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Dismantling Yard Readiness Assessment for Indonesia'sPlanned Offshore Structural Decommissioning: Case of MEI Handil Yard

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Abstract

In Indonesia, over 600 offshore oil and gas platforms have been erected, and over half of them will be removed in the next years. According to an earlier study, there is no Indonesian yard suited to execute onshore decommissioning operations, either in terms of permits or supporting infrastructure; thus, dismantling yard evaluation is required to receive and securely process decommissioned structures and equipment. The goal of this research is to create a set of recommendations for the yard owner in order to improve the yard's readiness as an onshore decommissioning processing facility for the planned oil and gas offshore platform decommissioning project. In this study, a case study of PT Meindo Elang Indah Handil Yard was compared to a reference of well-established dismantling yard for decommissioning.. The study began by identifying the possibility of onshore decommissioning work for the current yard facilities, notably the quay and other supporting facilities such as the dismantle yard and waste processing facilities. Following that, a yard modernization evaluation was carried out to establish the best location for turning the facilities into a decommissioning yard. The results show that the yard's primary facilities are comparable to those of a well-established yard, as both can moor barges and large lift vessels with comparable quayside depth (HLV). The load-out capacity, however, is less than that of the reference yard. Because the Handil Yard serves as the shore-based location for offshore oil and gas services for surrounding installations, it offers temporary storage for hazardous and nonhazardous wastes. The work area and placement of the yard's waste management facilities are also determined.

Keywords:*Decommissioning, Offshore Platform, Yard Assessment, Dismantling Yard*

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I. INTRODUCTION

In the South East Asia region, thousands fixed oil and gas offshore infrastructure has been installed. As indicated in Figure 1, Indonesia has over 600 offshore oil and gas platforms, of which approximately half must be retired in the coming years. Approximately one hundred offshore structures were designated as outdated and no longer usable for oil and gas production (Media Indonesia, 2021). In November 2022, one of these old offshore platforms, Attaka EB, was decommissioned (OG Indonesia, 2022).

The Government of Indonesia (GOI) will design a plan for the decommissioning of obsolete offshore fixed structures during the next seven years. While regulators and operators create protocols and laws for offshore platform decommissioning, it is equally critical to guarantee that onshore facilities are available to collect and securely treat retired structures and equipment. In Indonesia, there is currently no facility designated as an offshore platform decommissioning yard. The current yard is facing issues in planning for the prospect of numerous future decommissioning initiatives, both in the country and in Southeast Asia.

In light of this context, the objectives of the study are to review the available criteria and standard for safe and sustainable dismantling yard of decommissioned offshore structures, to identify existing potential facility in Indonesia for safe and sustainable dismantling yard of decommissioned offshore structures, and to evaluate the selected yard in Indonesia against the available criteria and standard. This research is expected to help improve yard preparation for onshore decommissioning not only in Indonesia, but also throughout Southeast Asia. The key steps of an onshore disposal yard include hazardous material inventory mapping, offloading, hazardous waste decontamination, deconstruction/demolition, and waste management (CRF Consultants, 2016).

