of draft EIA report for 8 weeks
9.	White paper	After the public consultation has ended the company prepares a white paper including all the comments from the public consultation and the company's response to these. The white paper will subsequently be evaluated by EAMRA and its scientific advisors, and the EIA is amended accordingly
10.	Amendment of draft EIA	The amended <i>draft EIA</i> will subsequently be evaluated by EAMRA and its scientific advisors, and the final EIA is prepared
11.	Final EIA and white paper	The final EIA and white paper will be handed to the Greenland Government for approval
12.	Approval document	Approval including environmental stipulations and requirements.

2.3 Environmental Studies Programme – ESP

The next step in the EIA-process will hence be the development of the Environmental Studies Programme (ESP). This programme shall describe the environmental studies needed for sufficient data to regulate the activities as well as baseline studies and environmental monitoring programmes.

The ESP shall include studies which may be considered needed to obtain sufficient knowledge for environmental assessment and mitigation. Examples of such studies is fate and effects of oil compounds and other chemicals, which may be included in the activities, in water and soil, and/or mapping of the ecological importance of the area expected to be impacted by the activities, etc.

The ESP shall describe how environmental data will be procured and prepared, and hence assure that baseline data are available for assessing the impact of routine activities as well as of accidents.

Baseline data may need to reflect the variation over several years.

Development of the monitoring programme shall be included in the ESP. Planning the monitoring programme will also ensure that the baseline studies are designed to support the post-activity evaluation of potential environmental impact including monitoring of injection well(s).

The ESP shall also include modelling of potential contamination where relevant, e.g. from dust and run-off. The results of the modelling shall provide basis for design and extent of the monitoring programme.

The ESP is developed in collaboration with DCE/GINR and shall be approved by EAMRA before any activities are initiated.

2.4 Environmental Baseline Studies – EBS

The baseline studies data and results shall be approved by the authorities by submission of the EBS report. This procedure step will assure that the data from the environmental survey(s) are approved as constituting sufficient baseline for assessing potential environmental impacts of the activities. The results of the baseline studies shall be included in the EIA, e.g., as part of the environment description.

Environmental baseline studies shall as a minimum include:

- Baseline chemistry and pollution levels (hydrocarbons, heavy metals etc.) in organisms and sediments/waters in the areas of impact. This may include soil and terrestrial biota, freshwater and coastal sediment/waters/biota. Collection of these baseline data may need to cover several (2-3) years of natural variation
- Mapping and identification of ecosystems/communities/key organisms in the area likely to be affected by the activities.

2.5 Local Use and Local Knowledge Studies – LUS

It is important to include local knowledge in the preparation of the EIA report. Special attention shall be aimed at mitigating conflicts between the drilling activities and the local use of the area for hunting, fishing, recreation and tourism. Inclusion of local knowledge can be through interviews with and questionnaires distributed to representative groups such as local hunters and fishermen, tourist operators and local industries. Those interviewed shall be given an opportunity to review and comment on the presentation of their input to the study.

2.6 Environmental Impact Assessment – EIA

On the basis of the proceeding approved reports (ToR, ESP, EBS and LUS), a draft EIA shall be developed and submitted. The report will be subject to public consultation for eight weeks. After the end of the public consultation period, the company shall prepare a white paper which includes and addresses all the comments from public consultation meetings and the written comments. This may lead to changes and/or amendments to the draft EIA.

The white paper and the (amended) draft EIA will subsequently be evaluated by EAMRA and their scientific advisors, and subsequently the final EIA will be handed to the Greenland Government for the purpose of approval.

The EIA-report shall cover the entire region that might be affected by the activities, including activities at sea, if relevant.

The EIA-report shall be accompanied by several separate documents, see below.

The EIA-report and its appendices shall be prepared in Greenlandic, Danish and English.

Potential impacts to be addressed and mitigated, see Chapter 5.

