Participant's Guidebook

National Training Course on Oil and Gas Exploration and Production and Promoting Sound Environmental Management

(insert dates here)

(insert names of country and city here)

PARTICIPANT'S NAME

Table of Contents

Background

Finding substantial reserves of oil and natural gas offers significant opportunities for the social, economic and political development of any country. When managed in an efficient and equitable manner, with social and environmental safeguards in place, the petroleum industry can enhance human development.

However, without following environmental standards, the opportunities brought by oil and gas resources can be wasted. Oil and gas exploitation can pose significant risks, from major accidents as well as from routine operations that cause serious environmental damage. The example of oil production in the Ogoniland region of the Niger Delta shows how potential development gains can be lost, with widespread environmental degradation impacting on human health, livelihoods and drivers of conflict. This legacy was documented by the UN Environment in its *Environmental Assessment of Ogoniland, Nigeria (2011).*

What is the aim of this course?

This training course aims to enhance understanding of oil and gas exploration and production and associated environmental management concerns in OfD – supported countries.

UN Environment and Oil for Development Partnership

As the world transitions towards low carbon economies to mitigate climate change, it is recognized that fossil fuels will continue to play a role in the global energy mix. It will still be important to provide support to developing countries with oil and gas reserves and enable them to better manage the use of their hydrocarbon resources in a responsible and sustainable manner.

Fragile and developing countries can now benefit from over 30 years of international best practice on environmental management in the oil and gas sectors to support sustainable development. Enabling countries to access this know-how is the key goal of the new partnership between UN Environment and the Government of Norway's Oil for Development Programme.

UN Environment has experience working with the oil industry in fragile and vulnerable countries and delivering capacity building support. It can draw from its in-house expertise and global network of partners, which will complement the specialized assistance provided by Norway. With UN Environment providing regular and basic training support, this will allow for optimization of the time, focus and resources of Norwegian experts. The collaboration responds to the following challenges faced by developing countries with an emerging petroleum sector:

- Few national technical experts with environmental management expertise in the oil and gas sectors;
- Poor understanding of national capacity development needs for improved environmental management of the oil and gas sectors and the lack of systematic means for measuring core capacities;
- Limited awareness amongst non-state actors (civil society, academia and media) on environmental management in the oil and gas sectors, limiting constructive dialogues with Governments and industry.

For further information, visit: https://www.unenvironment.org/explore-topics/disasters-conflicts/what-we-do/risk-reduction/extractive-resources-and-fragile-0

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The Foundation Course

With important offshore and onshore oil reserves, the Government of (sample country) is keen to ensure that the exploration, development and production activities associated with current and future oil and gas resources apply environmental management best practices and contribute towards sustainable development. Several international development partners, including the Government of Norway's Oil for Development Programme (OfD), have come forward to support the Government of (sample country) in managing its emerging oil and gas sector.

Summary of workshop structure	
Module	**Sub-section**
1 **An overview of oil and gas exploration and production and Social and environmental considerations**	- An overview of oil and gas exploration and production in the context of the global energy mix - Environmental challenges and opportunities related to oil and gas exploration and production: Introduction to strategic and environmental impact assessments of oil and gas projects
2 **Oil and Gas Industry in the Global Energy Mix**	
3 **Where does oil come from?**	- Petroleum geology - Environmental considerations and mitigation options for conducting seismic surveys onshore and offshore
4 **Drilling (Exploration)**	- Exploration and drilling onshore and offshore - Environmental considerations and mitigation options associated with drilling operations, with focus on chemicals and waste management
5 **Well completion and Production Strategies**	- Well completion and production strategies with case studies - Environmental considerations and mitigation options, with focus on produced water management and air emissions
6 **Emergency Preparedness and Response for oil spills and accidental releases**	- Risk Mapping - Overview of Emergency Preparedness and Response with case study
Field visit	
7 **Storage, Processing (separation) and Transportation**	- Storage, Processing and Transportation of crude oil and gas - Environmental considerations and mitigation options related to Storage/Processing/Transportation
8 **Decommissioning**	- Decommissioning for offshore and onshore installations, with examples - Environmental considerations related to decommissioning
9 **Environmental governance in the oil and gas sector**	- Key environmental policies and legislations related to the oil and gas industry in the country - Environmental Compliance Monitoring - Industry Standards for Compliance Monitoring
10 **Action Planning**	- Country Action Planning / Way forward

Case study Presentations

Title	Presenter
Emergency Preparedness and Response in XXX	XXX
Key Environmental Policies, Laws and Regulations related to the Oil and Gas Industry in XXX	XXX

Key Learning Objectives

Participants are expected to:

1) Develop basic knowledge of the key stages of oil and gas exploration and production;
2) Describe and analyze the environmental issues/concerns associated at each stage of oil and gas exploration and production, including impacts on health and safety;
3) Appreciate the importance of strengthening environmental management in the oil and gas sector and its relevance for the country;
4) Identify basic features of oil spill contingency planning;
5) Become familiar with environmental regulatory and legal frameworks and institutions associated with environmental management of the oil and gas sector in the country;
6) Identify and prioritize major capacity gaps and needs for strengthening environmental management in oil and gas exploration and production in the country.

Expected Outputs

- Mid-Course Evaluation of participant's knowledge
- End-of-Course Evaluation of participant's knowledge
- Group action Plan to address prioritized capacity needs for strengthening environmental management in the oil and gas sector in the country
- Networking for enhanced national coordination on environmental management in the oil and gas sector

Target Audience

This course is geared primarily towards officials from National and Local Government institutions which are responsible for overseeing oil and gas development and promoting sound environmental management in the sector, including emergency preparedness and response.

Government Departments/Agencies/Directorates from other development sectors (e.g. infrastructure, water, agriculture/fisheries, tourism, land-use planning, etc.) are also encouraged to participate.
Other potential audience of the training include:

- Technical consultants in Environmental Assessments (Environmental/Social Impact Assessments, Strategic Environment Assessments, Audits, Compliance Monitoring, etc.), Water and Waste Water Management
- Environmental advisors from national oil and gas companies and/or service providers
- Staff of national universities/academia related to oil and gas operations
- Media personnel and civil society which cover oil and gas operations.