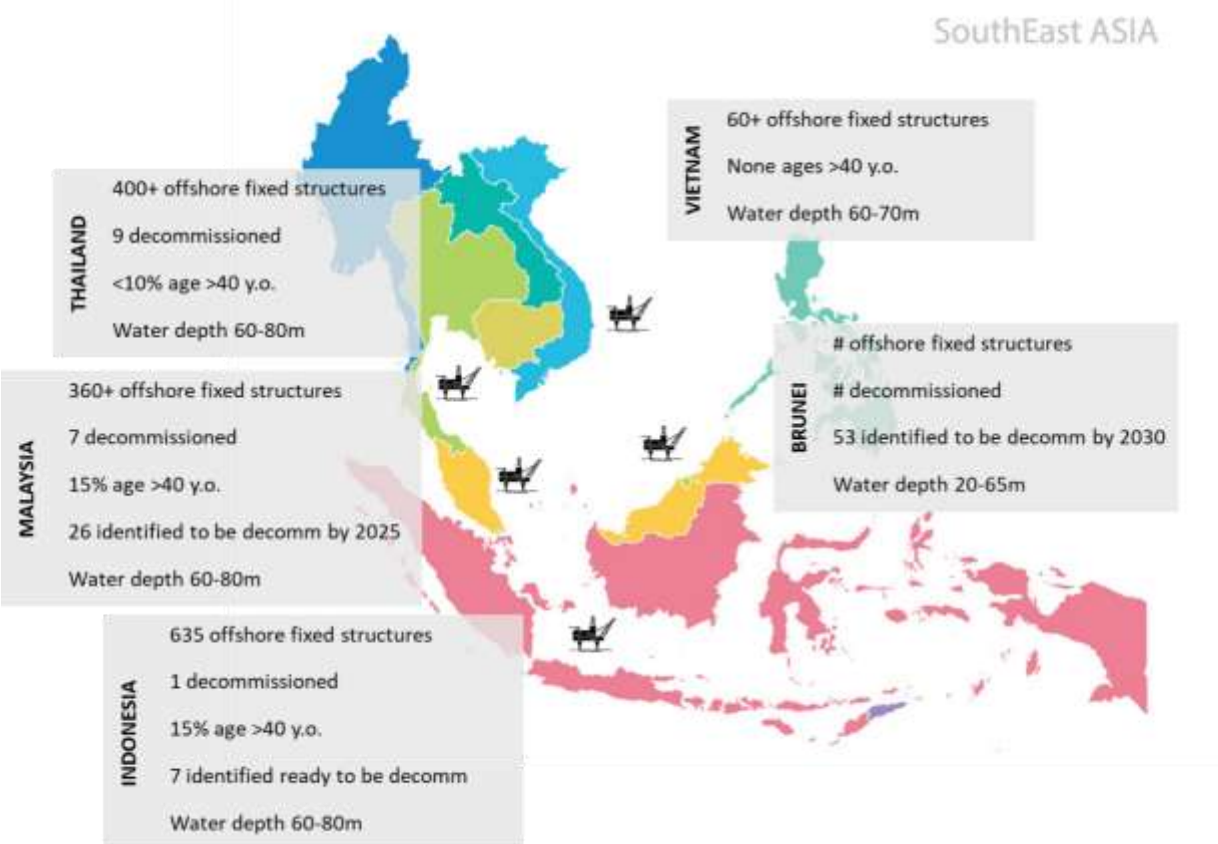

Figure 1. Fixed Offshore Installation in South East Asia (from Zawawi (2021) with updates)

Before any onshore dismantlement and disposal work begins, a series of surveys, inspections, and risk assessments, including hazardous waste inventory mapping, are carried out. This information provides the operator with an overview of the state of the discontinued project. Offloading refers to a removal procedure in which a crane vessel removes the topside, modules, jacket, and other components in a predetermined order from the decommissioned site. The crane vessel subsequently loads these dismantled components onto cargo barges for delivery to the decommissioning yard on land. Later, deconstruction and demolition include landing the parts from offshore, then washing, stripping, and separating these parts and metal fragments for reuse, recycling, or disposal. During this phase, there is a wide range of lifting equipment in the onshore decommissioning yard. For example, for landing, heavy lift vessels (HLV) crane vessels, yard craneage, or occasionally multi-wheelers are used, whereas cranes, skidding, or multi-wheelers are used for internal transit within the yard.

The difficult and crucial part of decommissioning activity is waste management. The hazardous materials will be discovered and assessed before any work is done on the topside or the production modules are separated. A qualified contractor is typically appointed to handle and remove hazardous materials from offshore buildings, such as asbestos, mercury, low specific activity (LSA) contaminated pipelines, oil, and sludge contamination. Following processing, the pipework, containers, and tanks are flushed to ensure no contamination exists (Seaway Heavy Lifting, 2011). Several "hot" and "cold" cutting techniques are utilized to further break the parts into smaller bits that may be handled, stored, and eventually transferred to recycling facilities.

