COST Action - ES1405

Marine gas hydrate - an indigenous resource of natural gas for Europe

WG3 **Environmental challenges**

First annual report

(updated on 18 November 2015)

WG 3 will review the environmental challenges associated with methane production from gas hydrates. Environmental risks are moderate compared to other deep-water operations since gas hydrates and the associated formation fluids do not contain toxic substances. Moreover, blow-outs are not a concern since gas hydrate deposits have low in-situ pressures and are maintained at or below hydrostatic pressure during the entire production process. However, gas hydrates can constitute environmental risks by affecting seafloor stability and releasing methane into the water column. Sediments deposited at continental slopes are in some cases stabilized by gas hydrates cementing the grain fabric. Gas production from these deposits may induce slope failure causing severe damage to seabed installations and benthic ecosystems and methane gas emissions into the marine environment. Leakage of methane gas may also occur during the production process since the overburden sealing the gas hydrate deposits from the marine environment has a thickness of only a few hundred meters. WG 3 aims to define an environmentally sound monitoring strategy and assess whether the legal framework regulating the exploitation of offshore oil and gas deposits needs to be adjusted to account for the specific environmental risks associated with the gas production from hydrates. To achieve the aims of WG 3 its participants will:

- Assess how slope stability may be compromised by gas production from hydrates under different geological boundary conditions
- Identify suitable precursors for slope failure to be targeted in a monitoring program
- Develop a generic strategy for environmental baseline studies and the environmental monitoring of gas production from hydrates
- Develop a specific environmental baseline and monitoring program for the planned production test
- Evaluate whether national legal frameworks regulating offshore oil & gas production are appropriate for gas production from hydrates using Norway as a case study

During the first year of the project the hazards related to gas hydrate production has been identified and discussed.

The identified hazards have been classified in three categories as follow:

1. SEABED DEFORMATION HAZARD
2. GAS RELEASE HAZARD
3. PRODUCTION RELATED HAZARD

1 Seabed deformation hazard

The gas hydrate production can have small (seismicity, hydrate dissociation…) and large (sliding, seismicity….) impact on the seabed deformation. The geomechanical properties change of sediments (related to gas hydrate concentration) due to production should be stressed in the report. Other effects that should be considered are: morphology of seafloor, shallow hydrate info, temperature changes…. We need to mention that we do not consider climate change because of different time scale. This hazard will be developed by UMBERTA, MICHELA, FEDERICO, ILARIA, CHRIS, others?

2 Gas release hazard

We can graph the gas release hazard considering areal/temporal extent (diffusive and/or bubbles) versus gas release rate. The cases that we will discuss should be summarized in few cases. The following points will be developed: ecosystem (benthos and water column), atmosphere (climate change), temperature (related to type of gas solubility), sea water chemical and physical properties change (salinity and PH of water), acidification of sea, potential release in the atmosphere, etc. The concentration of chemical exposition is important in order to evaluate the damage on the microbial community and fauna/flora (i.e. mammals). This hazard will be developed by ANA, LIVIO, FATIMA, FEDERICO, CINDY, GAVIN, ANNA, KEITH, others?

3 Production related hazard

State of the art about type of production (thermal, depressurization, inhibitor) should be summarised. The following topics should be considered: chemical inhibitor release, contamination, mechanical changes, reservoir simulation, wellbore integrity,... Possible effects: subsidence, blowout, ... To fill this point, the WG2 will be contacted to integrate the missed information. Japanese experiences and SUGAR reports (link provided by PEER) can be the starting point. This hazard will be developed by ANA, FATIMA (others?) in collaboration with WG2.

In addition, it is important to consider the safety of operators during production and the legal regulation that can be applied to gas hydrate production, considering that the gas hydrate reservoirs are shallower than conventional reservoirs. The regulation about conventional gas should be considered as starting point. For example, the Norwegian Petroleum Department (NPD) acknowledges the presence of unconventional oil and gas on the Norwegian Continental Shelf, including gas hydrates. However, in the NPDs view these resources are not especially suitable for production due to the size and physics of the hydrate reservoir. Since none of the unconventional oil and gas resources in Norway are viewed as very suitable to production by the NPD, there are no laws or regulations directly aimed for these resources. Thus, in Norway the law applying to these resources would be the general law on petroleum activity. We can include in the report some consideration about Italian regulation of conventional and no conventional gas production. It is also important to include definitions and the main points of the EU directives in which only the shale gas is considered as unconventional resource. What can change in regulation if hydrate will be considered a resource? This point will be completed by ROBERTO, HELLE, CLAUDIA, ILARIA, others?

Conclusions

A multidisciplinary group (lab, field and modelling expertise) is required to predict and describe the possible scenario. Graphs and tables should be produced to summarize the hazards and their effects. We need to be clear about the negative consequences.

Further activities

Next year WG3 will focalize the attention on monitoring activities, such as modelling, in order to evaluate the level of risks.

References

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