

ENVIRONMENTAL IMPACTS OF THE OIL AND GAS PLATFORM DECOMMISSIONING

DAMPAK LINGKUNGAN DARI DEKOMISIONING ANJUNGAN LEPAS PANTAI MINYAK DAN GAS BUMI

R. Desrina*), Chairil Anwar, and Tri Muji Susantoro

“LEMIGAS” R & D Centre for Oil and Gas Technology

Jl. Ciledug Raya, Kav. 109, Cipulir, Kebayoran Lama, P.O. Box 1089/JKT, Jakarta Selatan 12230 INDONESIA

Tromol Pos: 6022/KBYB-Jakarta 12120, Telephone: 62-21-7394422, Facsimile: 62-21-7246150

E-mail: desrinad@lemigas.esdm.go.id., E-mail: chairila@lemigas.esdm.go.id., E-mail: trimujis@lemigas.esdm.go.id

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ABSTRAK

Banyak anjungan minyak dan gas bumi yang berada di Laut Indonesia sudah mendekati akhir masa produksi yang ekonomis. Umumnya, ladang minyak dan gas bumi mempunyai masa ekonomis selama 20 hingga 40 tahun. Diperlukan program dekomisioning dan diperkirakan mencapai puncaknya pada periode 2010-2020. Beberapa anjungan terletak di perairan dangkal misalnya sekitar Pulau Seribu, Laut Jawa, dan Laut Cina Selatan; beberapa lainnya terletak di perairan yang lebih dalam misalnya di Selat Makasar dan Laut Maluku. Terdapat berbagai pendapat tentang keuntungan dan persoalan berkaitan dengan pengangkatan anjungan secara parsial atau secara menyeluruh. Dalam beberapa hal anjungan menjadi tempat pemancingan ikan yang bagus. Akan tetapi, di lain hal bahaya yang tidak terlihat dapat berasal dari anjungan tersebut. Meskipun dilakukan pengangkatan anjungan secara menyeluruh namun bila tidak disertai dengan pembersihan dasar lautan secara sempurna bekas anjungan tersebut masih dapat menimbulkan bahaya. Untuk pengelolaan lautan di luar batas teritorial, berbagai negara di dunia banyak yang mengikuti konvensi dan persetujuan secara internasional. Konvensi dan persetujuan internasional yang berada di bawah payung Perserikatan Bangsa-Bangsa antara lain adalah Konvensi Genewa, Konvensi Perserikatan Bangsa-Bangsa tentang Hukum Laut (UNCLOS) dan Organisasi Maritim Internasional (IMO). Secara nasional, sangat sedikit informasi yang dapat diperoleh tentang proyek dekomisioning. Tulisan di dalam makalah ini dimaksudkan untuk memberikan gambaran tentang opsi dekomisioning anjungan lepas pantai, dampak-dampak lingkungannya, dan regulasi-regulasi yang dapat diacu untuk suatu usulan dekomisioning. Aspek teknologi tentang dekomisioning dari struktur anjungan berada di luar lingkup makalah ini.

Kata kunci: Lingkungan, anjungan, dekomisioning, minyak dan gas

ABSTRACT

Many of the oil and gas installations in the Indonesian Sea are reaching the end of their economic production life. Typically, oil and gas fields have an economic life of 20 to 40 years and a decommissioning program will be required and predicted to peak during the period 2010-2020. Some of them are located in shallow water such as those around Pulau Seribu, Java Sea, and South China Sea; some others are in deeper water such those at Makasar Straits and Moluccas Sea. Many different opinions exist on the benefits and problems of a partial platform removal or a complete removal. For some reasons platforms would be a good fishing spot. On the other hands, an unseen hazard could be left behind by the platforms. Even a complete removal of the platforms is conducted but without proper clearing of the ocean floor, the unused platforms still can cause hazards. For the management of the seas outside the territorial waters, worldwide nations have historically entered into international agreements and conventions. These agreements and conventions that have been entered into under the umbrella of the United Nations are Geneva Convention, the United Nations Convention on the Law of the Sea (UNCLOS) and the International Maritime Organization (IMO)