The removal processes determine the choice of an onshore dismantle yard for an offshore structure decommissioning operation (Decom North Sea, 2015). Only the Able Seaton Port (ASP) yard on Teesside can accommodate the largest heavy lift vessel (HLV) in the United Kingdom. ASP yard was renovated to receive the Brent platform's topsides. ASP is a market leader in oil and gas decommissioning, and its facilities are used for sophisticated maritime decommissioning and end-of-life marine vessel recycling projects.

Figure 2. The ASP facility on Tess Estuary (United Kingdom (Shell, 2017)

Unlike the ship recycling business, no specific criteria for upgrading an onshore yard exist for offshore structure decommissioning operations. By comparing itself to a well-qualified onshore decommissioning yard, the ship and ship recycling yard might be developed to a qualified onshore decommissioning yard. According to this viewpoint, the Basel Convention is one of the references to be examined when determining the readiness of an onshore decommissioning yard. The primary goal of the Basel Convention on the Control of Transboundary Movements and Disposal of Hazardous Wastes is to protect human health and, whenever possible, to reduce productionofhazardous waste, through environmentally sound management (ESM). A Basel Convention technical working group has been tasked with commencing the technical guidelines development for the ESM of ships undergoing complete and partial dismantlement. Several materials that were previously utilized in the process of ships construction and operation are now classified as hazardous wastes under the Basel Convention. These chemicals are released during the deconstruction procedure's extraction step. As a result, it is clear that the ship recycling industry requires an ESM. The Basel Convention Secretariat collaborates with the United Nations Environment Program (UNEP). Figure 3 displays the intended structure of a model shipbreaking yard as defined in the technical specifications of the Basle Convention secretariat (UNEP, 2003).

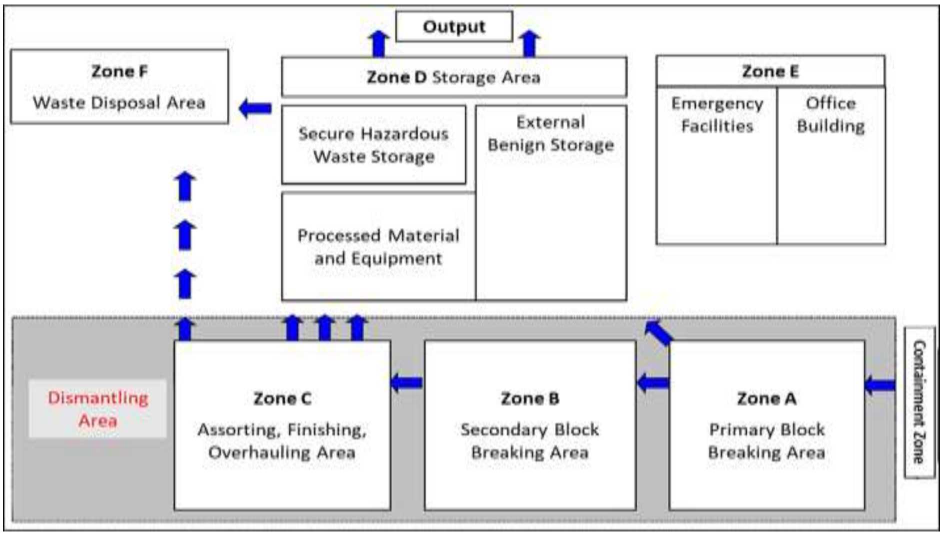

Figure 3. A model ship breaking yard's conceptual layout (UNEP, 2003)

It is critical for ecologically sound yard design to determine which activities take place in which zones and which associated dangers must be recognized and avoided through sound design. The activities in each zone in the preceding model, as well as the environmental, health, and safety concerns connected with them. In contrast, the operator, in collaboration with the heavy lifting vessel (HLV) contractor, selects an appropriate site for loading and dismantling of a decommissioning project based on economic, environmental, and operational parameters, and the contractor's vessel specification is described based on Seaway Heavy Lifting, 2011, as previously mentioned in Amelia et al, 2021. To be considered completely prepared for managing decommissioned products, a yard must also meet the unloading and dismantling standards described in Amelia et al, 2021.