3 Basis for the EIA

Onshore and derived coastal activities in Greenland shall be carried out in accordance with best international practice and in a safe and environmentally acceptable manner, which includes, but is not limited to:

- Best Available Technology (BAT), Best Environmental Practice (BEP) and Best Practicable Control Technology (BPT) shall be applied and used in order to mitigate and minimize environmental impacts. For definition of these terms, please refer to OSPARs webpage ([Link](#))
- and below¹)
- All international rules, guidelines and conventions regarding shipping are met: e.g. MARPOL Convention (Annexes IV and V), IMO (Ballast Water), OSPAR Convention, NORSOK, ISO 14001 etc.
- All national rules and guidelines in Greenland are met, including the regulation behind “Important areas for wildlife” ([Link](#)).
- Vessels engaged and machinery used during the exploration activities shall only use diesel and gasoil and with a sulphur content less than 0.5 % (weight) (MARPOL Annex VI).
- Chemicals listed shall follow OSPARs Harmonised Offshore Chemical Notification Format (HOCNF) (OSPAR Agreement: 2012/05 (update 2015). Criteria for discharges/emissions and environmental quality defined in Chapter 6 shall be met.
- All non-degradable materials and structures deployed on land or coast shall be removed upon termination of the operation, unless EAMRA approves otherwise.
- EAMRA and its scientific advisors will during the consultation phase point out if relevant information is missing, if specific issues need elaboration and if environmental standards/thresholds are not met.

¹ As defined in Appendix 2 of the OSPAR Convention BAT “means the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste”. BEP is defined as “the application of the most appropriate combination of environmental control measures and strategies”.

It follows that BAT and BEP for a particular source will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding.

4 Requirements of an EIA for onshore petroleum exploration drilling

- The EIA shall identify, predict, describe, assess and communicate potential environmental impacts of a proposed drilling activity.
- The EIA shall cover the entire area that may be affected by the activity, inclusive areas (terrestrial, freshwater, marine) that may be affected by oil spill by oozing oil. If the project includes activities in areas outside the licence area, for instance along transportation, shipping and helicopter routes, impacts of these shall be covered as well.
- The EIA shall present measures to address and mitigate the identified impacts.
- The EIA shall include all aspects in relation to nature, environment and public health regarding for instance disturbance of wildlife and release of hazardous substances.
- After approval by the Government of Greenland, an EIA is final. However, minor changes in the activities may be approved administratively, but substantial changes will require a new EIA.

5 Contents of an EIA for onshore oil exploration drilling

This section gives an overview of the contents of an EIA-report for the drilling of a petroleum exploration well. The report shall be concise and succinct and restricted to issues relevant for the activities and the area in which these take place. Note that a number of plans (Chapter 5;7 below), shall be included in the EIA-report.

Further information on EIA-reporting can be found in guidelines and EIA-reports from other Arctic countries and institutions: for example Canada ([Link](#)), The Arctic Council's workgroup on Protection of the Arctic Marine Environment (PAME) ([Link](#)) and the Arctic Council Assessment of Oil and Gas Activities in the Arctic ([Link](#)).

Proposed content:

1. Extended non-technical summary
A non-technical summary shall describe, in short, the project (operations/activities) and preferred options compared to alternative solutions, potential environmental effects, mitigation, uncertainties and the response from the public hearings. The non-technical summary shall include pertinent figures to function as a stand-alone document.
2. Introduction shall include:
 - a. A description of the operator/company/companies
 - b. The location of the license area
 - c. The purpose of the project
 - d. A time schedule of all activities covered by the EIA.
3. Physical conditions shall include concise descriptions of:
 - a. Climate; air temperature, precipitation, wind, visibility, extreme winds, etc.
 - b. Geology; topography, geomorphology on different scales for mapping of potential flowing/oozing routes of spilled oil
 - c. Freshwater bodies; lakes, rivers, creeks, wetlands
 - d. Permafrost
 - e. Coastal oceanography: water temperature, salinity, currents, waves, tides, etc.
 - f. Coastal ice conditions: sea ice and icebergs, concentrations, thickness/draft/mass, drift speed, iceberg/floes scour, etc.
4. Environmental settings shall include concise descriptions of:
 - a. The biological environment with emphasis on sensitive species and how they function and interact in the ecosystem, including:
 - i. The terrestrial vegetation communities, including occurrences of rare species
 - ii. Terrestrial mammals described on a species by species basis. The risk of disturbance from the activities connected to the license area to each species shall be evaluated on a seasonal basis