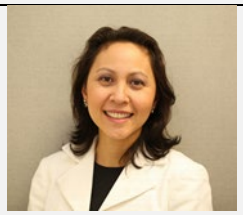
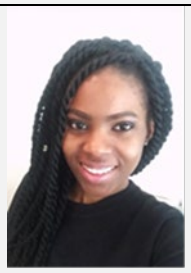
UN Environment strives to achieve ***gender balanced*** representation in all its trainings.

Course Duration

This is a 4-day intensive residential course, which will include a field visit on (insert date here).

Meet the Training Team

	***Mr. Saad Ibrahim, Course Leader*** Saad Ibrahim, P.Eng., is an independent consultant and president of Petro Management Group Ltd., established in Calgary (1994). Graduated from the University of Alexandria (Egypt) with B.Sc. in Mechanical Engineering in 1973. He also completed a post-graduate program with the University of Calgary, Canada, in Chemical and Petroleum Engineering in 1983. Mr. Ibrahim has over 35 years of reservoir/production engineering experience in Western Canada and internationally. The focus of Mr. Ibrahim's experience lies in the areas of reservoir management, production optimization, and training. Mr. Ibrahim is a member of the APEGA & SPE.
	***Mr. Joppe Cramwinckel, Course Co-leader*** Joppe Cramwinckel has 25 years' experience working at Shell as a leader in environmental research and sustainability. He was instrumental in improving the environmental and social performance of the company at corporate, operating unit and project level. At Shell, he worked in Oman, Brunei, Netherlands and the UK. He was also Director of the Water Programme for six years at the World Business Council for Sustainable Development, based in Switzerland. He has a technological economics

	from the University of Stirling and a chemical engineering degree from Technische Universiteit Delft, Netherlands.
	***Tone Sorgard, Senior Adviser, Oil and Gas Section, Norwegian Environment Agency*** Tone Sorgard has been working with the Norwegian Environment Agency for 35 years, dealing mostly with environmental issues within the offshore oil and gas industry. In addition, she has experience within the areas of hazardous waste, chemicals, drafting of regulations, and compliance monitoring. She has also worked in the Ministry of the Environment and in Norad (the Norwegian Agency for Development Cooperation). She has a MSc in Chemical Engineering from the Norwegian University of Science and Technology in Trondheim (NTNU).
	***Ms. Marisol Estrella, Coordinator, UN Environment-Oil for Development Partnership*** Marisol Estrella is Programme Coordinator for Disaster Risk Reduction in the Post-Conflict and Disaster Management Branch of the United Nations Environment Programme (UNEP), based in Geneva, Switzerland. She is the Coordinator of the UN Environment- Oil for Development Partnership, where she supports on capacity building under the Environment Pillar of the OfD Programme. She holds an M.A. with Distinction in Environment, Development and Policy from University of Sussex, UK, and B.A. with First Class Honours in Anthropology and Environmental Studies from University of McGill, Canada.
	***Ms. Chidinma Zik-Ikeorha, Project Support, UN Environment-Oil for Development Partnership*** Chidinma Zik-Ikeorha works as a Research Assistant in the Post-Conflict and Disaster Management Branch of the United Nations Environment Programme (UNEP), based in Geneva, Switzerland. She provides support on the UN Environment-OfD Partnership project. She holds a B.L in Law from Abia State University Nigeria and an LL.M in International Law from the University of Dundee, Scotland. She worked with UNITAR in the International Law programme, where she developed training materials and assisted in project coordination. She was a Legal officer for an Energy firm in Nigeria and has worked with different Human Rights NGOs in the USA.

Training Programme:

Time	Activity
	(insert date here)
8:30	**Registration** **Safety Briefing** *Marisol Estrella, UN Environment*
9:00	**Opening Remarks** *ECD Other?* *Ms. Tone Sorgard, Norwegian Environment Agency on behalf of the Oil for Development Programme*
9:30	**Introduction of Participants and Training Team** *Chidinma Zik-Ikeorha, UN Environment* **Course Overview and Baseline Assessment** *Marisol Estrella, UN Environment*
10:30	**Coffee/Tea Break**
10 :45	**Module 1: Why are we here?** **Presentation on the status of the oil and gas sector in (sample country) (20 min)** **ECD? MOEE?** **Presentation: An overview of oil and gas exploration and production and its environmental challenges and opportunities** *Joppe Cramwinckel, UN Environment* **Q&A** **Group Photo**
12 :30	**Lunch**

13 :30	**Module 2: Oil and gas industry in the global energy mix** **Visioning Exercise: Looking forward to the state of the petroleum sector in (sample country)** *Chidinma Zik-Ikeorha, UN Environment* **Oil/Gas Offshore and Onshore Production and the Global Energy Mix** *Saad Ibrahim, UN Environment*
15:30	**Coffee/tea break**
16:00	**Module 3: Where does oil and gas come from?** **Presentation on Petroleum Geology** *Saad Ibrahim, UN Environment* **Facilitated discussion and presentation on environmental considerations and mitigation options during seismic surveys** *Joppe Cramwinckel, UN Environment* *with Marisol Estrella*
17:30	**End of Day 1 – Taking the Pulse** *Chidinma Zik-Ikeorha, UN Environment*
Day 2, 22 May, Wednesday	
8:00	**Breakfast** available for all meeting participants
8:30	**Participant-led Recap of Day 1 – Pop Quiz is possible!** *Chidinma Zik-Ikeorha, UN Environment*
9:00	**Module 4: Drilling (Exploration)** **Presentation on Exploration and Drilling Onshore and Offshore** *Saad Ibrahim, UN Environment* **Q&A**

10:30	**Coffee/tea break**
10:45	**Module 4: Drilling (Exploration) – Continued** **Facilitated discussion and presentation on environmental considerations and mitigation options associated with drilling operations** *Joppe Cramwinckel, UN Environment* *With Chidinma Zik-Ikeorha*
11:30	**Module 5: Well Completion and Production Strategies** **Presentation on well completion and production strategies with case studies** *Saad Ibrahim, UN Environment*
12:30	**Lunch**
13:30	**Module 5: Continued** **Facilitated discussion and presentation on environmental considerations and mitigation options** *Joppe Cramwinckel, UN Environment* *With Chidinma Zik-Ikeorha*
14:30	**Module 6: Emergency preparedness and response** ***Government ministry responsible for oil spill contingency planning*** **Risk Mapping Group Exercise** *Chidinma Zik-Ikeorha, UN Environment*
15 :30	**Coffee/tea break**
16 :00	**Module 6: Emergency preparedness and response (continued)** **Group work presentations** *Marisol Estrella, UN Environment* **Presentation on Emergency Preparedness and Response with case study (Gas operations)** *Joppe Cramwinckel, UN Environment*