*Peneliti Madya PPPTMGB "LEMIGAS" & Staf Dosen Jur. Teknik Perminyakan FTKE USAKTI

Guidelines. Nationally, there is little information concerning with the decommissioning project. This paper is intended to highlight options for decommissioning of offshore platforms, its environmental impacts, and regulations that could be referred to following the decommissioning proposal. The technological aspects of the structural decommissioning of platforms are beyond the scope of this paper.

Keywords: Environment, platforms, decommissioning, oil and gas

I. INTRODUCTION

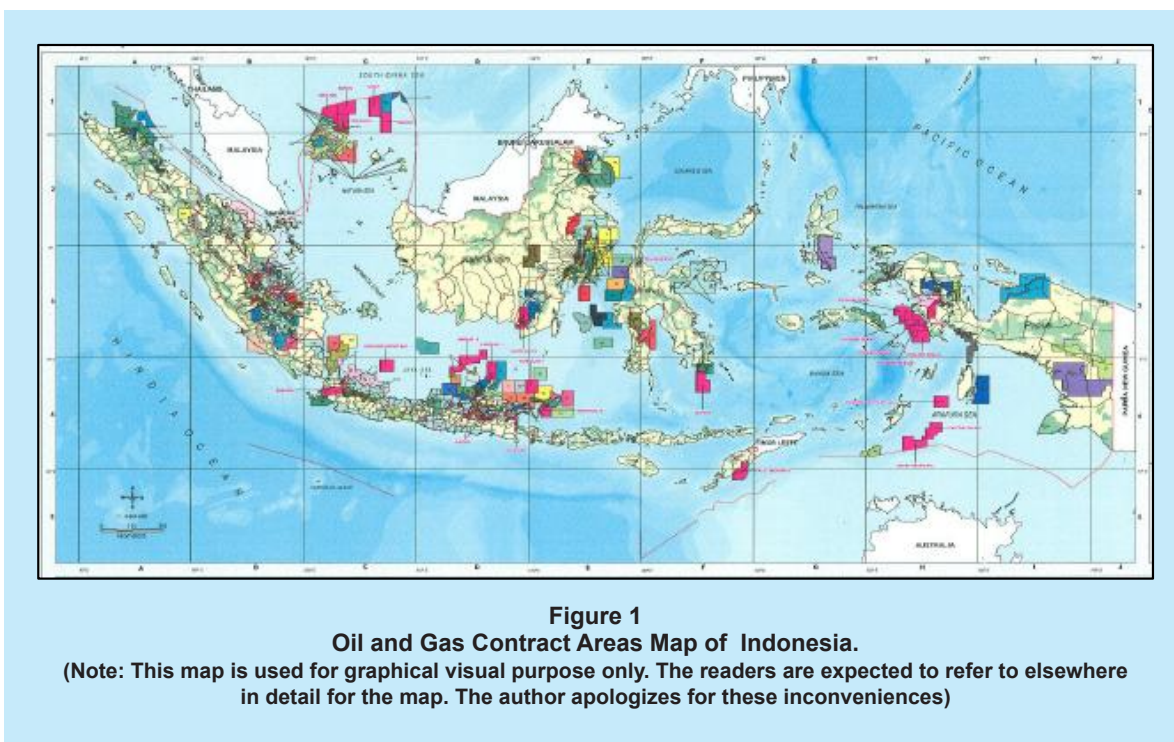
Many of the oil and gas installations in the Indonesia Sea are reaching the end of their economic production life. There is hundreds of oil and gas platforms that have been installed and spread off over the Indonesia Sea (cf. Figure 1). Many of them were installed in 1970's and are reaching the end of their service lives. Typically, oil and gas fields have an economic life of 20 to 40 years and a decommissioning program will be required and predicted to peak during the period 2010-2020. Some of them are located in shallow water such as those around Pulau Seribu, Java Sea, and South China Sea; some others are in deeper water such those at Makasar Straits and Moluccas Sea.