Aside from the yard, service providers must follow applicable laws, regulations, and rules that are technically appropriate for decommissioning activities (Petronas, 2021). Locations, equipment, and a disassembly facility are among the criteria for site facilities. Among the criteria that determine site selection are sea access for shipping, a suitable deep draught quay, and proximity to the supply chain, such as a waste treatment plant, smelting plant, and a specific zone for disassembly and storage. Equipment readiness and functioning criteria include lifting cranes, cutting tools, liquid pumps, weighing stations, self-propelled modular trailers (SPMT), and so on. The scope of interest for the dismantling area includes a containment area to collect hazardous liquid and marine growth, a covered area for naturally occurring radioactive material (NORM), dust handling and decontamination on works, a water treatment system, and a scraps and non-scraps separation area. This paper specifies its research aspects as yard criteria, model of dismantling yard, recommendation, and yard preparation ranking, based on earlier research. Figure 4 depicts the intellectual underpinnings of this paper.

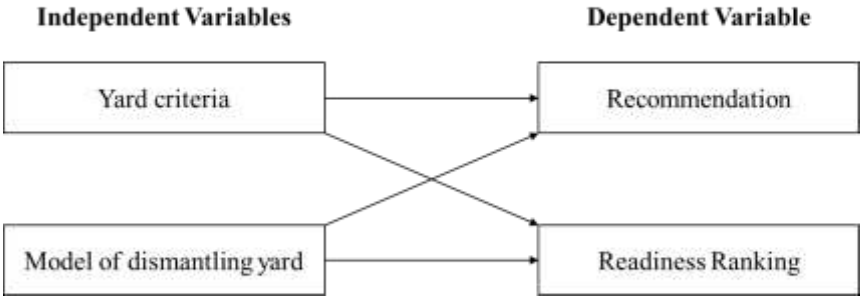

Figure 4. Research variables

II. METHODOLOGY

This paper utilized a mixed method, both qualitative and quantitative to conduct the study. The field survey was performed on 14th -15th January 2022. Research data was collected by using questionnaires and verified through observation and interview during field survey to the yard in the case study. The yard was nominated by the stakeholders based on the availability and willingness of the owner to be involved in the survey. PT. Meindo Elang Indah Handil yard is the 3rd yard that had been visited during the research. The other 2 (two) visited yards earlier were located inBintan Island (Indonesia). During the field survey, a set of interview and field observation were conducted with the yard's personnel. These activities were illustrated in Figure 5.