17 :00	**Briefing on Site Visit** *ECD*
17:30	**Taking the Pulse / End of Day**
Day 3, 23 May, Thursday	
8:30	**Site Visit** *Participants depart from training location in shuttle bus*
13:00	**Return from Site Visit to Training location** To be confirmed
12:30	**Lunch**
14:00	**Debriefing on Site Visit - Teams present** *Marisol Estrella, UN Environment*
15:30	**Coffee/Tea Break**
16:00	**Module 7: Storage, Processing & Transportation of crude oil and gas – offshore and onshore** **Presentation on Storage, Processing and Transportation, with case examples** *Saad Ibrahim, UN Environment* **Facilitated discussion and Presentation on environmental considerations and mitigation options** *Joppe Cramwinckel, UN Environment* *with Chidinma Zik-Ikeorha*
17:00	**End of Day – Taking the Pulse** *Chidinma Zik-Ikeorha, UN Environment*
Day 4, 24 May, Friday	

8:30	**Participant-led Recap of Days 2 and 3** *Chidinma Zik-Ikeorha, UN Environment*
9:30	**Module 8: Decommissioning** **Presentation on Decommissioning for offshore and onshore installations, with examples** *Saad Ibrahim, UN Environment* **Facilitated discussion and presentation on environmental considerations** *Joppe Cramwinckel, UN Environment* *with Marisol Estrella, UN Environment*
10:30	**Coffee/tea break**
10:45	**Module 9: Environmental governance in the oil and gas sector** **Key environmental policies and legislations related to the oil and gas industry in (sample country)** *ECD* **Environmental regulations in Norway** *Norwegian Environment Agency* **Facilitated Discussion** *Marisol Estrella, UN Environment*
11:45	**Module 9: Environmental governance in the oil and gas sector (continued)** **Environmental Compliance Monitoring in Norway (Site Visits vs. Audits)** *Norwegian Environment Agency* **Presentation on Industry Standards for Compliance Monitoring** *Joppe Cramwinckel, UN Environment* **Q&A**
13:00	**Lunch**

14:00	**Module 10: Action Planning** Group Work and Group Presentations *Marisol Estrella, UN Environment*
15:30	**End of Course Assessments** *Chidinma Zik-Ikeorha, UN Environment*
16:15	**Coffee/tea break**
16:30	**Wrap Up** **Final Knowledge Assessments** **Training Evaluations** **Closing Remarks** **Awarding of Certificates**
17:00	**End of Course Programme**

Day 1

Participant Introductions - Poster session

- Your name
- Your organization/institution
- Your expectation from this training
- Something about yourself that you would like to share and be remembered (e.g. a hobby, favorite music, etc)

Participants-led Daily Recaps

Participants will be divided into teams. Each team will be responsible for leading the Daily Recaps the following day, as the first daily activity. To prepare for this, each team is encouraged to summarize the discussions. You can be as creative as you can! e.g. prepare a quiz, role play, etc.

Each team is asked to present on the following: You will have maximum 15 minutes.

1. What are your top 3 key messages/lessons from the previous day?

2. How do these lessons/messages relate to your own institutional or country context?

3. What did you like about the sessions? What did you not like?

Module 1. Why are we here
Learning objectives

At the end of Module 1, participants will be able to:

- Describe the process of oil and gas exploration and production value chain;
- Identify the key stages of oil and gas exploration and production;
- Explain the importance of oil and gas industry and its relationship with the Sustainable Development Goals.

Module 1.1. An Overview of Oil and Gas Exploration & Production and Social & Environmental Considerations

Contents

- Background of the oil industry
- Oil industry value chain
- Key stages of oil and gas exploration and production

Key messages

- Oil and gas are important source of energy and they are also critical for developing many everyday products that are used.
- The oil and gas industry Value Chain includes the upstream, midstream and downstream.
- Significant amounts of conventional oil reserves still remain unexploited in both conventional and unconventional reservoirs even though they are depleting. Unconventional reservoirs are usually very tight rock formation, such as shale, which contain oil and gas
- Greenhouse gas (GHG) emissions from fossil fuels are an important contributor to climate change and global warming and can therefore play an important role in reducing GHGs.
- Although renewable sources of energy are emerging, oil and gas remain an important energy source for the next 30-40 years.

Add any other take away messages and key lessons for you:

Experiences and lessons from Myanmar's current status of the oil and gas sector will be presented by ECD. Note down your key take-away messages from this presentation.

Module 1.2. An overview of oil and gas exploration and production and its environmental challenges and opportunities

Contents

- Oil and gas value chain, climate change and the Sustainable Development Goals (SDGs)
- Challenges of SDG implementation in country
- Next steps in achieving SDGs

Key messages

- The oil and gas sector is a major emitter of greenhouse gases and can therefore play an important role in reducing GHGs
- There is a huge potential for the oil and gas sector contributing to many sustainable development goals, including gender equality (5), clean water and sanitation (6), decent work and economic growth (8), life below water (14), life on land (15), among others.
- Countries have high expectations that oil and gas development will bring multiple social and economic benefits and contribute to the development of their people and national economies. Making this goal into a reality will help prevent the so called "Dutch disease" where a country becomes overly dependent on extractive industries.
- Environmental impacts of oil and gas exploration and production can be significant and need to be carefully managed, by applying the mitigation hierarchy: Avoid, Mitigate, Restore, Offset.
- The mitigation hierarchy is underpinned by conducting an Impact Analysis of the environmental consequences (both positive and negative) of oil and gas development.
- There are 2 main tools used for conducting impact analysis: SEAs and EIAs
- Consultation is a key step in the impact assessment process to reach agreement on the Impact Analysis and the actions resulting from the Impact

Add any other take away messages and key lessons for you:

Module 2. Oil and gas industry in the global energy mix

Learning objectives

At the end of Module 2, participants will be able to:

- Describe the importance of oil and gas industry in the Global Energy mix;
- Analyze the environmental issues/concerns associated at each stage of oil and gas exploration and production;
- Explain the various environmental impacts associated with each stage of oil and gas operation and tools used in conducting impact analysis;
- Discuss the importance of Strategic Environmental Assessment, and Environmental (& Social) Impact Assessment in the oil and gas industry.