Beside the steel structures (cf. Figure 2), oil and gas platforms commonly consist of drilling cutting pile which could be leaved *in situ* or removed. The drill cuttings are usually discharged into the sea adjacent to the platforms and although some of the drilling muds are recovered and re-used, some adhere to the cuttings and are also discharged.

The removal of offshore platforms as artificial reefs has been viewed as a potential benefit as well as a hazard. Recent platform decommissioning and removals have raised concerns by local governments and local populations, specifically by recreational and commercial fishermen who are concerned about the loss of fisheries and potential physical hazards.

Many different opinions exist on the benefits and problems of a partial platform removal or a complete removal. A partial removal consists of removing those portions of the structure that are located above sea level and some portion of the structure sub sea. For some reasons there would be a good fishing spot. On the other hands, however, an unseen hazard could be left behind. Even a complete removal without proper clearing of the ocean floor can cause hazards⁽¹⁾.

Until recently, decommissioning is still a part of the industry that received little attention. It was a problem that most operators wished would just go away because there appeared to be no benefit to decommissioning⁽²⁾. If this attention were left as it is, we could not imagine what would happen with



the platforms that were abandoned without any rearrangement.

For the management of the seas outside the territorial waters, nations have historically entered into international agreements and conventions. These agreements and conventions have been entered into under the umbrella of the United Nations such as: Geneva Convention, the United Nations Convention on the Law of the Sea (UNCLOS) and the International Maritime Organization (IMO) Guidelines.

Nationally, there is little information concerning with the decommissioning project. This paper is intended to highlight options for decommissioning of offshore platforms, its environmental impacts, and regulations that could be referred to following the decommissioning proposal. The technological aspects of the structural decommissioning of platforms are beyond the scope of this paper.

II. DECOMMISSIONING OPTIONS FOR OFFSHORE PLATFORMS

Depending on legislation, a number of options may be available for platform decommissioning⁽³⁾:

- Reuse for oil and gas purposes
- Complete removal
- Partial removal
- Deep water disposal
- Leave in place - abandonment
- Reuse for other purposes e.g. artificial reef

Below, Figure 3 depicts a diagram of dismantling and abandonment options for offshore installations. There have been newer techniques that give alternative ways to reduce decommissioning expenditures. Nevertheless, the costs for decommissioning services and equipment are currently increasing. In addition, the cost for fabricating new structures is also increasing. It is, therefore, one current trend for compensating costs is to reuse a portion or all of the offshore facility. Alternative idea of reuse has primarily been implemented in the Gulf of Mexico. Many operators are considering this option in other locations, such as Southeast Asia.

Another possibility for facility reuse is the use of old platforms for functions besides oil and gas production. Some conceptual applications that have been suggested are the conversion of offshore

structures into fish farms, prisons, or small military camp. Artificial reefs made from decommissioned oil and gas structures have been popular with sports fisherman and divers in the Gulf of Mexico.

From the techno-economic point of view, for larger structures and deeper they are located more appropriate to leave them totally or partially intact. In shallow waters, however, total or partial structure removal would be more likely. The fragments can be taken to the shore, buried, or reused for some other purposes.

From the fisheries perspective, many suggestions



Figure 2
Structural Removal of Oil
and Gas Platform Decommissioning

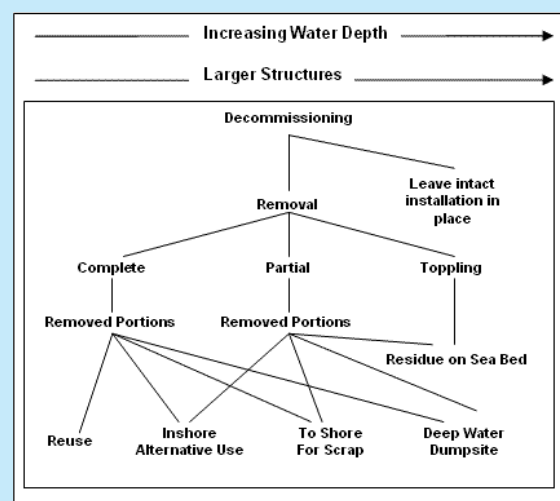


Figure 3
A diagram of dismantling and abandonment
options for offshore installations⁽³⁾