- iii. Nesting, moulting and foraging birds described on a species by species basis. The risk of disturbance from the activities connected to the license area to each species shall be evaluated on a seasonal basis
 - iv. Freshwater bodies and their biota
 - v. Coastal fish and invertebrate species described on a species by species basis (occurrence, spawning, etc.). The risk of disturbance from the activities connected to the license area to each species shall be evaluated on a seasonal basis
 - vi. Coastal marine birds on a species by species basis (seasonal abundance, breeding and concentration areas, etc.). The risk of disturbance from the activities connected to the license area to each species shall be evaluated on a seasonal basis
 - vii. Coastally occurring marine mammals described on a species by species basis (seasonal abundance, breeding, concentration areas, etc.). The risk of disturbance from the activities connected to the license area to each species shall be evaluated on a seasonal basis.
 - b. A summary description of threatened (red listed) species, national responsibility species and species of conservation concern occurring in the area
 - c. A summary description of important habitats and/or areas of particular ecological importance, e.g. terrestrial habitats, freshwater bodies, shorelines
 - d. Baseline of ecosystems/communities/key organisms likely to be affected by the activities, based on the Environmental Baseline Studies (EBS)
 - e. Baseline chemistry and pollution level (hydrocarbons, heavy metals etc.)
 - f. Present use of natural resources (fishing, hunting, tourism)
 - g. Identification of missing relevant information.
5. Activities and their environmental impacts, this section shall include:
- a. A description of proposed activities, including their purpose, location, duration and intensity.
 - b. Account and description of platforms, machinery, vehicles, ships, buildings, roads and other infrastructure
 - c. Off-road travel management: To avoid and mitigate damage to vegetation and terrain, an off-road travel mitigation plan must be developed. The plan shall include travel routes and distances, mitigation measures and potential establishment of road and/or ice-roads (see Chapter 5; 7a)
 - d. Drilling mud system: An application for use and potential discharge of drilling mud (Drilling Mud Application) shall include an analysis of several mud systems and their chemicals, where pros and cons are compared and documented with emphasis on environmental impact. The system and chemicals which has the least risk of environmental impact shall be selected. The Chemical Plan (see below) shall be included in the Drilling Mud Application. See separate guidelines for selection and use of drilling mud for exploration drilling in Greenland ([Link](#))

- e. Chemicals: A list of chemicals (Chemical List) planned for use or contingency (including drilling mud) shall be prepared. All included chemicals shall be registered in the Danish Product Register PROBAS (documentation needed), and shall be categorized according to the Norwegian colour code system (green (PLONOR), yellow, red and black) based on OSPARs HOCNF. The environmentally less harmful chemicals shall be selected; preferably those on OSPARs PLONOR list (Link). Chemicals categorized as yellow shall furthermore be classified according to the Norwegian system (Y1, Y2, Y3, see Appendix 1). Y3 and red chemicals needs separate applications, which shall include a detailed assessment of degradation products and an environmental risk evaluation of these degradation products. Black chemicals will not be allowed. See further details regarding the Chemical List in Chapter 5;7b
 - f. Disposal of drilling cuttings/mud. Description of injection well(s) and, if considered, temporary disposal. Discharges or permanent disposal of drilling cuttings/mud will not be allowed. A Disposal Plan shall be developed (see more details in Chapter 5; 7c)
 - g. Waste handling (to be described in more details in a Waste Handling Plan – see more details in Chapter 5;7f)
 - h. An estimate of energy requirements
 - i. Emissions to air shall be described including an estimate of amounts and how emissions are minimized. Emissions to air shall be included in the Environmental Monitoring Plan describing how emissions are monitored
 - j. Decommissioning shall be described if or when the activities do not continue, and a separate Decommissioning Plan shall be submitted
 - k. Alternative project development options shall be described in order to compare and assess, and justification/documentation for the selected solution shall be presented.
6. The impact analysis shall include:
- a. Establishment of drilling activity facilities, including, e.g. drilling pad, tracks/roads
 - b. Impact assessment of drilling cuttings and mud handling, injection well(s) and temporary storage
 - c. Evaluation of effects of discharges/emissions of other contaminants to soil, water and air
 - d. Oil spill
 - i. Risk for and impacts of acute oil spills
 - ii. Identification and mapping of potential oil flow/oozing routes as a consequence of geomorphology and presence of permafrost
 - iii. Flowing/oozing predictions/modelling of oil, including potential freshwater carrier ways and potentially risk for access to freshwater bodies and eventually the marine environment
 - iv. Containment and mitigation of acute oil spill dispersion, e.g., location and establishment of dispersal barriers
 - v. Summary of the oil spill contingency plan.

