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Optimization of Waste Pit Treatment Using The TAPIR Method in Tanjung Field, South Kalimantan

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Abstract. Pertamina EP Tanjung Field is engaged in the upstream oil and gas sector with oil and gas exploration and production activities where there is produced water that arises from these activities. The produced water is pumped to the WIP (Water Injection Plant) facility, then all produced water is injected into the well. injection as pressure maintenance (zero discharge program). The need for clean water for injection water is an average of 89,632 barrels in 2020 so that quite a lot of water is needed from the Clean Water Treatment Plant (WTP) facility owned by PEP Tanjung Field. In addition, there are fluids from outside the process of existing production facilities such as cellars, rig activities, workshops and other supporting activities that enter the fluid separation facility and then the separated water is discharged into the environment. The fluid separation activity from outside the process of the existing production facility has not been maximized so that the amount of B3 waste resulting from the separation process is quite large.

One of the efforts that can be done to overcome this problem is to use the TAPIR Method (Accommodate, Sediment, Separate, Transfer) where with this method modifications are made to the fluid separation process and also the waste pit building. discharged into the environment and can be useful in increasing the volume of water that can be injected into the injection well facility because it already uses a zero discharge system by modifying the Waste Pit facility minor. This method has proven to be effective and useful to help with the problem of injection water requirements and reduce the production waste.

Keyword(s): Waste Pit, Accommodate, Sediment, Separate, Transfer, Water Treatment Plant.

1 Introduction

Pertamina EP Tanjung Field is engaged in the upstream oil and gas sector with oil and gas exploration and production activities, with an average production as of June 2022 of 2,012.63 BOPD for oil and 1.03 MMSCFD for natural gas. Oil and gas production is obtained from several structures using well pumps of the type SRP (Sucker Rod Pump) and ESP (Electric Submersible Pump) pumps. Then it flows through a pipe to the block station, and the liquid fluid (oil and water) and gas are separated using a separator. The gas obtained is associated with gas and is used for wells, boilers, and other facilities. Liquid fluid is pumped

to PPP Manunggul and separated between oil and water using FWKO Tank. The oil obtained is then stored in the production tank. Then, the stored crude oil is sent to RU V Balikpapan every month. The produced water is pumped to the WIP (Water Injection Plant) facility, and all the produced water is injected into the injection well as pressure maintenance (zero discharge program).

In addition, there is fluid from outside the existing production facility processes, such as basements, rig activities, workshops, and other supporting activities that enter the waste pit. Then the separated water is discharged into the environment. The movement of fluid separation from outside the existing production facilities has not been maximized. From this condition, the results of the separation of the produced water and the rest of the process activities cannot be reused to help the volume of injection water needed by the field, here is a graph of the injection water demand and the availability of water for these activities.

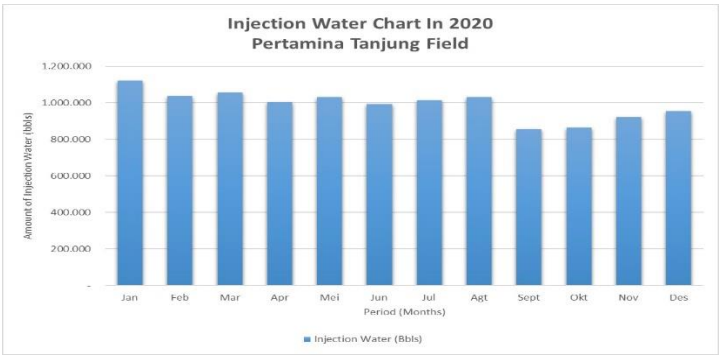

Figure 1 Amount of Injection Water in 2020

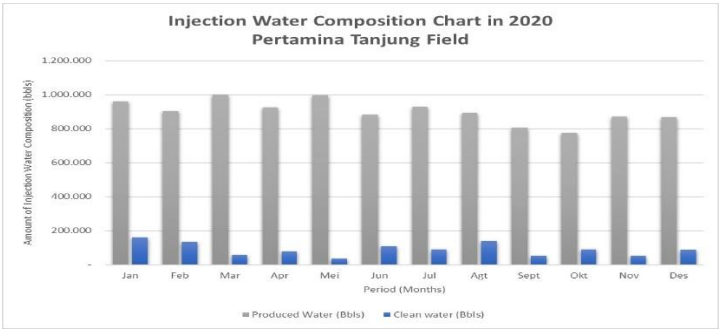

Figure 2 Total Composition of Produced Water and Clean Water Needs to support the Injection program in 2020

2 Methodology

The right solution to overcome the problem of not optimally separating the fluid generated from outside the existing production facility at Tanjung Field to be used as additional injection water is to install TAPIR. We made this innovation by modifying existing facilities in the field with internal human resources. In principle, this TAPIR innovation consists of 6 parts, namely Separation Tank (1), Pre-sediment Tank (2), Mixing Tank (3), Mixing Tank (3), Flocculation Tank (4), Sedimentation Tank (5) and the pumping process to production facilities (6).