are made to convert the fixed marine structures into artificial reefs. Artificial reefs are known to be one of the most effective means of increasing the bioproductivity of coastal waters by providing additional habitats for marine life. They are widely and effectively used on the shelves of many countries⁽⁴⁾.

The offshore structures can attract many species of migrating invertebrates and fish searching for food, shelter, and places to reproduce. This phenomenon has been observed in the Gulf of Mexico that showed a strong positive correlation between the amount of oil platforms and commercial fish catches in the region. The growth of the fish catch in this case was connected with their redistribution due to the reef effect of the platforms. Besides, the areas around the platforms became very popular places of recreational and sport fishing. This also made a significant contribution to the total catch volumes. Wide popularization of this fact led to the mass movement using the slogan "From rigs to reefs" in the USA in the mid of 1980s.

III. ENVIRONMENTAL ASPECTS

In the shallow waters, the strong tidal currents disperse the drill cuttings and any environmental impacts from their discharge rapidly disappear. In the deeper waters, however, tidal currents are much weaker and the drill cuttings could be accumulated around the platforms from which they have been discharged. These accumulations are called "cuttings piles", which may contain as much as 40,000 tones of contaminated sediment.

Formerly, drilling muds were based on diesel oil which has a relatively high content of toxic aromatic compounds. Adverse effects of these cuttings discharges on the ecology of the adjacent sea bed may extend out to more than 5 km from the point of discharge. Early concern about the environmental effects of these oil based drilling muds has led to replacement of oil based cuttings with less toxic.

These piles of contaminated sediment can remain toxic to marine life up for 20 or more years after discharge. It is unfortunately that there is no proven technology that could cleanly remove the large amounts of heterogeneous sediments from the deep water. For example, the seriousness of this problem was recognized by the UK Offshore

Operators Association (UKOOA) that have examined the environmental impacts of drill cuttings and the options for their management⁽⁵⁾.

Although abandoned platform has significant benefit for the surrounding society, it should be noted, however, the possible negative impacts of this installation. At the same time, there would be danger that abandoned offshore oil platforms and their fragments pose to navigation and trawling fishing. With an abundance of such artificial reefs, this problem requires special regulations such as mapping the area to indicate the locations of platforms, underwater pipelines, and other structures left on the bottom. The regulation should also include monitoring, collecting data, developing a warning system, and other activities necessary to control the situation and ensure safety in the region.

Complete or partial removal of steel or concrete fixed platforms that weigh thousands of tons is practically impossible without using explosive materials. Bulk explosive charges have been used in 90% of cases. Short-term impact on the marine environment and biota should not be neglected. It is not easy to get estimates of possible mortality of marine organisms, especially fish during an explosive activity. Nevertheless, some calculations show that with a 2.5-ton (TNT equivalent) charge, the mass of killed fish will be about 20 tons during each explosion. One of the observations of fish damage in zones of explosive activity was done in 1992 in the Gulf of Mexico. Removal over 100 fixed platforms and other structures using more than 12,000 kg of explosives showed the significant amount of dead fish floating on the surface. It was totaled to about 51,000 specimens.

During the removal of the offshore installations the hazardous contents, such as hydrocarbons and chemicals may be spilled into the environment. However experience has shown that work procedures can be implemented to effectively contain, remove and dispose of such residues.