Module 2.1. Oil and Gas Offshore and Onshore Production and the Global Energy Mix

Contents

- Oil and gas in the global energy mix
- Conventional and Unconventional oil
- Global oil and gas discoveries
- Renewable energy

Key messages

- Flat life Index indicates how many years current global oil reserves are expected to last
- There can be conventional oil in both conventional and unconventional reservoir rocks as well as unconventional oil in conventional and unconventional reservoir rocks
- The world will still remain heavily dependent on oil and gas for at least 30years
- Liquified Natural Gas is stored in Cryogenic tanks with double-wall construction Outer walls are made of reinforced concrete for safety, in case of leak in the inner steel tank
- Nearly three-fourths of the world's kerogen-bearing shales occurs in the United States.

Add any other take away messages and key lessons for you:

Visioning Exercise

Exercise instructions:

What you'll need →

Working in established teams and using a different colored post-it to represent each question, answer the following questions:

- What should oil and gas bring for your country?
- What current efforts are being made to make this vision a reality?
- What are the challenges to achieving this reality?

Module 2.2. Environmental considerations and mitigation options

Contents

- Introduction to Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA)
- Central concepts: Types of Environmental Impacts
- Mitigation Hierarchy
- Environmental (and social) Impact Assessment (ESIA)

Key messages

- Environmental Impacts of oil and gas exploration and production can be significant and need to be carefully managed by applying mitigation hierarchy: Avoid, Mitigate, Restore, Offset.
- The mitigation hierarchy is underpinned by conducting Impact Analysis of the environmental consequences (both positive and negative) of oil and gas development.
- There are 2 main tools used for conducting impact analysis: SEAs and EIAs.
- Consultation is a key step in the impact assessment process to reach agreement on the Impact Analysis and the actions resulting from Impact Analysis.

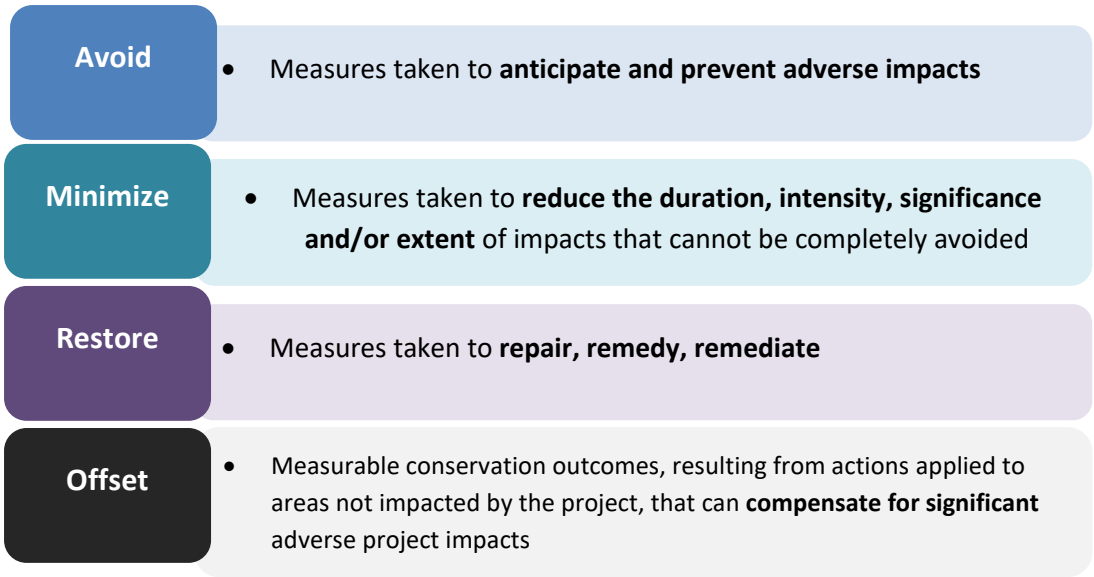


Figure.1. Central concept in Impact Assessment: Mitigation Hierarchy

Add any other take away messages and key lessons for you:

Module 3. Where does oil and gas come from?

Learning objectives

At the end of Module 3, participants will be able to:

- Explain the importance of seismic evaluation in oil and gas exploration and production;
- State the main elements of petroleum reservoirs and types of reservoir rocks;
- Outline the environmental effects of seismic operations;
- Identify and Apply mitigation measures during seismic operations.

Module 3.1. Petroleum Geology

Contents

- Geologic cycle/time
- Depositional environment
- Types of reservoir rocks
- Main elements of petroleum reservoirs
- Seismic and air surveillance

Key messages

- Oil and gas are hydro-carbons that are naturally occurring, flammable liquid and gas found in rock formations, made of organic materials
- Main elements of a reservoir include: source rock, reservoir trap and reservoir seal
- Reservoir rocks should have good porosity and permeability.
- To locate where oil and gas might be, aerial surveillance and seismic surveys are needed. Different methods are applied for offshore or onshore seismic surveys
- The possibility of success for an exploration well is 1 out of 5, making oil and gas exploration a high-risk and capital-intensive business

Add any other take away messages and key lessons for you:

Module 3.2. Environmental considerations and mitigation options during seismic surveys

Contents

- Introduction to impact assessment and environmental impacts of seismic operations
- Environmental (and social) Impact Assessment
- Seismic survey (onshore and offshore)
- Mitigation measures for seismic (onshore and offshore)

Key messages

- It is important to apply best practices in Public Consultation compensation procedures, and waste management.
- Design seismic lines to avoid environmentally and culturally sensitive sites and to minimize environmental and social impact.
- Seismic surveys maybe considered onshore and offshore.
- Environmental Impact assessments should be carried out prior to oil and gas activities and ensure comply with guidelines.
- There are new ways of conducting seismic which leave smaller environmental footprint.

Add any other take away messages and key lessons for you:

End of Day 1 – Team Reflections

Take a 5-10 minutes to discuss in teams the following:

1. What are Your key lessons learned today?

2. What are the main institutional capacity challenges/gaps with regards to environmental management in the oil and gas sector that apply to your country context?

3. Are there any current efforts, opportunities or entry points to address these challenges within your own country context?