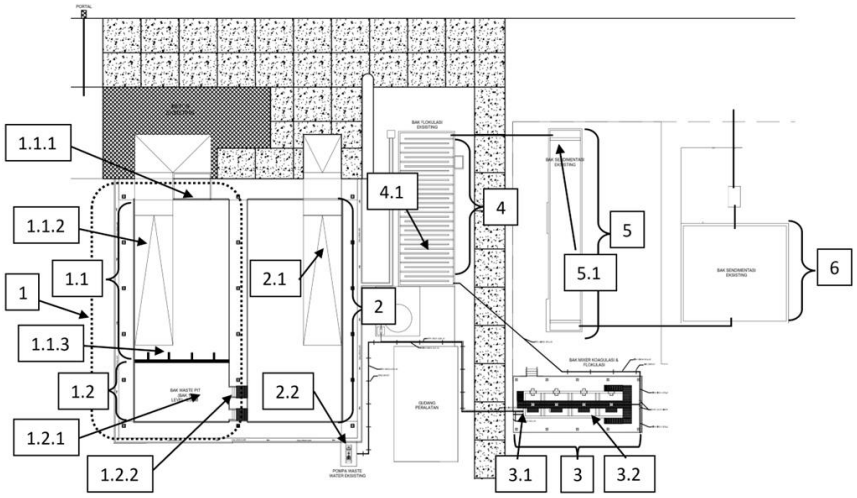

Figure 3 Part of the Fluid Separation Facility using TAPIR Inovasi Innovations

1) Filling the separator tank (1) with those produced from outside the existing production facility process using a VT or Roadtank where the production fluid is in the form of water mixed with oil, the separator tank (1) serves to accommodate and separate water and oil, which consists of:

- The first section separation chamber (1.1) which serves to receive and precipitate the initial phase of the separation fluid, which consists of:
  - a filter (1.1.1) which is placed at the input in the form of an inlet to separate the oil and gas production process fluids from road tanks and vacuum trucks;
  - access facilities (1.1.2) heavy equipment for the collection of heavy sediment that has settled in the form of mud for disposal;
  - buffle (1.1.3) in the form of a T-pipe that is placed vertically on one side of the tub wall where there are at least 4 pieces with placement in a position 2/3 of the top of the wall, thus allowing early sedimentation in the Separation Tub (1) there is an initial deposition of heavy sediment and gravity allows the sediment in the upper layer to be pumped through the buffle;
- The second part separator (1.2) which serves to receive the upper sediment fluid from the first part separator (1.1), which consists of:
  - Pump (1.2.1) to transfer the upper sediment to the pre-sediment basin (2) which is equipped with a safety valve to protect the pump from dirt so that there is no blockage;
  - Fluid channel (1.2.2) which serves as a means of fluid flow path;

2) Draining water from the separator basin (1) to the pre-sediment basin (2) where the pre-sediment basin (2) serves for the second stage of sedimentation, aiming to obtain a fluid that has a low silt content, depositing the fluid in the pre-sediment basin (2) for 3 to 4 weeks for the sediment and water to separate, which consists of:
   - Access facilities for heavy equipment (2.1) to collect heavy sediment that has settled in the form of mud for disposal;
   - A pump (2.2) to transfer the top sediment to the mixing tank (3) which is equipped with a safety valve to protect the pump from dirt so that it does not clog;

3) Pumping water from the pre-sediment basin (2) to the mixing basin (3), where the mixing basin (3) functions to mix water with chemicals in the mixing tank (3) in the form of aluminum sulfate, chlorine to the fluid capacity in the mixing tank (3) with a ratio of 0.84:0.02:1 in liter units, where through the mixing a chemical reaction is obtained which results in a minimum water quality of water that will be reused in the production process in accordance with water quality standards, which consist of:
   - four mixing chambers (3.1) which are arranged in series and stratified and connected to each other, each mixing chamber (3.1) is equipped with a mixer to speed up the mixing of chemicals;
   - outlet pipe (3.2) which serves to drain the mixing results in the mixing chamber (3.1) to the flocculation bath (4);

4) Drains water to the flocculation basin (4) which functions as a reservoir with the scheme of extending the sedimentation waiting time in the previous tank to obtain the desired water quality, where the flocculation basin (4) consists of a spiral path (4.1) which is formed in a minimum of 32 arrangements. which are interconnected from the input line to the output line which serves to accommodate the fluid and increase the waiting time for further deposition so that the water capacity is met from the sedimentation process in the previous tanks through the flow of gravity motion and the process of clumping of destabilized particles into flocs;

5) Drains water to a settling basin (5) serves for further sedimentation, where sedimentation basin 5 is deposited for 2 to 3 weeks, which consists of a multi-storey sediment chamber (5.1) equipped with a dividing wall between the chambers of a certain height to drain water at the top of each sediment chamber by gravity consisting of 3 chambers is channeled through pipes to the reservoir (6);

6) Drains water from the settling basin (5) to the holding tank (6) which functions to maintain a minimum capacity of water discharge before being channeled to the collection station II using a pump to assist the transfer of oil to the Petroleum Production Collection Center. From PPP Manunggul, it is pumped into WIP and then injected into the injection well.