- e. Effects on birds and mammals from noise and disturbance (e.g. helicopters)
 - f. Effects of lights and flaring, in particular attraction of birds
 - g. Impacts on fishing and hunting
 - h. Cumulative impacts with other human activities in and near the license area shall be considered
 - i. The risk of introducing new and potential invasive species
 - j. A description of the predictive methods used to assess effects on the environment and a discussion of limitations in this assessment for example due to lack of data
 - k. The concept of Valued Ecosystem Components (VEC) may be applied. See the Regional Strategic Impact Assessment of the Eastern Baffin Bay region on DCEs webpage (Link).
 - l. Complete reference list
7. Separate plans to be submitted as appendices to the EIA report:
- a. Off-Road Travel Management Plan shall include a description of all transportation across country, including routes and distances, establishment of tracks, roads, ice-roads and mitigation measures with regard to vegetation, terrain and wildlife.
 - b. Chemicals List shall include the activity's total list of chemicals, with their colour code (see above), and amount for use/contingency and potential discharge/disposal. The plan must include a pre-prepared template for reporting of chemical use and potential discharge/disposal. The plan shall include the drilling mud chemicals.
 - c. Disposal Plan The plan shall describe how drilling cuttings and mud will be handled including development of injection well(s) and potentially temporary above ground storage. The amounts of polluting substances shall be estimated. It shall be described how injected and above ground temporary disposal volumes are minimized, and potential environmental impacts mitigated.
 - d. Environmental Monitoring Plan, which may be an updated ESP
 - e. Environmental Management Plan describing measures to be taken in order to mitigate impacts on the environment
 - f. Waste Handling Plan which shall describe and list the estimated amounts and handling of general waste generated from the activities, hazardous and non-hazardous, but excluding chemicals (see Chemical List, Chapter 5; 7b)
 - g. Decommissioning Plan.

All appendices shall be in English, Danish and Greenlandic.

8. Other documents related to the environment and which shall be included among the application documents (in English only):
- a. Drilling Mud Application; chemicals and amount for use and potentially discharge/disposal of drilling mud. The Drilling Mud Application also shall include justification of choice of drilling mud system according to the Guidelines for Selection of Drilling Mud Chemicals in Greenland
 - b. Oil spill Contingency Plan

6 Criteria for discharges/emissions to the environment and environmental quality criteria

The oil companies shall use Best Available Technique (BAT), Best Environmental Practice (BEP) and Best Practicable Control Technology (BPT) to reduce discharges/emissions to the environment and minimise the risk of environmental impacts. See also Guidelines for preparing an Environmental Impact Assessment (EIA) report for mineral exploitation in Greenland ([Link](#)).

6.1 Discharges/emissions to the environment

Emissions from power plants, fuel combustion plants, incineration plants, process plants and similar shall comply with EU standards (the EU Directive on Industrial Emissions, IE Directive). Emissions from non-road mobile machinery (e.g. excavators, bulldozers, front loaders, back loaders and drilling equipment) shall comply with EU environmental standards (EU directives on emissions from non-road mobile machinery). US or DK standards shall be used if EU standards are not available. Emissions from means of transport such as ships shall at least meet EU, IMO and DK standards.

6.2 Environmental quality criteria

Where relevant, environmental quality criteria defined by MRA for water, sediment, biota and air for mining activities, shall be met. Appendix 2 presents the Greenland water quality criteria for freshwater and seawater. Appendix 3 presents air quality criteria. For elements, substances and chemicals not included in these lists, environmental quality criteria will be determined on the basis of EU/DK guidelines. The quality criteria are developed in order to protect the environment and the biota. The quality criteria shall be met outside a pre-defined mixing zone and buffer zone. The criteria for compliance with threshold values and the size of the mixing zone will be determined by MRA.

6.3 Noise

Indicative Danish noise limits for environmental noise from activities, installations, machinery, road and ship traffic, etc. shall be met. Final limit values for environmental noise are determined by MRA.