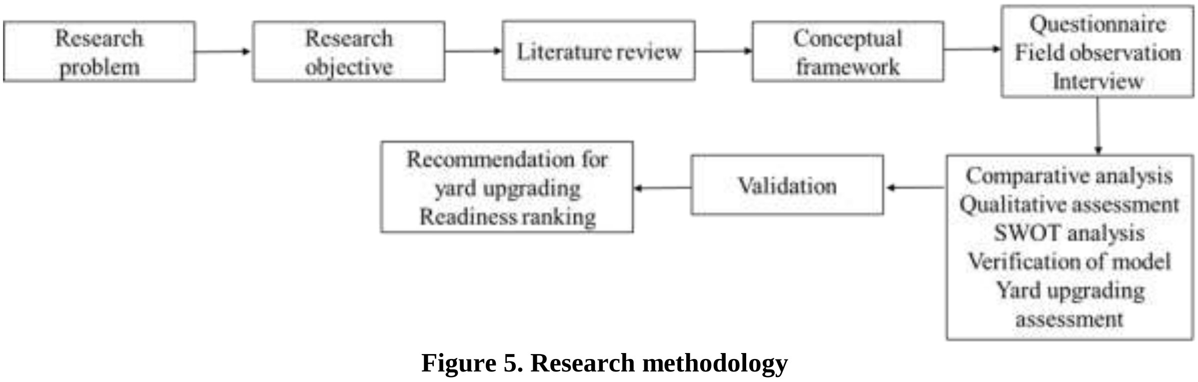

Figure 5. Research methodology

Prior to the yard analysis, a pilot survey was conducted to measure the acceptance level among the industrial experts in modernizing layout of ship breaking yard (UNEP, 2003) to onshore dismantling and disposal yard for the offshore decommissioning projects. The survey was performed online during April 2021 and feedback from 11 respondents were received. However, after evaluation, feedbacks of two respondents were categorized as invalid because of lacking experience in the related offshore, shipping, or oil and gas subject.

CRF Consultant's (2016) methodology was used for the qualitative evaluation of decommissioning readiness. It is awarded based on the evaluation criteria for site, facilities, sea access, waste disposal proximity, and hazardous waste containment.All obtained data from respondents was evaluated using a comparative case study with Able Seaton Port (ASP) in the United Kingdom as a benchmark yard. The information regarding ASP was gathered from sources and publications in the public domain. Comparative studies involve the investigation and synthesis of similarities, differences, and patterns among two or more examples with a similar emphasis or objective (Goodrick, 2014). In Table 1, Pickvance (2001) categorised types of comparative analysis according to whether they begin with similarities or differences.

Figure 6. Discussion and field data collection with Handil Yard personnels

Table 1. Comparative analysis types based on whether the starting point is similarities or differences (Pickvance, 2001)

		End point: description in terms of	
		Variation principle	Universality Principle
Starting point:	Differences observed or created	A *Comparative analysis differentiation*	B
	Similarities observed or constructed	C	D *Comparative analysis made universal*

Since the objective of comparing the selected yard with ASP is to verify whether both yards have similarities, hence the analysis is categorized as type D, which is universalizing comparative analysis. Using the CRF Consultant (2016) evaluation criteria, the selected yard assessment was determined based on the criteria as listed instrument used in previous research (Amelia et. al., 2021). The scoring from the qualitative assessment of the selected yard in the decommissioning readiness was then compared with scoring of the decommissioning yard to be benchmarked. The results were organized in a tabular format. Afterwards, a strengths-weaknesses-opportunities-threats (SWOT) analysis was conducted for the selected yard based on the survey data. In this instance, a SWOT analysis (Oreski, 2012) was utilized to analyze internal and external aspects in order to develop a systematic approach and support for assessing the readiness of the selected yard.Finally, a justification of yard readiness was determined by analyzing the layout plan of the selected yard against the conceptual layout of model ship breaking yard. It was continued by a yard modernization assessment to identify the most appropriate location for upgrading and adding the required facilities of onshore decommissioning activities.

III. RESULT AND DISCUSSION

3.1 Comparative analysis

In the current work, the ASP yard is compared with the MeindoHandil Yard. The comparison is shown in Table 2.

Table 2 Comparison between ASP, MeindoHandil Yard, and Meitech Eka Bintan Yard

Criteria	**ASP**	**Handil Yard**	**MEB**
Depth at quayside	9.5 m	5 m to 10 m	8 m to 12 m
Mooring facilities	Capable of mooring barges and HLV	Capable of mooring barges and HLV	Capableofmooringbarges and HLV
Maximum load-out capacity	More than 22,000 MT	Less than 5,000 MT	10,000 MT
Laydown area	185,000 m^2	64,000 m^2	26,000 m^2
Ground bearing capacity	75 MT/m^2	Less than 25 MT/m^2	25 MT/m^2 to 100 MT/m^2
Liquid containment at fabrication area	Yes	Yes	Yes
Distance to disposal center	0.5 km	3 km	3 km

3.2 Qualitative assessment

This section provides qualitative assessment for the Handil Yard decommissioning readiness. The method is by performing scoring for the yard decommissioning readiness (Table 3), then ranked by comparing the yard with several decommissioning yards at North Sea area, refer to CRF Consultant (2016) as shown in Table 4.