III. DISCUSSION ON THE EXISTING PLATFORMS AND REGULATIONS

A. Regulation

The process of decommissioning is very strictly regulated by international, regional, and national legislation. Generally all oil and gas installations

shall be entirely removed when these structures are being abandoned and become disused. There is an exception, however, that it may be considered to leave parts of these structures in place. Factors that should be taken as considerations are: safety to navigation, environment, the fishing industry and risks associated with removal or leaving these structures partially in place⁽⁶⁾.

Formerly, according to the Convention on the Continental Shelf (Geneva, 1958) and the United Nations Convention on the Law of the Sea (Montego Bay, 1982), decommissioning and removal of abandoned offshore installations have to be removed totally. However, due to the extremely high cost of decommissioning and removal of offshore installations, some of the national and international regulations have been revised.

It suggests immediate and total removal of offshore structures (mainly platforms) weighing up to 4,000 tons in the areas with depths less than 100 m. In deeper waters, removing only the upper parts from above the sea level to 55 m deep and leaving the remaining structure in place is allowed. The removed fragments can be either transported to the shore or buried in the sea. This approach considers the possibility of secondary use of abandoned offshore platforms for other purposes.

On a national level, many European Countries have an extensive system of legislation to regulate the offshore oil and gas installations that are present within their continental shelves. The respective national administrations have incorporated the international conventions and agreements into their national legislation, and taking these conventions and agreements as establishing minimum requirements.

Indonesia has signed UNCLOS on Desember 10, 1982, and ratified UNCLOS through National Act No 17/1985⁽⁷⁾. As a member of UNCLOS, Indonesia has responsibility to prevent, minimize, and control of sea pollution as well as establishing safety procedure during and after operation of oil and gas platforms. The consequences of being a member of UNCLOS, the Oil and Gas Contractors operating in Indonesia especially those located at offshore area have responsibility to conduct what is so called Abandonment and Site Restoration (ASR) at post operational phase. Not following this regulation, Indonesia would receive sanction

according to the International Law. This should be seriously considered for platforms located at the national border such as those at South China Sea and Indonesia-Australia border.

There is very few information concerning platform decommissioning in Indonesia. Related with the decommissioning projects in Indonesia, as the author's perspective, there are at least four institutions that should be involved. These institutions are Ministry of Environment, Ministry of Energy and Mineral Resources (cq. Directorate General of Oil and Gas), Ministry of Transportation (cq. Directorate General of Sea Transportation), and Ministry of Ocean and Fishery.

Ministry of Energy and Mineral Resources has published a Ministerial Regulation concerning with the platform decommissioning through a decree No. 01/2011 describing The Technical Guidance for Dismantling of Oil and Gas Offshore Installation⁽⁸⁾. Upon the relinquishment or abandonment of any field or well, or of a offshore Production Sharing Contractor (PSC), the PSC contractors must remove all equipment in a manner acceptable to the Minister, as well as all necessary site restoration activities. The PSC contractor is obligated to provide reserve funds for the abandonment and site in a joint account with the government through the Minister.

Article 3 of the guidance states five purposes for dismantling of the offshore installation. Beside of the beneficiary for oil and gas activities, other activities have to be considered such as environmental protection, safe navigation, and optimization uses of national properties.

As an example, for the environmental protection, the Government Regulation (*Peraturan Pemerintah*, PP) No. 19/1999 describing Sea Pollution And/ Or Destruction Control could be referred to. There are articles that indirectly regulate platform decommissioning, such as Dumping, which are described in Chapter VIII, Article 18⁽⁹⁾. It is therefore, any platform decommissioning project should follow partially or completely this Government Regulation.

Other institutions such as the Ministry of Transportation and the Ministry of Oceanology and Fishery would give suggestion on the benefit or hazard of the platforms being removal. These would be in parallel to the Article 3 of the Ministerial

Guidance No. 01/2011 as stated above. Such suggestion would be route and safety navigation that could be influenced by the project. While the use of an artificial reef could be suggested by Ministry of Oceanology and Fishery coordinated with the local provincial government.