6.4 Dust

Limit values for dust concentration in the air and the deposition of dust outside the defined buffer zones must be observed. MRA determines the size of the buffer zone. MRA will also set limit values for the content of hazardous substances in dust, including limits for containing metals, radioactive substances, etc.

7 Strategic Environmental Impact Assessments and databases for environmental data

DCE and GINR prepare regional Strategic Environmental Impact Assessments (SEIA) before new regions are opened for hydrocarbon exploration. These SEIAs cover the area that potentially could be affected by the activities. To provide up-to-date knowledge for the SEIA process (and for subsequent EIA-reports) additional environmental studies are conducted funded by the authorities. The SEIAs are available from the EAMRA web page ([Link](#)).

The SEIAs are important sources of information when preparing the EIA-reports. These SEIAs include a number of maps showing different environmental elements and based on GIS layers (Geographic Information System). The layers will be updated as new data are retrieved and they will be available to companies preparing EIA reports (see paragraph below).

DCE and GINR keep and update databases of all environmental data collected in connection with hydrocarbon activities, both from the authorities and the license holding companies. Data must be submitted to DCE in formats agreed to by EAMRA and its scientific advisors, and will be available to companies preparing EIA reports.

Appendix 1

OSPAR recommendations, decisions and agreements for offshore chemicals shall be used in classification of chemicals used in onshore operations. Key documents are currently:

Harmonised Offshore Chemical Notification Format OSPAR Recommendation 2010/13.

OSPAR Recommendation 2010/4 on a Harmonised Pre-screening Scheme for Offshore Chemicals OSPAR Guidelines for Completing the Harmonised Offshore Chemical Notification Format (HOCNF). OSPAR Agreement: 2012/05. Update 2015.

Petroleum Safety Authority Norway Forskrift om utføring av aktiviteter i petroleumsvirksomheten (Aktivitetsforskriften) § 63, categorisation of substances and chemicals; the yellow category of drilling chemicals is subdivided ([Link](#)):

- Y1: The chemical is expected to biodegrade completely.
- Y2: The chemical is expected to biodegrade to products which are not environmentally hazardous. Documentation is needed for biodegradation end products and their properties.
- Y3: The chemical is expected to biodegrade to products which may be environmentally hazardous.

In case of insufficient knowledge of the breakdown products, these will need to be categorized as potentially hazardous (precautionary principle).

Appendix 2

Greenland Water Quality Criteria for mining activities

The following water quality criteria will be applied to mining operations in Greenland. The listed metal concentrations are for dissolved metals, here defined as metals that can pass through a 0.45 micron filter. DCE/GINR recommend that both filtered and unfiltered water samples are taken (for dissolved and total metals, respectively) as part of the environmental studies. Please consult DCE/GINR in advance on which filtering equipment to use because some systems are prone to contaminate the samples.

Greenland Water Quality Criteria for mining activities

	Freshwater (µg/l)	Sea water (µg/l)
Arsenic (As)	4	5
Cadmium (Cd)	0.1	0.2
Chromium (Cr (III))	3	3
Copper (Cu)	2	2
Iron (Fe total)	300	30
Lead (Pb)	1	2
Mercury (Hg)	0.05	0.05
Nickel (Ni)	5	5
Zinc (Zn)	10	10
Cyanide (CN free)	5	2
Nitrogen (N total)	300	
Phosphorus (P total)	20	
Total suspended solids*	50000*	50000*

* Or maximum increase of 10% if baseline concentration is above 50000 µg/l

The Greenland Water Quality Criteria (GWQC) are developed in order to protect living organisms in streams, lakes and in the marine environment from pollution due to disposal of mine tailings, waste rock, sewage and other substances derived from activities in connection with mining in Greenland.

The criteria values will be used to set limits for effluent discharges to freshwater and to the sea. This will be done on a case-by-case basis, and several parameters including physical, chemical and biological conditions will be taken into account such as naturally elevated metal concentrations, biology and local use of receiving waters.

The water quality criteria have to be met outside a defined mixing zone. It could, for example, be at the entrance of a stream to a lake holding fish or to the sea and will typically be at an easy recognisable and accessible site. The criteria for compliance with threshold values and the size of the mixing zone will be determined by MRA.

For elements or substances that are not included in the Greenland list, water quality criteria will be determined by MRA on the basis of other existing guidelines from EU/Denmark or elsewhere, if relevant.