Based on your discussions, **record the identified capacity challenges on post-its. 1 challenge = 1 post-it.** For each identified capacity challenge, **record on a separate post-it, the identified opportunity or entry point/s for addressing that particular challenge**. Paste post-its on your Team reflection flipchart in the room. You will continue to build this Team reflection flipchart at the end of each day. It should look like this.

Team reflection flipchart sample:

Identified Capacity Challenge	**Current efforts, opportunity or entry point for addressing the challenge**
Challenge 1 Challenge 2	Opportunity/ Entry point to address challenge 1 Opportunity / Entry point to address challenge 2

Day 2

Participants' led Recap of Day 1

Record the key take-away messages here presented by the team. Please add your own!

Module 4. Drilling (Exploration)

Learning objectives

At the end of Module 4, participants will be able to:

- Describe the process of Onshore Drilling and give examples of types of wells;
- Identify equipment used in Drilling of oil and gas;
- Analyze and Identify environmental issues of drilling;
- Recognize the importance of chemicals and waste management and mitigation measures in drilling.

Module 4.1. Exploration and Drilling Onshore and Offshore

Contents

- Well construction and types of wells
- Process of Onshore drilling and equipment
- Process of Offshore drilling and equipment

Key messages

- There are several types of wells, including exploration, appraisal, development(producing) and injector or disposal wells.
- Before drilling begins, a cellar with a conductor pipe and the blow out preventer (BOP) are installed.
- A blow-out preventer is used during drilling to monitor and control the flow and pressures of oil and gas that fluctuates during drilling. Its main purpose is to prevent a blowout and the damage to the rig and insure safety of the crew.
- The Christmas tree is an assembly of valves, spools and fittings used for oil and gas wells; it sits atop the wells for wireline operations, injection of chemicals and allow production or choke the well.
- Drilling fluids can consist of water-based mud, oil-based mud, synthetic oil mud and foam. The type of fluid to be used depends on cost, technical performance and environmental impact considerations.
- Drilling principles/techniques onshore and offshore are similar; however, safety and environmental considerations become more significant.
- Offshore exploration and production is significantly more capital intensive.

Add any other take away messages and key lessons for you:

Module 4.2. Environmental considerations and mitigation options associated with drilling operations

Contents

- Environmental issues of drilling (onshore and offshore)
- Introduction to chemical and waste in oil and gas sector
- Drilling fluids and cuttings
- Chemical management
- Waste management
- Mitigation measures (drilling)

Key messages

- Minimize footprint by good site selection from beginning (hence the importance of good SEAs and EIAs)
- Select the "right" drilling fluid from an economic and environmental point of view
- Appropriate waste management is key
- Oily waste needs special attention
- Use only "approved" chemicals – need to have chemicals regulations in place.

Add any other take away messages and key lessons for you:

Module 5. Well completion and Production strategies

Learning objectives

At the end of Module 5, participants will be able to:

- Describe Well completion methods;
- Discuss the objectives of Well evaluation and well Testing in oil and gas operations;
- Analyze and Identify environmental issues in well completion and production strategies;
- Recognize the importance of proper management of produced water and air emissions during production.

Module 5.1. Well Completion and Production Strategies – Case studies

Contents

- Well Completion methods
- Formation evaluation
- Well testing
- Well simulation
- Primary, Secondary and Tertiary recovery mechanisms
- Unconventional oil and gas

Key messages

- Well completion techniques include: cased hole, and gravel pack. Wells are tested to confirm well potential and collect fluid samples, pressure data and production data
- During well testing, flammable gas may be produced from the reservoir and may be flared for limited periods of time
- Wells can be stimulated to produce more oil and gas.
- Oil recovery slows down after primary production, during which the existing pressure from the reservoir decreases.
- Water is injected through injection wells to increase reservoir pressure and increase oil production. This is known as 'water flooding'
- Methods for enhanced oil recovery include thermal recovery, gas injection, miscible flooding and chemical injection into the reservoir.

Add any other take away messages and key lessons for you:

Module 5.2. Environmental considerations and mitigation options related to Well Completion and Production

Contents

- Environmental Issues in Well Completion and Production
- Produced water
- Venting and flaring
- Waste management
- Chemical management
- Natural Occurring Radioactive Material (NORM)

Key messages

- Water is always produced during oil and gas operations
- It is usually treated and reinjected or discharged back into the sea
- Produced water and gas are the two important issues faced during production phase and must be managed carefully
- Natural infrastructure can also be considered as alternative to deep sub surface injection or gravity separation of oil and water. For example, use of Reedbeds in Oman
- Venting and flaring are contributors to greenhouse gas emissions as flaring produces predominantly carbon dioxide emissions while venting produces methane emissions.

Add any other take away messages and key lessons for you:

Module 6. Emergency Preparedness and Response

Learning objectives

At the end of Module 6, participants will be able to:

- Identify the types of emergencies in the oil and gas industry;
- Explain the environmental Impacts of oil and chemical spills;
- Identify basic features of oil spill contingency planning and State the importance of risk assessment in emergency preparedness and response;
- List the different Response strategies, structure and tiered response in an oil spill incident.

Experiences and lessons from Myanmar's Oil Spill Contingency Planning will be presented. Note down your key take-away messages from this presentation.

Group Exercise: Participatory risk mapping

What you'll need →

Objective: Create a map of existing or future oil and gas operations and consider how environmental management can reduce future risks.

Participants will:

- Draw main natural and human features that are important: houses, roads, rivers, fields, temples, etc.
- Identify potential risks and threats;
- Outline elements /zones at risk in **red;**
- Identify measures for reducing risks: what can be done?

Instructions:

1. Select one location in the country with the following components:
   - A source of risk from oil spills
   - Potential environmental and human impacts
2. Using flipchart paper, draw the following elements:

a. Sources of oil spills (e.g., oil rig, pipeline, ship, etc)
   - Consider other potential risks (natural disasters, human-related, e.g. conflict-related)

b. Trajectory of the spill

c. Potential impacts
   - Environmental
   - Human

3. Identify challenges in responding to these risks at the national level.

Module 6.1. Emergency Preparedness and Response- case study (Gas operations)

Contents

- Types of Emergencies in the oil and gas industry
- Oil spills and environmental impacts
- Chemical spills and environmental impact
- Contingency Planning
- Guiding principles in oil spill response
- Risk Assessment and sensitivity mapping
- Response strategies
- Tiered response

Key messages

- Contingency plans are very important and national contingency and response plans must be exercised regularly
- Environmental sensitivity mapping is critical and provides information for the risk assessments and contingency plans. Sensitivity maps should be very clear and simple
- The 3-tier response: ***Tier 1*** relates to small spills taken care of by the oil companies; ***Tier 2*** relates to big spills requires other companies and the government; ***Tier 3*** relates to bigger spills which requires external resources to be brought in- equipment and international cooperation- and government takes full control of the response.