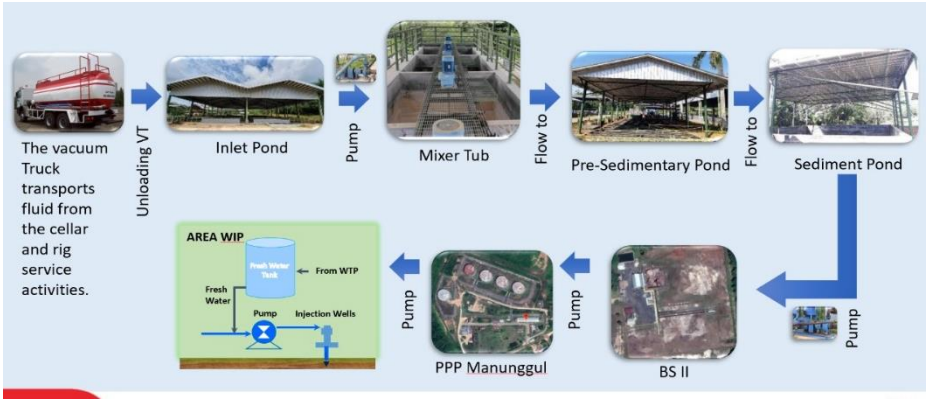

Figure 4 TAPIR innovation design in the field

3 Result

The application of the TAPIR Method was carried out in mid-2021 by trying to regulate the pattern of disposal of produced water and other waste to the waste pit which had been modified with the principles and engineering of the TAPIR method, then after separation and treatment in the waste pit area the water still had oil content was sent back to Block Station 2 which is then sent by the main collector, namely PPP Manunggul to be treated for oil content that can still be recovered, so that from this condition additional oil is obtained for the company, adding water stock for injection from the wastepit, reducing the use of clean water from the water treatment plant for injection and reducing residues from the production process waste with the following data:

Description	2020	2021	2022 (Until June)
	Before Program	After Program	After Program
Production Process Residue (Tons)	619,73	364,9	64,14
Amount of Production Process Residue Waste Reduction (from the previous year)	-	254,83	300,76

Table 1 Residual reduction data

No	Period	Amount of recovery fluid	
		Liter	Bbls
1	July - September 2021	1.750	11,01
2	October-December 2021	2.000	12,58
3	January- March 2022	2.500	15,72
4	April - June 2022	3.000	18,87

Table 2 Recovery Oil from Waste Pit

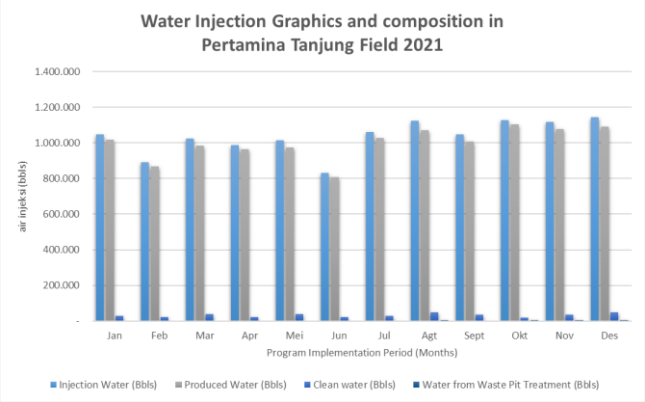

Figure 5 Water Injection Graphics and Compotition in 2021

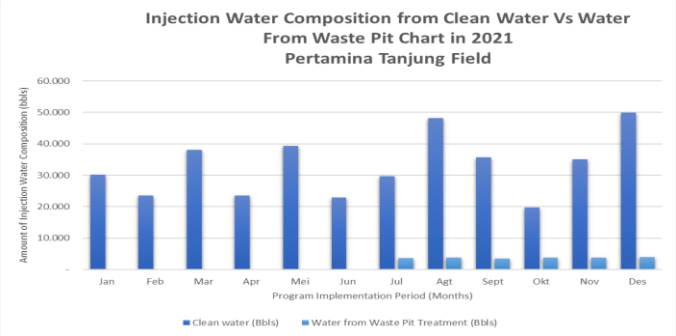

Figure 6 Injection Water Composition from Clean Water Vs Water From Waste Pit in 2021

In general, the TAPIR method by modifying the existing waste pit building to suit the current conditions required by the company has succeeded in meeting applicable environmental standards with zero discharge, is able to regulate the pattern of segregation of the remaining production fluid efficiently so that operations are more affordable and generate additional income for the company.

4 Conclusion

Modifying The Water Treatment System from the Production Process with the Application of TAPIR can be used to assist the process of sending oil from Block Station II to PPP Manunggul and can also increase the volume of injection water availability,

On the other hand with the application of the TAPIR method, no more water is discharged into the environment so that zero discharge is achieved and the pollution load in the Jaing River is reduced.

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