The criteria have been determined from published information on water quality criteria used in USA, Canada, Australia/New Zealand, Norway, the European Union and Denmark and from typical values found in Greenland waters. The Greenland criteria values were mostly selected among the lowest criteria values from these other countries using a safety factor reasonable for Arctic conditions. Baseline concentrations typically found in Greenland were also taken into account. The Greenland criteria values will ensure that good water quality will be maintained if discharges are properly managed.

In addition to these criteria, the following effluent criteria for the biological and chemical oxygen demand (BOD₅ and COD, respectively) as well as total nitrogen and phosphorus will be used to set discharge limits:

Parameter	Concentration (mg/l)
BOD ₅	15
COD	75
Total N	8
Total P	1.5

Appendix 3

Environmental Air Quality Criteria for mining activities in Greenland

The following air quality criteria will be applied to mining operations in Greenland. The purpose of the criteria is to protect living organisms outside the immediate vicinity of the mining areas against adverse effects of air pollutants (gasses and dust particles). Values for air pollutants are given as ambient air concentrations and deposition rates.

Environmental Air Quality Criteria for mining activities in Greenland (EAQCG).
Values for ambient air concentrations are 24-hour means. Values for deposition rates are 1-month means.

	Ambient air concentrations ($\mu\text{g}/\text{m}^3$)	Deposition rates ($\mu\text{g}/\text{m}^2$)
<i>Gasses</i>		
Nitrogen dioxide (NO_2)	100	-
Sulfur dioxide (SO_2)	125	-
<i>Particles</i>		
Arsenic (As)	0.010	120
Cadmium (Cd)	0.010	60
Chromium (Cr)	0.50	-
Copper (Cu)	10	-
Cobalt (Co)	0.10	-
Iron (Fe)	4.0	-
Lead (Pb)	0.40	3000
Mercury (Hg)	0.10	1.5
Molybdenum (Mo)	5.0	-
Nickel (Ni)	0.10	450
Silver (Ag)	0.20	-
Thallium (Tl)	-	60
Uranium (U)	0.30	-
Vanadium (V)	0.30	-
Zinc (Zn)	60	-
Fluoride (F)	1.0	-
Particulate matter <2.5 μm ($\text{PM}_{2.5}$)	30	-
Particulate matter <10 μm (PM_{10})	50	-
Total particulate matter		4.0 $\text{g}/\text{m}^2/\text{month}$

The EAQCG will be applied to areas outside defined buffer zones close to potential air pollution sources within the mining areas. Such potential pollution sources include ore crushers, open pits, waste rock and tailings deposits, air ventilation outlets from underground mines, roads and ports of shipping. Buffer zones will be defined on a case-by-case basis depending on, for instance, the type of mining and the background values in the recipient area.

The EAQCG were developed/determined from published information on air quality criteria used in Canada, US, EU, Denmark, Norway, Australia and Germany. Defining the EAQCG, the averaging time for ambient air was set to 24 hours. This averaging time was considered appropriate to account for short-term local variations in parameters such as wind speed and turbulence and considering the potential effects. The averaging time for both single element and total deposition was set to 1 month, which is similar to the Australian and Norwegian standards. The values in the EAQCG were set to the lowest of the guideline values used in those other countries selected regardless of the differences in averaging times. This precautionous approach was taken due to the general lack of studies and knowledge of how dust and particle contamination may affect Arctic ecosystems.

Emissions from, for example, power plants, fuel combustions plants, incinerations plants and process plants shall comply with EU standards (EU Directive on Industrial Emissions – IE Directive). Emission from non-road mobile machinery (e.g. excavators, bulldozers, front loaders, back loaders and drilling equipment) shall comply with EU environmental standards (EU directives on emissions from non-road mobile machinery etc.). US standards shall be used if EU standards are not available. Best Available Technique (BAT) is specified in BREF documents.

ONSHORE DRILLING IN GREENLAND BACKGROUND INFORMATION FOR PREPARATION OF GUIDELINES TO ENVIRONMENTAL IMPACTS ASSESSMENT

This background memo provides information for defining the process towards development of an Environmental Impact Assessment (EIA) for onshore petroleum exploration drilling activities in Greenland. The Memo contains the DCE and GINR advice to EAMRA on the preparation of guidelines for the industry on EIA development.