Table 3 Comparison of ASP and Handil Yard

	Criteria	Score	Status
a	Location	3 out of 5	• Existing facility involved in the marine/offshore business • Waste handling permits may be required for decommissioning activities.
b	Yard facilities	3 out of 5	• Enough space for demolition, but only in small pieces - cannot handle massive modules • Can berth and discharge barges, but not large lift vessels, sheer legs, or monohull vessels. • Bounded area for liquid runoff
c	Sea accessibility	3 out of 5	• Restricted/limited access for heavy lift vessel • Estimated 3-5 days sailing distance
d	Proximity to waste disposal	M	• The waste disposal contractor is located within 50 miles of the yard.
e	Waste license	No	•
f	Containment of liquids	Yes	• A concrete area for size reduction and trash management is capable of controlling waste run-off in a pollution-prevention manner.

Table 4Handil Yard's Decommissioning Readiness Ranking as compared to North Sea Decommissioning Yards (CRF Consultant, 2016)

Rank	Yards	Location	Facilities	Sea Accessibility	Proximity to waste disposal	Waste Licenses	Liquid Containment
1	VATS	5	5	5	H	Y	Y
2	STORD	5	5	5	H	Y	Y
3	ABLE UK	5	4	3	H	Y	Y
4	Greenhead Base	5	3	4	H	Y	Y
5	Nigg Energy	4	4	4	H	N	Y
6	Montrose	4	3	2	H	N	Y
7	Port of Dundee	3	4	3	H	N	N
8	Kishorn	3	3	4	L	N	N
9	Harland & Wolf	3	3	3	H	Y	Y
10	Burntisland	3	3	3	H	N	N
11	**Handil Yard**	**3**	**3**	**3**	**M**	**N**	**Y**
12	Peterhead	3	3	3	M	Y	Y
13	Swan Hunter	3	3	3	M	Y	Y
14	Ardesier	3	3	3	L	N	N
15	Leith	3	3	3	M	N	N
16	Methil	3	3	1	H	N	N
17	Dales Voe	3	3	1	H	N	N
18	Wick	3	2	3	L	N	N
19	Ardyn Point	2	2	3	L	N	N
20	Huntersten	2	2	2	L	N	N

The onshore dismantling industry at North Sea region is considered as one of most experienced and active among the other regions due to OSPAR 98/3 decision regulation. From the assessment in this paper, the status of decommissioning readiness of MEI Handil yard and the required gap can be clearly identified.

3.3 SWOT analysis

Using a strength, weakness, opportunity, and threat (SWOT) analysis, all obtained information regarding the selected yard facility was compared to the available criteria as specified in the literature review. Table 5 shows the results of the SWOT analysis.

Table 5. MEI Handil yard SWOT analysis result

MEI Yard SWOT Analysis	
Strength	***Weakness***
1. Have ISO 9001, ISO 14001, ISO 45001, and ISO 18001 compliances 2. Can operate everyday (7 days per week) 3. For about 10 km to waste disposal center 4. 64.000 m2 laydown area 5. Has up to 500MT crane to support tall structure demolition activity 6. Has permit for temporary hazardous & toxic waste storage which is authorized by local government 7. Has <5000MT loadout weight in the past 8. Has impermeable surface at fabrication area 9. Has waste handling capacity for hazardous & toxic (B3) waste and also for the non hazardous & toxic waste	1. Does not have international waste management license 2. Has no liquid containment system with fabrication area near quayside
Opportunities	***Threats***
1. Developed facility and has availability to temporarily store hazardous & toxic (B3) waste and also non hazardous & toxic (B3) waste	1. Dependent on 3rd party vendor waste management system 2. Yard has no experience in loadout structure with weight >5000MT

3.4 Acceptance level for layout modernization

The acceptance level among the industrial expertise upgrading shipyard to onshore decommissioning yard is shown in Table 6. The result of survey indicated that more than half of the respondents agreed the ship recycling yard can be modified for onshore dismantling and disposal in an offshore decommissioning project.