Figure.2. Contingency planning process

Add any other take away messages and key lessons for you:

Briefing on the Field Trip in Day 3

(sample country's) Environmental Conservation Department (ECD) has organized a field visit to Mann Oil Field, Magway. **Please refer to the field visit handout in your packet.**

You will receive an additional hand-out which reflects the group work discussions you had previously. The hand-out is a checklist of the key elements/issues you will investigate further when you are at the field visit site. Feel free to ask additional questions, depending on what you observe and learn while on the site visit.

Working in teams, you will be assigned key sections from this checklist where you will take the lead in your investigations. Each team will report back based on their assigned sections, and your performance will be evaluated by the Team Leader.

Important Note: Please keep in mind that we are on a learning field visit – and only "simulating" a site inspection! Any serious concerns or issues that you observe should be raised more formally through your ECD focal point, as our main Government host for this field visit. We shall keep this visit friendly and cordial and discuss what we have learned when we are back in the training classroom.

Do's and Don't's while on the field visit

Do:

- Be on time and prepared for the field visit: pens, hand-outs, notepads.
- Wear your assigned Personal Protective Equipment (coveralls, shoes, safety helmet)
- Bring your personal medications
- Bring your mobile phone
- Bring sun protection – hats, glasses, etc.
- Pay attention to signage and other potential risks: e.g. when crossing the road, standing next to uneven ground/cliffs, etc.
- Ask permission before taking photos
- Remain respectful and cordial when asking questions

Don't:

- Take photos in prohibited areas
- Take unnecessary risks; ask first, if in doubt
- Stray away from the group
- *Other things to remember?*

End of Day 2 – Team Reflections

Take 5-10 minutes to discuss in teams the following:

1. What are Your key lessons learned today?

2. What are the main institutional capacity challenges/gaps with regards to environmental management in the oil and gas sector that apply to your country context?

3. Are there any current efforts, opportunities or entry points to address these challenges within your own country context?

Adding to your discussions at the end of Day 2, discuss and **record additional capacity challenges on post-its. 1 challenge = 1 post-it.** For each identified capacity challenge, **record, on a separate post-it, the identified opportunity or entry point/s for addressing that particular challenge**. Paste post-its on your Team reflection flipchart in the room. You will continue to build on this Team reflection flipchart at the end of each day. It should look like this:

Team reflection flipchart sample:

Identified Capacity Challenge	**Current efforts, opportunity or entry point for addressing the challenge**
Challenge Challenge	Opportunity/ Entry point to address challenge Opportunity / Entry point to address challenge

Day 3

Field visit to Mann Oil Field, Magway, Myanmar

Departure date/time and location: 23 May, 08:00 hrs, Nan Htiek Thu Hotel Magway, Myanmar

Participants' led Recap of Day 2

Record key take-away messages presented by the team. Please add your own!

Reporting back on Field Trip

Record key take-away messages presented by the different teams. Please add your own!

Module 7. Storage, Processing and Transportation of Crude Oil and Gas (Onshore and Offshore)

Learning objectives

At the end of Module 7, participants will be able to:

- Outline the main methods of transporting and storing oil and gas;
- Identify the technique involved in processing oil and gas;
- Describe the impacts of waste from and challenges in oil and gas storage, processing and transportation;
- Discuss mitigation measures available and importance of proper management of storage and transportation in oil and gas operations.

Module 7.1. Storage, Processing and Transportation of Crude Oil and Gas – Case studies

Contents

Key messages

- The main methods of transporting oil and gas are: pipeline (most commonly used), rail, truck and ship
- Oil and gas can be stored either on surface (pipelines, tankers) or subsurface (tunnels, salt caverns).
- Artificial lift is used to retrieve oil from the wells. Surface facilities separate the oil/gas/water and channel oil and gas through various flow lines.
- Types of Artificial methods include- sucker pump, hydraulic pump, progressive cavity pump, Gas lift and Electrical submersible pump
- Flow lines are pipes which are used for conveying liquid, gas and connect the wellhead to the pipe header at the surface facilities and should conform with the dimensional requirements of ASME (American Society of Mechanical Engineering)

Add any other take away messages and key lessons for you:

Module 7.2. Environmental considerations and mitigation options

Contents

- Environmental considerations of storage, processing and transportation of oil and gas
- Venting and Fugitive Emissions
- Storage of oil and gas (challenges)
- Transport of oil and gas (challenges)
- Issues in storage, processing and transport of oil and gas.

Key messages

- Venting is the direct release of methane gas to the atmosphere
- Best available technologies can be used to address fugitive emission
- Several waste streams are created when oil and gas are store: tank vapors, tank bottoms may contain heavy metals, contaminated waste water, etc.
- Biggest problems faced in oil and gas transportation are risk of pollution and the chance that the oil can spill
- Pipelines often traverse a wide variety of habitats, cultural heritage sites. Another challenge with the use of pipelines is people may need to be resettled or compensated.

Add any other take away messages and key lessons for you:

End of Day 3 – Team Reflections

Take 5-10 minutes to discuss in teams the following:

1. What are Your key lessons learned today?

2. What are the main institutional capacity challenges/gaps with regards to environmental management in the oil and gas sector that apply to your country context?

3. Are there any current efforts, opportunities or entry points to address these challenges within your own country context?

Adding to your discussions at the end of Day 3, discuss and **record additional capacity challenges on post-its. 1 challenge = 1 post-it.** For each identified capacity challenge, **record, on a separate post-it, the identified opportunity or entry point/s for addressing that particular challenge**. Paste post-its on your Team reflection flipchart in the room. You will continue to build on this Team reflection flipchart at the end of each day. It should look like this:

Team reflection flipchart sample:

Identified Capacity Challenge	Current efforts, opportunity or entry point for addressing the challenge
Challenge Challenge	Opportunity/ Entry point to address challenge Opportunity / Entry point to address challenge

Day 4

Participants' led Recap of Day 3

Record key take-away messages presented by the team. Please add your own!

