Geophysical Research Abstracts,
Vol. 11, EGU2009-302-1, 2009
EGU General Assembly 2009

Risk factors of methane hydrate resource development in the concentrated zones distributed in the eastern Nankai Trough

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Some environmental and safety concerns on the offshore methane hydrate development have been raised, but the ground of such allegations are sometime not fully reasonable. The risks of methane hydrate resource development to environment and safety should be discussed upon methane hydrate occurrences condition, the production methods, and the designs of production system, under comprehensively scientific manners.

In the Phase 1 of the Methane Hydrate Exploitation Program in Japan (FY2001-2008), the Research Consortium for Methane Hydrate Resources in Japan (MH21 Research Consortium) found methane hydrate concentrated zones in the eastern Nankai Trough that are potential prospects for resource development. The concentrated zones are consisted of turbidite-derived sandy sediments and hydrate crystals in pore spaces of sand grains (pore-filling type structure). The MH21 Research Consortium proposed the depressurization method as prime technique due to its efficiency of gas production in such concentrated zones, and has tried to develop conceptual designs of production systems based on the information of existing devices and facilities.

Under the condition and circumstances described above, the authors tried to extract and evaluate some risk factors concerning methane hydrate development using depressurization in the area.

Leakage of methane gas, that is less harmful substance to ecosystem than heavier hydrocarbons, from production system can be one possible risk. However, in the case of gas production through wellbore, even if catastrophic damages happen in the subsea production system during gas production, the leakages do not continue because the borehole could be filled by seawater and depressurization is stopped immediately.

Another possible risk is a leakage of produced gas through seafloor. If methane hydrate production makes high pressure or temperature zones in sediments, the risk should be considered. However, depressurization method makes opposite condition, low pressure.

Deformation and subsidence of the sea floor may be unavoidable but does not cause serious concern on the safety. Some have argued that hydrate dissociations in wide area may cause landslide due to weakened formation by dissociation. To manage the concern, the test site should be chosen carefully and formation property alternation should be well known.

One common misunderstanding widespread in public is that methane hydrate is “unstable material.” Indeed, the hydrate is stable in the original temperature and pressure conditions, and the endothermic process of hydrate dissociation leads negative feedback to the formation conditions from the altered states by artificial depressurization. Also the hydrate dissociation in the sandy sediments is governed by relatively slow heat and fluid transport phenomena in porous media, so the process is gradual. Therefore, a catastrophic chain reaction which many people imagine is surely unlikely.

As mentioned above, at present, risks of methane hydrate resource development in the concentrated zones distributed in the eastern Nankai trough are not significant, and comparable or less serious than conventional oil and gas production, we concluded. Of course, this evaluation should be verified with offshore production tests in

the future, and new knowledge should be reflected to the safe and environmentally friendly production system designs. The nature of unconsolidated formation after the hydrate dissociation is key issue of such investigation. MH21 consortium has studied the issue in many aspects, and will continue the investigation.