B. Oil and Gas Platforms in Indonesia Offshore Areas

As depicted in Figure 1, oil and gas platforms are spread of over the Indonesia sea. The shallowest offshore area seems to be in Java Sea, Malacca Strait, and South China Sea, which are located at Sunda Shelf. Those having deeper water are in Strait of Makassar and Moluccas Sea (cf. Figure 4)⁽¹⁰⁾. Average depths of Java Sea are around 120 meters, while those of the deeper sea such as Makassar Sea and Moluccas Sea are deeper than 2000 meters. It is therefore, the decommissioning options for the oil installations located in those locations would be different depending on the depth of the sea.

According to the international convention, the platform decommissioning located at the sea having depth less than 100 meters is suggested to immediate and total removal of the structures. Nevertheless, the project proposal could be adjusted depending on the ship navigation and the possible benefit for fishery. As an example, platforms that located at Java Sea could possibly be used as artificial reefs. This would be a participation of the local or provincial government; in this case they are DKI Jakarta and West Java Provincial Government, to take part in making policy for the use of such platforms.

Feasibility and environmental study on the use of such platforms has to be conducted with the initiatives of the provincial government. The environmental study is conducted to predict impacts from full or partial platform removal and from depositing platform components offshore, to develop guidelines and processes for use during removal, and to ensure adequate cleanup afterwards.

The environmental setting for the platform decommissioning would include several factors. Such factors among others are oceanographic conditions, seabed, marine life, fishing and aquaculture,



Figure 4
Morphology of Indonesia Sea Bed⁽⁷⁾

infrastructure, cultural and amenity value, nearby coasts and resources, and protected as well as conservation sites value⁽¹¹⁾.

Meanwhile, for the platforms located in the deeper water, such as those in Makassar Strait, Moluccas Sea, and others, the decommissioning program could follow the international law. It is noted that artificial reefs by leaving or emplacing structures on the seabed of such deeper water will have very limited environmental or socio-economic benefits⁽⁵⁾. IMO Guidelines for the Removal of Offshore Installations that establish minimum requirements to ensure safety of navigation could be referred to. Platforms exceeding the limits (standing in less than 100 meters of water and weighing less than 4000 tons) would need to be cut off to allow 55 meters free water column above the remains.

V. CONCLUSIONS AND RECOMMENDATION

There are hundreds of oil and gas platforms that have been installed and spread off over the Indonesian Sea. Many of them were installed in 1970's and are reaching the end of their service lives. Typically, oil and gas fields have an economic life of 20 to 40 years and a decommissioning program will be required and predicted to peak during the period 2010-2020.

A number of options may be available for platform decommissioning, namely: reuse for oil and gas purposes, complete removal, partial removal, deepwater disposal, leave in place – abandonment, reuse for other purposes e.g. artificial reef. Although abandoned platform has significant benefit for the surrounding society, it should be noted the possible

negative impacts of this installation. At the same time, there would be danger that abandoned offshore oil platforms and their fragments pose to navigation and trawling fishing.

The platform decommissioning would depend on the legislation that should be followed. As stated in the Article 3 of the Ministerial Regulation No. 01/2011, beside of the beneficiary for oil and gas activities, other activities have to be considered such as environmental protection, safe navigation, and optimization uses of national properties. The legislation body for those purposes would at least involves four institution, i.e.: the Ministry of Environment, the Ministry of Energy and Mineral Resources, the Ministry of Transportation, and the Ministry of Oceanology and Fisheries. In addition, since Indonesia has been a member of UNCLOS, the international provisions has also to be seriously considered in order not to be sanctioned by the International Law.

Nationally, there is little information concerning with the decommissioning project of oil and gas offshore platforms as well as its regulation. It is, therefore, recommended to the government regulator to establish a national regulation, which describes an integrated guidance that could be referred to not only by the oil company but for the provincial government for the offshore oil and gas platform decommissioning proposal.

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