Module 8. Decommissioning

Learning objectives

At the end of Module 8, participants will be able to:

- Discuss the production life of a field, decommissioning and abandonment procedures and oil recovery mechanisms;
- Identify the different types of Well abandonment; with good and bad examples;
- State the importance of Decommissioning and proper Well abandonment; and identification of costs and responsibilities during decommissioning.

Module 8.1. Decommissioning for offshore and onshore installations, with examples

Contents:

- Oil recovery mechanisms
- Well abandonment:
  - Reasons and time for abandonment
  - Orphan wells
  - Abandonment procedures
  - Types of abandonment (open-hole, cased hole
- Decommissioning of offshore wells
  - Permitting and Regulatory Compliance
  - Platform preparation
  - well plugging and abandonment

Key messages

- The production life of an oil field depends on the size of the reservoir, the daily production rate, the economic limits and the decommissioning considerations
- Well abandonment involves removing the downhole equipment; cleaning the wellbore by flushing with fluids; and plugging the well using cement to create multiple impermeable barriers between zones
- Decommissioning of wells is a legal requirement and should be addressed in the Production Sharing Agreement (PSA)
- Decommission of offshore wells is complex and local circumstances dictate whether parts of the structure can be sunk, once cleaned or need to be disassembled and taken onshore
- Planning for decommissioning starts the moment wells and surface facilities are built. Decommissioning is highly cost-intensive and resources need to be set aside during the production life to finance decommissioning.

Add any other take away messages and key lessons for you:

Module 8.2. Environmental Considerations (Decommissioning / Abandonment)

Contents

- Decommissioning oil fields
- Legal requirements in decommissioning
- The Brent Spar case

Key messages

- EIA must include abandonment
- Area decommissioned must be restored to how it was found or in better condition
- Who is responsible and who will pay for the costs of decommissioning must be clearly established before the start of well production
- Closer to actual abandonment, carry out specific EIA with adequate public consultation!

Add any other take away messages and key lessons for you:

Module 9. Environmental Governance in the oil and gas sector

Learning objectives

At the end of Module 9, participants will be able to:

- Demonstrate the importance of good environmental governance, and give examples of international conventions and national legislations, regulations;
- Discuss HSE Audits, its preparation, contents, responsibilities and implementation;
- Identify and prioritize major capacity gaps and needs to strengthen environmental governance in the country.

Experiences and lessons from Myanmar's key environmental policies and legislations related to the oil and gas industry will be presented by ECD. Note down your key take-away messages from this presentation.

Module 9.1. Environmental Regulation in Norway; Environmental Compliance Monitoring (Site visits vs. Audits)

Contents

- Legal framework (environment)
- Principles : precautionary, polluter pays, chemicals substitution, etc.
- Types of environmental regulations relevant to oil and gas industry
- Environmental compliance monitoring
- Site visits vs Audits

Key messages

- It is important to identify chemicals for substitution and replace chemicals of environmental concern.
- Norway categorizes chemicals into 4: **Environmentally acceptable (green), Chemicals that pose little or no environmental risk (yellow), of environmental concern (red) and prohibited (black).**
- It is important to consider not only environmental but also health risks when examining chemicals.
- Regulate chemicals and require ground water monitoring, sampling and analysis.
- It is important for companies treating hazardous waste to have expertise and economic security to ensure proper treatment of waste in case of bankruptcy or cessation of company.

Add any other take away messages and key lessons for you:

Module 9.2. Industry Standards for Compliance Monitoring

Contents

- Good environmental governance
- International conventions
- International guidance
- HSE Audits: Responsibilities, Preparation and Implementation of Audits

Key messages

- There is need for transparency and stakeholders' participation in environmental governance
- Compliance auditing and monitoring must be carried out
- Competent environmental independent authorities/auditors/inspectors are required and tools for sanctions should be put in place
- International conventions on shipping, ozone depletion, biodiversity loss, waste management, chemical management etc. should be complied with. Also, international guidance like from the IFC and IPIECA can help in strengthening good governance
- Type of audit include: external, internal, planned inspections and emergency inspections based on incidents

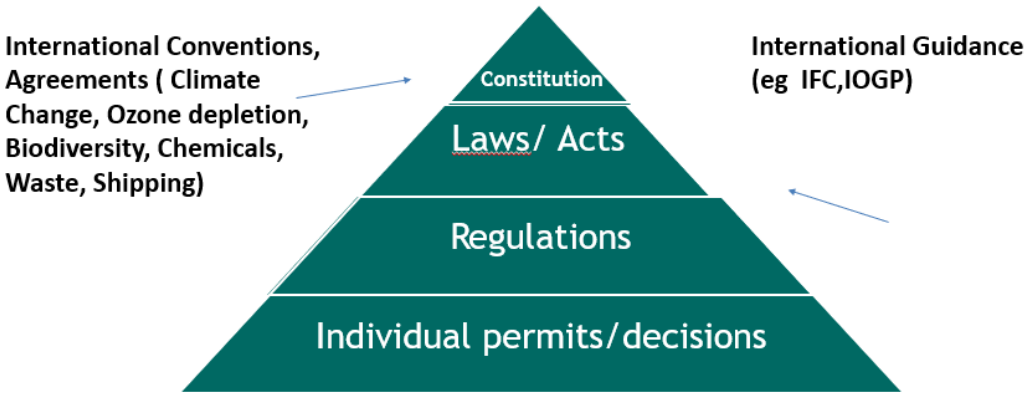


Figure.3. The Governance Pyramid

Add any other take away messages and key lessons for you:

Role Play

Instructions

A foreign oil producer has been awarded an oil/gas block in XXX region. It has determined that oil and gas traps exist and they would like to initiate drilling of one well in XXX. Scoping has been completed and an EIA study for drilling has been initiated. A public consultation meeting has been convened by the XXXRegulator to obtain views from various stakeholders on drilling.

Roles will be assigned to some participants while the remaining participants will act as observers to reflect on:

- Which actors are missing?
- What issues were not mentioned?
- Which are the solutions identified in the meeting which can be moved forwards?