Table 6. Pilot Survey Responses

Respondent code	Having experience in offshore, shipping, or oil and gas	Country of origin	Agree	Disagree	Remarks
1	Yes	Indonesia	√		
2	Yes	Malaysia	√		
3	Yes	Indonesia	√		
4	No	Indonesia	√		Invalid
5	No	Indonesia	√		Invalid
6	Yes	Norway	√		
7	Yes	Indonesia	√		
8	Yes	Indonesia		√	
9	Yes	Norway		√	
10	Yes	Singapore		√	
11	Yes	Indonesia	√		

Meanwhile, the reasons of disagreement for modernizing ship breaking yard to be decommissioning yard is of our interest as well. From the feedbacks, the reasons of disapproval are there will be potential contamination of hazardous and toxic waste, as well as radioactive, which can endanger the workers. The residue of NORM and other hazardous materials may not be stated in the Inventory of Hazardous Material (IHM) under certain circumstances. Also, shipyard is considered as spacious area for dismantling and disposal of the offshore decommissioned structure. Hence, the activities were better to be carried out in a dedicated yard, unless the decommissioned structure is a floating storage (ship model). Another reason is the shipyard quality in each country is not equal, shipyard in certain region was rated as insufficient enough for this type of work, which needs proper hazardous waste management skill.

3.5 Yard upgrading assessment

MEI Handil Yard is categorized as developed facility and has availability to temporarily store both the hazardous & toxic waste (B3) and non-hazardous & toxic waste. In the modernization of this yard towards a qualified onshore decommissioning yard, several improvements are required. These includes (i) a water treatment system to clean any residues on the structure, (ii) availability of specific tools to support the dismantling activities, such as the excavator with ripped blade, (ii) closed waste storage facilities to store any hazardous material such as metal which is contaminated by asbestos or mercury for further treatment by licensed waste management vendor, and (iv) workshop or space for the licensed waste management vendor to pre-treat the contaminated material above in case it is sophisticated to be transported.

Figure 7. Satellite View of MEI Handil Yard Layout

Prior to deciding the location for the required facility, a preliminary layout assessment was carried out to identify the buildings and facilities that can be involved in onshore dismantling process. This layout assessment had been done by comparing the actual selected yard layout against the UNCEP conceptual layout (UNEP, 2003), as illustrated in Figure 8.

Figure 8. Selected Yard Zonation against Conceptual Layout of UNEP 2003

Furthermore, the yard owner is suggested to appoint a dedicated area for the demolition work and assure it has a liquid containment system. Firstly, the selected demolition area must have the least interference with the main operation of the yard. Secondly, the demolition area must near to quayside since on-land transportation of the aged structures may have a number of uncertainties due to structure integrity. Thirdly, it is not necessary to be nearby the material laydown area and the assembly area since the one nearby existing laydown area is more critical for the fabrication purpose.

Based on the described criteria and recommendations, area nearby jetty (1) is suggested to be chosen for the dismantling function. The availability of jetty will support the transportation barge berthing during decommissioned structure load out. A temporary waste storage has been available around the area which will ease the mobilization of generated waste.

The flow of the dismantling project will be started with offloading the receiving structure from jetty to Zone A. At Zone A, any resalable, reusable and contaminated inventory will be removed prior to primary block breaking. Then, the removed inventory will be sent to workshop for overhauling if required, or else it will be sent to Zone D. While for the main structure, after primary block breaking, it will be sent to Zone B for secondary block breaking into smaller pieces and then to Zone C if required, or else it will be sent to Zone D. At Zone D, the material will be sold or sent to Zone F for disposal.

IV. CONCLUSION

This paper investigated onshore decommissioning readiness of an offshore fabrication yard in Indonesia. The results indicated this selected yard was ready in the aspects like the depth at quayside, mooring facilities, maximum load-out capacity, size of laydown area, ground bearing capacity, availability of liquid containment system, and distance to disposal center.

Acknowledgement

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