Final Group Exercise: Action Planning

Consider the CHALLENGES identified related to chemicals and waste management in the oil and gas sector in your country.

PRIORITIZE the top three CHALLENGES.

Discuss OPPORTUNITIES or TECHNIQUES for improving chemicals and waste management standards in your work?

IDENTIFY gaps as well as current efforts that are being used in addressing these CHALLENGES.

IDENTIFY solutions and next steps to take to ADRESS these CHALLENGES. What instruments, techniques and agencies will be involved in next steps?

Action planning template

Capacity Challenges and Gaps in environmental management within the oil and gas sector	Current Efforts / Opportunities / Entry Points to address the challenge	Additional actions to be taken	Leading Agency/Ministry
Priority Challenge 1			
Priority Challenge 2			
Priority Challenge 3			

Action Plan Monitoring Form

This form has been developed to help UN Environment and participants monitor their level of progress in the application of knowledge and skill gained as a result of the training.

Participants are requested to use this template to track the level of progress of the 3 priority challenges that have been identified during the training. Periodically, they are to fill in the steps they take or initiate towards achieving the proposed solutions to these challenges and gaps as well as the outcome where applicable.

This form is to be submitted **4 months** after the training by email to: (insert email address here).

Action Plan Monitoring Form				
Challenges	**Current Efforts**	**Gaps**	**Proposed solutions / Lead Agency(ies)**	**Steps taken towards achieving proposed solutions**
Priority Challenge 1				
Priority Challenge 2				
Priority Challenge 3				

Annexes

1. API (2012) Environmental Protection for Onshore Oil and Gas Production Operations and Leases. Accessed from https://www.api.org/~/media/Files/Policy/Exploration/API_RP_51R.pdf
2. Darko E (2014) Short guide summarizing the oil and gas industry lifecycle for a non-technical audience. Overseas Development Institute, London. Accessed from https://assets.publishing.service.gov.uk/media/57a089efed915d3cfd0004d4/Short_guide_summarising_the_oil_and_gas_industry_lifecycle-43.pdf
3. IFC, IPIECA, and UNDP (2017) Mapping the Oil and Gas Industry to the Sustainable Development Goals. Accessed from http://www.ipieca.org/resources/awareness-briefing/mapping-the-oil-and-gas-industry-to-the-sustainable-development-goals-an-atlas/
4. IFC (2012) IFC Performance Standards on Environmental and Social Sustainability. Accessed from https://www.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES
5. IFC (2007) Environmental, Health and Safety General Guidelines. Accessed from https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final+-+General+EHS+Guidelines.pdf?MOD=AJPERES
6. IFC (2015) Environmental, Health, And Safety Guidelines For Offshore Oil And Gas Development. Accessed from https://www.ifc.org/wps/wcm/connect/f3a7f38048cb251ea609b76bcf395ce1/FINAL_Jun+2015_Offshore+Oil+and+Gas_EHS+Guideline.pdf?MOD=AJPERES
7. IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 1-19. https://wg1.ipcc.ch/srex/downloads/SREX-All_FINAL.pdf
8. IPCC (2012). Summary for Policymakers. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Cambridge University Press, Cambridge, UK, and New York, NY, USA. https://wg1.ipcc.ch/srex/SREX-SPM_FINAL.pdf
9. IPIECA (2015) Response strategy development using net environmental benefit analysis (NEBA): Good practice guidelines for incident management and emergency response personnel Accessed from http://www.ipieca.org/resources/good-practice/response-strategy-development-using-net-environmental-benefit-analysis-neba/
10. IPIECA (2012) Sensitivity mapping for oil spill response: Good practice guidelines for incident management and emergency response personnel Accessed from http://www.ipieca.org/resources/good-practice/sensitivity-mapping-for-oil-spill-response/
11. IUCN (2009). Environmental guidance note for disaster risk reduction. https://www.iucn.org/sites/dev/files/content/documents/2013_iucn_bookv2.pdf
12. Joint E & P Forum / UNEP (1997) Environmental Management in Oil and Gas Exploration and Production. Accessed from https://wedocs.unep.org/bitstream/handle/20.500.11822/8275/-Environmental%20Management%20in%20Oil%20&%20Gas%20Exploration%20&%20Production-19972123.pdf?sequence=2&isAllowed=y
13. Laurance et al (2015) Reducing the Global Environmental Impacts of Rapid Infrastructure Expansion. Accessed from https://www.sciencedirect.com/science/article/pii/S0960982215002195
14. Liu et al (2014) Assessing Oil Spill Risk in the Chinese Bohai Sea: A Case Study for both Ship and Platform related Oil Spills. Accessed from https://www.sciencedirect.com/science/article/pii/S0964569114002671
15. NOAA (2002) Environmental Sensitivity Index Guidelines. Accessed from https://response.restoration.noaa.gov/sites/default/files/ESI_Guidelines.pdf
16. Norwegian Petroleum Directorate (2013) Environmental and Climate Considerations in the Norwegian Petroleum Sector. Accessed from http://www.npd.no/global/engelsk/3-publications/facts/facts2013/figures/chapter-09/chapter-9.pdf

17. OECD (2007) Monitoring (Environmental). Accessed from https://stats.oecd.org/glossary/detail.asp?ID=1684
18. Schneider et al. (2011) Achieving Conservation when Opportunity Costs are High: Optimizing Reserve Design in Alberta's Oil Sands Region. Accessed from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0023254
19. STRONGER (2017) 2017 Guidelines Accessed from https://www.strongerinc.org/guidelines/
20. UNEP (2004) Environmental Impact Assessment and Strategic Environmental Assessment. Towards an Integrated Approach. Accessed from https://unep.ch/etb/publications/EnvImpAss/textONUBr.pdf
21. UNEP (2011) Environmental Assessment of Ogoniland. Accessed from https://postconflict.unep.ch/publications/OEA/UNEP_OEA.pdf
22. UNEP-WCMC (2018) Assessing Environmental Impacts - A Global Review of Legislation. Accessed from https://www.unep-wcmc.org/resources-and-data/assessing-environmental-impacts--a-global-review-of-legislation
23. UNISDR (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf
24. World Bank (2013) Extracting Lessons on Gender in the Oil and Gas Sector. Accessed from http://documents.worldbank.org/curated/en/266311468161347063/pdf/798940NWP0280E0Box0379795B00PUBLIC0.pdf

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